## Bachelor of Technology (Electronics & Communication Engineering) (Credit Based)
## KURUKSHETRA UNIVERSITY KURUKSHETRA
### Scheme of Studies/Examination

### Semester V (w.e.f. session 2021-2022)

| S.No. | Course No. | Subject | L:T:P | Hours/ Week | Credits | Examination Schedule (Marks) | | | | Duration of Exam (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Major Test | Minor Test | Practical | Total | |
| 1 | HTM-901A | Universal Human Values II : Understanding Harmony | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | EC-303LA | Electromagnetic Waves Lab | 0:0:2 | 2 | 1 | - | 40 | 60 | 100 | 3 |
| 3 | EC-305A | Computer Organization & Architecture | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 4 | EC-307A | Information Theory and Coding | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 5 | EC-309A | Digital Signal Processing | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 6 | EC-311LA | Digital Signal Processing Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 7 | ECP* | Program Elective-I | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 8 | ECO* | Open Elective-I | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 9 | **EC-313A | Industrial Training-II | 2:0:0 | 2 | - | - | *100 | - | *100 | 3 |
| 10 | ***MC-903A | Essence of Indian Traditional Knowledge | 3:0:0 | 3 | - | 100 | - | 0 | 100 | 3 |
| | | **Total** | | **27** | **20** | **550** | **230** | **120** | **900** | |

*** The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.**

****EC-313A is a mandatory credit-less course in which the students will be evaluated for the industrial training undergone after 4th semester and students will be required to get passing marks to qualify.**

*****MC-903A is a mandatory credit-less course in which the students will be required to get passing marks in the major test.**

| HTM-901A | Universal Human Values II: Understanding Harmony | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | 0 | 3.0 | 75 | 25 | 100 | 3 Hours |
| Purpose | Purpose and motivation for the course, recapitulation from Universal Human Values-I | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| CO 1 | Development of a holistic perspective based on self-exploration about themselves (human being),family, society and nature/existence. | | | | | | |
| CO 2 | Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence. | | | | | | |
| CO 3 | Strengthening of self-reflection. | | | | | | |
| CO 4 | Development of commitment and courage to act. | | | | | | |

**Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment ofaspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at variouslevels.

**Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrarinessin choice based on liking-disliking**

**Module 2: Understanding Harmony in the Human Being - Harmony in Myself!**

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health.

**Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease**

**Module 3: Understanding Harmony in the Family and Society- Harmony in**

**Human-HumanRelationship**

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the othersalient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- fromfamily to world family.

**Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives**

**Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

**Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" canbe used), pollution, depletion of resources and role of technology etc.**

**Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics**

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

28. Sum up.

**Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. todiscuss the conduct as an engineer or scientist etc.**

**READINGS:**

**Text Book**

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

**Reference Books**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J CKumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

**MODE OF CONDUCT**

**Lecture hours are to be used for lecture/practice sessions.**

**Lectures hours are to be used for interactive discussion, placing the proposals about the topics at handand motivating students to reflect, explore and verify them.**

**Practice hours are to be used for practice sessions.**

**While analysing and discussing the topic, the faculty mentor’s role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.**

**In the discussions, particularly during practice sessions, the mentor encourages the student to connect with one’s own self and do self-observation, self-reflection and self-exploration. Scenarios may be used to initiate discussion. The student is encouraged to take up” ordinary” situations rather than” extra-ordinary” situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.**

**Practice experiments are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.**

**It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.**
**This course is to be taught by faculty from every teaching department, including HSS faculty. Teacher preparation with a minimum exposure to at least one 8-day FDP on Universal Human Values is deemed essential.**

**ASSESSMENT:**
**This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.**
**Example:**
**Assessment by**
**faculty mentor: 5 marks**
**Self-assessment: 5 marks**
**Assessment by peers: 5 marks**
**Socially relevant project/Group Activities/Assignments: 10 marks**
**Semester End Examination: 75 marks**
**The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.**

**Bachelor of Technology (Electronics & Communication Engineering) (Credit Based) KURUKSHETRA UNIVERSITY KURUKSHETRA**
**Scheme of Studies/Examination**
**Semester VII (w.e.f. session 2021-2022)**

| S. No. | Course No. | Subject | L:T:P | Hours/ Week | Credits | Examination Schedule (Marks) | | | | Duration of Exam (Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Major Test | Minor Test | Practical | Total | |
| 1 | HM-904A | Intellectual Property Rights for Technology Development & Management | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | ECP* | Program Elective-III | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 3 | ECP* | Program Elective-IV | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 4 | ECP* | Program Elective Labs-V | 0:0:4 | 4 | 2 | - | 40 | 60 | 100 | 3 |
| 5 | ECO* | Open Elective-III | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 6 | EC-401LA | Project Stage-I | 0:0:8 | 8 | 4 | - | 40 | 60 | 100 | 3 |
| 7 | **EC-403A | Industrial Training-III | 2:0:0 | 2 | - | - | *100 | - | *100 | 3 |
| | | **Total** | | **26** | **18** | **300** | **180** | **120** | **600** | |

*** The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.**

**EC-403A is a mandatory credit-less course in which the students will be evaluated for the industrial training undergone after 6th semester and students will be required to get passing marks to qualify.

**Bachelor of Technology ( Electronics & Communication Engineering) (Credit Based) KURUKSHETRA UNIVERSITY KURUKSHETRA**
**Scheme of Studies/Examination**
**Semester VIII (w.e.f. session 2021-2022 )**

| S. No. | Course No. | Subject | L:T:P | Hours/ Week | Credits | Examination Schedule (Marks) | | | | Duration Of Exam. (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Major Test | Minor Test | Practical | Total | |
| 1 | ECP* | Program Elective-VI | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | ECP* | Program Elective-VII | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 3 | ECO* | Open Elective-IV | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 4 | ECO* | Open Elective-V | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 5 | EC-402LA | Project Stage-II | 0:0:10 | 10 | 5 | - | 40 | 60 | 100 | 3 |
| 6 | ECP* | Program Elective Labs-VIII | 0:0:4 | 4 | 2 | | 40 | 60 | 100 | 3 |
| | | Total | | 26 | 19 | 300 | 180 | 120 | 600 | |

***The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.**

**Bachelor of Technology ( Electronics & Communication Engineering) (Credit Based) KURUKSHETRA UNIVERSITY KURUKSHETRA**
**Scheme of Studies/Examination**

| LIST OF OPEN ELECTIVES (B.TECH. ECE) | | |
|---|---|---|
| **SEM** | **CODE** | **SUBJECT** |
| **VII** | **Open Elective-III** | |
| | ECO-9A | Bio-informatics |
| | ECO-10A | Electromechanical Energy Conversion |
| | ECO-11A | Operating Systems |
| **VIII** | **Open Elective-IV** | |
| | ECO-12A | Wavelets |
| | ECO-13A | Soft Computing |
| | ECO-14A | Neural Networks and Fuzzy Logic |
| | **Open Elective-V** | |
| | ECO-15A | Statistics and Operational Research |
| | ECO-16A | Mixed Signal Design |
| | ECO-17A | Blockchain Technology |

| LIST OF PROGRAM ELECTIVES (B.TECH. ECE) | | |
|---|---|---|
| **SEM** | **CODE** | **SUBJECT** |
| **VII** | **Program Elective-III** | |
| | ECP-10A | Fiber Optic Communications |
| | ECP-11A | Mobile Communication and Networks |
| | ECP-12A | Adaptive Signal Processing |
| | ECP-13A | Nano electronics |
| | **Program Elective-IV** | |
| | ECP-14A | Microwave Theory and Techniques |
| | ECP-15A | Embedded systems |
| | ECP-16A | Robotics |
| | ECP-17A | Digital Image Processing |
| | **Program Elective Labs-V** | |
| | ECP-14LA | Microwave Communication Lab |
| | ECP-15LA | Embedded System Lab |
| | ECP-16LA | Robotics Lab |
| | ECP-17LA | Digital Image Processing Lab |
| **VIII** | **Program Elective –VI** | |
| | ECP-18A | Wireless Communication |
| | ECP-19A | Biomedical Signal Processing |
| | ECP-20A | Machine Learning |
| | ECP-21A | Artificial Intelligence |
| | ECP-22A | Internet of Things |
| | **Program Elective –VII** | |
| | ECP-23A | Error correcting codes |
| | ECP-24A | Satellite Communication |
| | ECP-25A | High Speed Electronics |
| | ECP-26A | Software Defined Radio |
| **VIII** | **Program Elective Labs-VIII** | |
| | ECP-18LA | Wireless Communication Lab |
| | ECP-19LA | Biomedical Lab |
| | ECP-20LA | Machine Learning Lab |
| | ECP-21LA | Artificial Intelligence Lab |
| | ECP-22LA | Internet of Things Lab |
| | ECP-23LA | Augmented Reality/Virtual Reality Lab |

| HM-904A | Intellectual Property Rights for Technology Development & Management | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 Hr. |

**Course Outcomes**

| | |
|---|---|
| CO1 | Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular. |
| CO2 | Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits. |
| CO3 | To understand different laws related to the Intellectual Property ,copyright act,trademarks,patent act,duration of patents law and policy considerations |
| CO4 | Underastand New Developments in IPR ,administration of patent system,IPR of biological systems etc. |

**Unit-I**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

**Unit-II**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

**Unit-III**

Law relating to Intellectual property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet –Remedies and procedures in India; Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies;

**Unit-IV**

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

**Text Books/Reference Books:-**


- T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House
- Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co
- Bare text (2005), Right to Information Act
- O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers
- Rustamji R.F., Introduction to the Law of Industrial Disputes, Asia Publishing House

Ethics in Engineering- M.W.Martin& R.Schinzinger, McGraw-Hill

| ECO-9A | BIOINFORMATICS | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | **The Purpose of this course to provide focus on the key concepts of Bioinformatics like biological databases, Sequence Alignment, Phylogenetic Analysis, Plasmid Mapping And Primer Design and Predictive Methods using nucleotide sequences and protein sequences** | | | | | | |
| **Course Outcomes** | | | | | | | |
| CO1 | Students will be able to illustrate with the basic principles of various types of databases | | | | | | |
| CO2 | Students will be able to perform various tools related to sequence alignment and statistical significance of alignment | | | | | | |
| CO3 | Student will develop the knowledge of various software tools for sequence analysis and primer designing | | | | | | |
| CO4 | Students will be able to differentiate between predictive methods for nucleotides and protein sequence analysis | | | | | | |

## UNIT I

### Databases

**a.** Sequence Databases: introduction of Databases, primary and secondary databases, nucleotide and protein sequence databases: Genbank, EMBL, DDBJ, Swissprot, pfam, PIR

**b.** Structure Databases: Introduction to structures. PDB (Protein Data bank) Molecular Modeling database at NCBI. , visualizing structural information.

**c.** Sequence and Structure File Formats.

**The Entrez system**: Integrated information axis, Information retrieval from biological database, sequence database beyond NCBI. Medical databases.

## UNIT II

### Sequence Alignment AND Database Searches

Introduction, the evolutionary basis of sequence alignment, Type of Aligmnents, Pair-wise Alignment, Multiple Alignment, The modular nature of proteins, Optimal alignment methods, substitution scores and gap penalties, statistical significance of alignment. FASTA, BLAST, low-complexity regions, repetitive elements, Tool of multiple sequence alignment: CLUSTAL W/X, progressive alignment method.

### Phylogenetic Analysis:

Elements of phylogenetic models, phylogenetic data analysis: alignment, substitution model building, tree building and tree evaluation, building the data model (alignment), determining the substitution model, tree-building methods, searching for trees, rooting trees, evaluation trees and data, phylogenic software (PHYLIP). phylogenetics online tool.

## UNIT III

**Sequence Analysis Using Software Resources :**

Introduction. The Wisconsin package, the Seq Lab environment, analyzing sequences with operations and Wisconsin package programmes, viewing output, monitoring programme progress and troubleshooting problems, annotating sequences and graphically displaying annotations in the Seqlab Editor, saving sequences in the Seq Lab Editor, Example of analysis that can be undertaken in Seqlab,

## UNIT IV

**Plasmid Mapping And Primer Design**

Restriction mapping, Mac Vector and OMIGA. primer design for PCR Sequencing, primer design programs and software.

**Predictive Methods using nucleotide sequences and protein sequences:** Predictive methods using nucleotide sequences: Introduction, Gene prediction methods, Computational gene prediction in eukaryotes , identity based on composition, physical properties based on sequence, prediction of protein secondary and tertiary structures. Related software.

**Text Books-**


1. Bioinformatics by Andreas D.Boxevanis. Wiley Interscience, 4th edition 2020.

2. Essential bioinformatics by Jin Xiong. Cambridge Uni Press 2020

3. Biocomputing Informatics and The Genome Projects by Smith D.W., Academic Press, 2014.

4. Bioinformatics: A Biologists Guide to Computing and the Internet. by Stuart M. Brown, NKU Medical Center, NY USA, 2000.


**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| ECO-10A | Electro-Mechanical Energy Conversion | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | **To provide the constructional and working knowledge of various EMEC Devices.** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | **To study various fundamental concepts of EMEC& DC machines.** | | | | | | |
| **CO 2** | **To study fundamental concepts and characteristics of Induction Machines.** | | | | | | |
| **CO 3** | **To study the basics of** Synchronous Machines | | | | | | |
| **CO 4** | **To study working idea of some special electric motors with applications.** | | | | | | |

**UNIT-I(Qualitative analysis only)**

Introduction: Basic principles, conservation of energy, physical phenomenon involved in conversion, energy balance, energy stored in magnetic field, principles of Generating and motoring, prime movers, necessity of starters in motoring.

**DC MACHINES:**

DC generator: Basic construction, theory and working, commutation,generated EMF equation,Demagnetizing and cross magnetizing ampere turns, armature reaction,voltage build-up,brief idea of load characteristics of shunt, series and compound generator.

DC motor: Basic construction, theoryand working, concept of back EMF, torque and power equations, brief idea of load characteristics of shunt, series and compound motor, armature and field control methods of speed control of a DC shunt motor,3 point starter.

**UNIT-II(Qualitative analysis only)**

**INDUCTION MACHINES**:

3-phase induction motors:Rotating magnetic field, Basic construction, theory and working ofsquirrel cage and phase wound rotor types of3-phase I.M., slip, Torque- slip and load characteristics. Blocked rotor tests power and BHP developed at shaft. Star delta starting.

Single phase Induction Motor: Basic construction of, double revolving field theory, working of a capacitor start capacitor run Single phase Induction motor.

**UNIT-III (Qualitative analysis only)**

**SYNCHRONOUS MACHINES:**

Synchronous generator (alternator): Basic construction, theory and working, types of rotors&excitation systems.

Synchronous motor:Basic construction, theory and working of, locking operation, speed torque characteristics, V- Curves. Hunting -causes and remedies.

**UNIT-IV(Qualitative analysis only)**

**SPECIAL ELECTRICAL MACHINES:**

Basic concept and workingideas of:Stepper motor, permanent magnet brushless DC motor, permanent magnet synchronous motor, hysteresis motor, synchronous reluctance motor, repulsion motor.

Industrial and domestic applications and comparison of various types of motors.

**Text/Reference Books**

1. D.P Kothari and I.J Nagrath, “Electric Machines”, Tata McGraw Hill Publishers
2. P.S Bhimbra, “Electric Machines”, Khanna Publisher
3. AshfaqHussain, “Electric Machines”, DhanpatRai and Company
4. Fitzgerald &Kingsley, Electrical Machines, MGH publications.

| ECO-11A | Operating Systems | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Lecture | Tutorial | Practical | Credits | Major Test | Minor Test | Total | Time |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 Hr. |
| Course Outcomes | | | | | | | |
| CO1 | | Student will be able to understand structure and function of OS. | | | | | |
| CO2 | | Student will be able to understand the concept of OS | | | | | |
| CO3 | | Student will be able to understand the concurrent processing | | | | | |
| CO4 | | Student will be able to understand scheduling and deadlock in OS. | | | | | |

## Unit- I

**Introduction:**OS functions: as user/computer interface, interaction with OS, commands, efficient resource manager, security and protection, evolution of OS, OS structure and future trends.

## Unit- II

**OS Prerequisites:** Important software resources, interaction with OS in mainframe systems: PSW,controlling i/o, interrupt, interrupt priority, interrupt cycle. Fundamental concept related to IPC.

## Unit -III

**Concurrent Processing :** Introduction, process concept, process control block, exec sys, concurrent program, process state transitions, hierarchy of processes.

## Unit-IV

**Scheduling:** CPU scheduling algorithms: allocation of different resources, scheduling queues, different scheduling algorithms.
**Deadlock:** Introduction, deadlock and starvation, resource allocation graph, way to solve dedlock.

**Text Books:**
1. P. P Choudhary, Operating Systems by PHI Learning Pvt Ltd.

**Reference Books:**
1. Operating Systems : Internals and Design Principles, William Stallings, Pearson
2.Operating System Concepts", Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, Wiley

**Note: Question paper template will be provided to the paper setter.**

| ECO-12A | Wavelets | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | **To understand the concept of wavelet theory and applications.** | | | | | | |
| **Course Outcomes<br>At the end of this course, student will be able to** | | | | | | | |
| **CO 1** | Interpret stationary and non-stationary signals | | | | | | |
| **CO 2** | Construct continuous wavelet transform | | | | | | |
| **CO 3** | Develop discrete wavelet transform | | | | | | |
| **CO 4** | Apply wavelets in different applications | | | | | | |

**Unit-I**

**Introduction** Stationary and non-stationary signals, Signal representation using basis and frames, Brief introduction to Fourier transform and Short time Fourier transform, Time- frequency analysis, Bases of time frequency: orthogonal, Filter banks, Multi resolution formulation: Wavelets from filters, Classes of wavelets: Haar, Daubechies, bi-orthogonal.

**Unit-II**

**Continuous Wavelet Transform** Continuous wavelet transform (CWT), Time and frequency resolution of the continuous wavelet transform, Construction of continuous wavelets: Spline, orthonormal, bi-orthonormal, Inverse continuous wavelet transform, Redundancy of CWT, Zoom property of the continuous wavelet transform, Filtering in continuous wavelet transform domain.

**Unit-III**

**Discrete Wavelet Transform And Filter banks** Orthogonal and bi- orthogonal two-channel filter banks, Design of two-channel filter banks, Tree-structured filter banks, Discrete wavelet transform, Non-linear approximation in the Wavelet domain, multi resolution analysis, Construction and Computation of the discrete wavelet transform, the redundant discrete wavelet transform.

**Unit-IV**

**Multi Resolution Analysis** Multirate discrete time systems, Parameterization of discrete wavelets, Bi-orthogonal wavelet bases, Two dimensional, wavelet transforms and Extensions to higher dimensions, wave packets, Application of wavelets in signal de-noising.

**TEXT BOOKS:**


1. A Wavelet Tour of Signal Processing, 2nd edition, S. Mallat, Academic Press, 1999.
2. Wavelets and Sub band Coding, M. Vetterli and J. Kovacevic, Prentice Hall, 1995.
3. Wavelet transforms: Introduction, Theory and applications, Raghuveer rao and Ajit S.Bopardikar, Pearson Education Asia, 2000.


**REFERENCES:**


1. Fundamentals of Wavelets: Theory, Algorithms, and Applications, J.C. Goswami and A.K. Chan, 2nd ed., Wiley, 2011.
2. Wavelets and their Applications, Michel Misiti, Yves Misiti, Georges Oppenheim, Jean- Michel Poggi, John Wiley & Sons, 2010 .
3. A premier on Wavelets and their scientific applications, J S Walker, CRC press, 2002.
4. Wavelets and signal processing: An application based introduction, Stark, Springer, 2005.
5. A friendly guide to Wavelets, Gerald keiser, Springer, 2011.
6. Multirate Systems and Filter Banks, P. P. Vaidyanathan, Pearson Education, 2004. Wavelets : from math too practice, Desanka.P.Radunovik, springer, 2009.
7. Insight into wavelets from theory to practice, K P Soman and KL Ramachandran, PHI, 2008.

| ECO-13A | Soft Computing | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture (Hrs.) | Tutorial (Hrs.) | Practical (Hrs.) | Credit | Major Test | Minor Test | Total | Time |
| 3 | - | - | 3 | 75 | 25 | 100 | 3Hr |
| Purpose | To familiarize the students with the basics of Soft Computing | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Motivation and historical background of Soft Computing. | | | | | | |
| **CO 2** | Application of Fuzzy logic. | | | | | | |
| **CO 3** | Biologically inspired algorithm such as neural networks, genetic algorithms, ant colony optimization, and bee colony optimization. | | | | | | |
| **CO 4** | Hybrid systems of neural network, genetic algorithms and fuzzy systems. | | | | | | |

## Unit-I

**Soft Computing and Artificial Intelligence**: Introduction of Soft Computing, Soft Computing vs. Hard Computing, Various Types of Soft Computing Techniques, Applications of Soft Computing, AI Search Algorithm, Predicate Calculus, Rules of Interference, Semantic Networks, Frames, Objects, Hybrid Models

## Unit-II

**Artificial Neural Networks and Paradigms**: Introduction to Neuron Model, Neural Network Architecture, Learning Rules, Perceptrons, Single Layer Perceptrons, Multilayer Perceptrons, Back propagation Networks, Kohnen'sself-organizing networks, Hopfield network, Applications of NN.

## Unit-III

**Fuzzy Logic**: Introduction, Fuzzy sets and Fuzzy reasoning, Basic functions on fuzzy sets, relations, rule-based models and linguistic variables, fuzzy controls, Fuzzy decision making, applications of fuzzy logic.

## Unit-IV

**Genetic Algorithms and Swarm Optimizations**: Introduction, Genetic Algorithm, Fitness Computations, Cross Over, Mutation, Evolutionary Programming, Classifier Systems, Genetic Programming Parse Trees, Variants of GA, Applications, Ant Colony Optimization, Particle Swarm Optimization, Artificial Bee Colony Optimization.

**Text Books:**

1. Simon S. Haykin, Neural Networks, Prentice Hall, 2nd edition.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill.
**3.** D.E. Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y.

**Reference Books:**

1. Zimmermann, “Fuzzy Set Theory and its Application”, 3rd Edition.
2. B. Yegnanrayana , “Artificial Neural Networks” , PHI.
3. Jacek M. Zurada, Introduction to Artificial Neural Systems, Jaico Publishing House.
4. Jang J.S.R., Sun C.T. and Mizutani E, "Neuro-Fuzzy and Soft computing", Prentice Hall.

| ECO-14A | Neural Networks and Fuzzy Logic | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hr.** |
| **Course Outcomes** | | | | | | | |
| **CO1** | Understand the concept of Artificial Intelligence, search techniques and knowledge representation issues | | | | | | |
| **CO2** | Understanding reasoning and fuzzy logic for artificial intelligence | | | | | | |
| **CO3** | Students will be able to learn defuzzification and fuzzy measures | | | | | | |
| **CO4** | Students will be able to learn the applications of fuzzy logic and hybrid soft computing techniques | | | | | | |

**UNIT I – INTRODUCTION**

Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models - important technologies - applications. Fuzzy logic: Introduction - crisp sets- fuzzy sets - crisp relations and fuzzy relations: cartesian product of relation - classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm- Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts.

**UNIT II - NEURAL NETWORKS**

McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks – adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto- associative memory network, hetero-associative memory network, BAM, hop field networks, iterative auto associative memory network & iterative associative memory network – unsupervised learning networks: Kohonen self organizing feature maps, LVQ – CP networks, ART network.

**UNIT III - FUZZY LOGIC**

Membership functions: features, fuzzification, methods of membership value assignments- Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.

**UNIT IV - HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS**

Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems – simplified fuzzy ARTMAP - Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.

**References:**


- Elaine Rich and Kevin Knight “Artificial Intelligence”, 2nd Edition, Tata Mcgraw-Hill, 2005.
- Stuart Russel and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 3rd

Edition, Prentice Hall, 2009.
Text book(s) and/or required material
1. T1. Kliryvan- Fuzzy System & Fuzzy logic Prentice Hall of India, First Edition.
2. Lawrence Fussett- fundamental of Neural network Prentice Hall , First Edition. Reference Books: 1. Bart Kosko, ―Neural network and Fuzzy System‖ - Prentice Hall-1994.
2. J.Klin and T.A.Folger, ―Fuzzy sets‖ University and information- Prentice Hall -1996.
3. J.M.Zurada, ―Introduction to artificial neural systems‖-Jaico Publication house,Delhi 1994.
4. VallusuRao and HayagvnaRao , ―C++ Neural network and fuzzy logic‖-BPB and Publication, New Delhi,1996.
5. Intelligent Systems and Control-http://nptel.ac.in/courses/108104049/16

| ECO-15A | Statistics and Operational Research | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hr.** |
| **Course Outcomes** | | | | | | | |
| **CO1** | The Objective of the paper is to introduce the basic concepts of Operational Research and linear programming to the students | | | | | | |
| **CO2** | Student will be able to learn and apply different methods to solve Linear Programming Problem. | | | | | | |
| **CO3** | Student will be able to learn moments, standard deviation ,correlation ,regression | | | | | | |
| **CO4** | Students will be able large sample test for single proportion ,difference of means, difference of proportions | | | | | | |

## UNIT-I

**Basics of Operational Research**: Origin & Development of Operational Research, Definition and Meaning of Operational Research, Different Phases of an Operational Research Study, Scope and Limitations of Operational Research, Mathematical Modeling of Real Life Problems.

## UNIT-II

**Linear Programming Problem**: Formulation, solution by Graphical Method, Theory of Simplex Method, Simplex Algorithm, Two phase Method, Charnes-M Method, Degeneracy,

## UNIT-III

**Basic Statistics:** Measures of Central tendency: Mean, median, quartiles, mode, Geometric mean, Harmonic mean, Measures of dispersion: Range, Quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, Skewness and Kurtosis, Correlation, Coefficient of correlation, methods of calculations, Lines of regression, Rank correlation.

## UNIT-IV

**Test of significance:** Basic terminology, large sample test for single proportion, difference of proportions, single mean, difference of means, Small samples test for single mean, difference of means, Chi-square test for goodness of fit

**References /Suggested Readings:**


1. G. Hadley: Linear Programming. Narosa, Reprint, 2002.
2. G. Hadley: Linear Algebra, Narosa, Reprint, 2002.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Hamdy A. Taha: Operations Research-An Introduction, Prentice Hall, 9th Edition,2010.
6. Ravindran, D. T. Phillips and James J. Solberg: Operations Research- Principles and Practice, John Wiley & Sons, 2005.

F.S. Hillier. G.J. Lieberman: Introduction to Operations Research- Concepts and Cases, 9th Edition, Tata Mc-Graw Hill, 2010.

| ECO-16A | Mixed Signal Design | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hr.** |
| **Purpose** | This course teaches how in real life applications both analog and digital circuits can be implemented for various system design. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | To know basics and working of various Switched-Capacitor Circuits. | | | | | | |
| **CO2** | To understand various PLL circuits. | | | | | | |
| **CO3** | To gain knowledge on various D/A and A/D converters. | | | | | | |
| **CO4** | To apply knowledge of different architectures in mixed signal circuits for real life problems. | | | | | | |

**Unit-I**

**Switched-Capacitor Circuits**

Introduction to Sampling Switches: MOSFETS as switches, speed considerations, precision considerations, charge injection cancellations. Switched-Capacitor Amplifiers: Unity Gain Sampler-Buffer, Noninverting Amplifier, Precision Multiply-by-Two Circuit. Switched-Capacitor Integrator, Switched-Capacitor Common-Mode Feedback.

**Unit- II**

**Phase Locked Loop**

Characterization of a comparator, basic CMOS comparator design, analog multiplier design, PLL-simple PLL, charge-pump PLL, Applications of PLL

**Unit- III**

**D/A Converter**

Sample-and-Hold Characteristics, DAC Specifications, DAC Architectures: Digital input Code, Resister Steering, R-2R Ladder Networks, Current Steering, Charge-Scaling DACs, Cyclic DACs, Pipeline DACs.

**Unit- IV**

**A/D Converter**

ADC Specifications, ADC Architectures: Flash, The Two-Step Flash ADC, The Pipeline ADC, Integrating ADCs, The Successive Approximation ADC, The Oversampling ADC. Applications of DACs and ADCs.

**TEXT BOOKS:**


1. Jacob Baker, “CMOS circuit design, layout and simulation”, John Wiley India.
2. Razavi, “Design of analog CMOS integrated circuits”, McGraw Hill, Edition 2002.


**REFERENCE BOOKS:**


1. CMOS Analog Circuit Design –Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition.
2. Gregorian, Temes, “Analog MOS Integrated Circuit for signal processing”, John Wiley & Sons, 1986.
3. Analog Integrated Circuit Design- David A. Johns,Ken Martin, Wiley Student Edition

| ECO-17A | Blockchain Technology | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture (Hrs.) | Tutorial (Hrs.) | Practical (Hrs.) | Credit | Major Test | Minor Test | Total | Time |
| 3 | - | - | 3 | 75 | 25 | 100 | 3Hr |
| **Course Outcomes** | | | | | | | |
| **CO1** | Understand how blockchain systems (mainly Bitcoin and Ethereum) work | | | | | | |
| **CO 2** | To securely interact with them | | | | | | |
| **CO 3** | Design, build, and deploy smart contracts and distributed applications | | | | | | |
| **CO 4** | Integrate ideas from blockchain technology into their own projects. | | | | | | |

**Unit I**

Basics: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. • Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

**Unit II**

Blockchain: Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

**Unit III**

Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.

**Unit IV**

Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin

**Text Book**

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
2. **Reference Books**

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
3. DR. Gavin Wood, “ETHEREUM: A Secure Decentralized Transaction Ledger,”Yellow paper.2014.
4. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

| ECP-10A | Fiber Optic Communications | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hr.** |

| Course Outcomes | |
|---|---|
| **CO1** | **Students will be able to understand the structure of fiber and the mechanism of light travelling in the fiber.** |
| **CO2** | **Students will be able to analyze various losses associated with fibers.** |
| **CO3** | **Students will learn about the optical sources and optical detecters.** |
| **CO4** | **Students will be able to understand the various components and devices required in making optical networks** |

## UNIT – I

**INTRODUCTION** : Optical Fibers: Structure, Propagation within the fiber, Numerical aperture of fiber, acceptance angle, step index and graded index fiber, Modes of propagation in the fiber, Single mode and multi mode fibers. Splices and connectors. Optical Power Launching and Coupling. Fiber-to-fiber joints.

## UNIT –II

**LOSSES IN OPTICAL FIBER** : Attenuation, Absorption Losses, Scattering Losses, Leaky modes, Mode coupling losses, Bending Losses, Combined Losses in the fiber.

**DISPERSION EFFECT** : Effect of dispersion on the pulse transmission Intermodal dispersion, Material dispersion, Wave guide dispersion, Polarization Mode Dispersion, Total dispersion, Transmission rate. Dispersion Shifted Fibers, Dispersion Compensating Fibers.

## UNIT – III

**LIGHT SOURCES** : LEDS, Laser Action in semiconductor Lasers, Semiconductor Lasers for optical communication – Laser modes, Spectral Characteristics, Power Voltage Characteristics, Frequency response.

**DETECTORS** : P-I-N Photodiode, APD, Noise Analysis in detectors, Coherent and non-coherent detection, Infrared sensors. Bit error rate.

## UNIT – IV

**The fiber-optic Communication System:** Design considerations of fiber optic systems: Analog and digital modulation. Optical Devices: Optical coupler, space switches, linear divider-combiners, WDM: strategy, wavelength division multiplexer and demultiplexer, optical amplifier

**OPTICAL NETWORKS**: Elements and Architecture of Fiber-Optic Network, Optical link network-single hop, multihop, hybrid and photonic networks.

**Suggested Books:**

John Power, An Introduction to Fiber optic systems, McGraw Hill International.
John Gowar , Optical communication Systems.
R. Ramaswamy, Optical Networks, Narosa Publication
John M. Senior,Optical Fiber Communication
Gerd Keiser, Optical Fiber Communication

| ECP-11A | Mobile Communication and Networks | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture (Hrs.)** | **Tutorial (Hrs.)** | **Practical (Hrs.)** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| 3 | - | - | 3 | 75 | 25 | 100 | 3 Hrs. |
| **Course Outcomes (CO)**<br>To expose the students to the most recent technological developments in Mobile communication systems.. | | | | | | | |
| **CO1** | To familiarize the students with the fundamental concepts of wireless, cellular technology<br>And signal propagation in mobiles | | | | | | |
| **CO2** | Students will able to learn the detail knowledge of GSM and GPRS. | | | | | | |
| **CO3** | After this unit students will understand the wireless access techniques and standards | | | | | | |
| **CO4** | Students will understand the concept of mobile receivers. | | | | | | |

**UNIT-I**

**Cellular concepts**: Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 2G and 3G cellular standards.
**Signal propagation**: Propagation mechanism- reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing. Fading channels-Multipath and small scale fading- Doppler shift, statistical multipath channel models, narrowband and wideband fading models

**UNIT-II**

**Mobile System and Network Architectures GSM Services and Features** – GSM system Architecture, GSM radio subsystem, Frame structure for GSM, Signal processing in GSM, GPRS Network architecture, GPRS services and features, 3G UMTS network architecture, UMTS services and features.

.

**UNIT-III**

**Wireless Standards Multiple access techniques:** FDMA, TDMA and CDMA, Wireless networking, Design issues in personal wireless systems, Cordless systems and Wireless Local Loop (WLL), IEEE 802.16 Fixed Broadband Wireless Access standard, Mobile IP and Wireless Application protocol**.**

**UNIT-IV**

**Receiver structure**: Diversity receivers- selection and MRC receivers, RAKE receiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Altamonte scheme.

**Text Books**

1. Rappaport, T.S., “Wireless Communications”, Principles and Practice, Prentice Hall, NJ, 1996.
2.William Stallings, “Wireless Communication and Networking”, Pearson Education, 2002.

| ECP – 12A | **Adaptive Signal Processing** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **MajorTest** | **MinorTest** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hr.** |
| **CourseOutcomes** | | | | | | | |
| CO1 | To understand various stochastic processes and models in adaptive signal processing. | | | | | | |
| CO2 | To understand the analysis of wiener filters, the concept of the linear prediction and steepest descent algorithms. | | | | | | |
| CO3 | To use Least-Mean-Square (LMS) & Recursive Least-Squares (RLS) algorithms for specific engineering problems. | | | | | | |
| CO4 | To apply the concept robustness and analysis the Finite-Precision effects on LMS and RLS algorithms. | | | | | | |

## Unit -I

**Stochastic Processes and Models:** Partial Characterization of a Discrete-Time Stochastic Process, Mean Ergodic Theorem, Correlation Matrix, Correlation Matrix of Sine Wave Plus Noise, Stochastic Models, Wold Decomposition, Asymptotic Stationarity of an Autoregressive Process, Yule—Walker Equations.
**Wiener Filters**: Linear Optimum Filtering: Statement of the Problem, Principle of Orthogonality, Minimum Mean-Square Error, Wiener-Hopf Equations, Error-Performance Surface, Multiple Linear Regression Model.

## Unit -II

**Linear Prediction:** Forward Linear Prediction, Backward Linear Prediction, Levinson-Durbin Algorithm, Properties of Prediction-Error Filters, Schur-Cohn Test.
**Method of Steepest Descent**: Basic Idea of the Steepest-Descent Algorithm, The Steepest-Descent Algorithm Applied to the Wiener Filter, Stability of the Steepest-Descent Algorithm, Example, The Steepest-Descent Algorithm as a Deterministic Search Method, Virtue and Limitation of the Steepest- Descent Algorithm.

## Unit -III

**The Least-Mean-Square (LMS) Algorithm:** Signal-Flow Graph, Optimality Considerations, Applications, Statistical Learning Theory, Transient Behavior and Convergence Considerations, Efficiency.
**The Recursive Least-Squares (RLS) Algorithm:** Some Preliminaries, The Matrix Inversion Lemma, The Exponentially Weighted RLS Algorithm, Selection of the Regularization Parameter, Update Recursion for the Sum of Weighted Error Squares, Example: Single-Weight Adaptive Noise Canceller.

## Unit -IV

**Robustness:** Robustness, Adaptation, and Disturbances, Robustness: Preliminary Considerations Rooted in $H\infty$ Optimization, Robustness of the LMS Algorithm, Robustness of the RLS Algorithm, Comparative Evaluations of the LMS and RLS Algorithms from the Perspective of Robustness.

**Finite-Precision Effects:** Quantization Errors, Least-Mean-Square (LMS) Algorithm, Recursive Least- Squares (RLS) Algorithm, Summary and Discussion.

**TEXT BOOKS:**

1. S. Haykin, Adaptive filter theory,Pearson

**REFERENCE BOOKS:**

1. T. Adali and S. Haykin, Adaptive Signal Processing, WileyIndia
2. B. Widrow and S.D. Stearns, Adaptive signal processing, PrenticeHall.

| Course No. | Course Title | Teaching Schedule | | | Allotment of Marks | | | Duration of Exam (Hrs.) |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Major Test | Minor Test | Total | |
| **ECP-13A** | **Nano electronics** | **3** | **0** | **0** | **75** | **25** | **100** | **3** |

| **Course Outcomes** | |
|---|---|
| **CO 1** | Students will Understand the basic physics behind the nanoelectronics devices |
| **CO 2** | Students be able learn various classification of the nano-materials. |
| **CO 3** | To Understand various fabrication methods of nonmaterials. |
| **CO 4** | Students will learn to characterize various nanomaterials using various characterization tools. |

**UNIT-I**

Introduction to nanotechnology, Impacts, Limitations of conventional microelectronics, Trends in microelectronics and optoelectronics, Mesoscopic physics, trends in microelectronics and optoelectronics, characteristic lengths in mesoscopic systems, Quantum mechanical coherence

**UNIT- II**

Classification of Nano structures, Low dimensional structures Quantum wells, wires and dots, Density of states and dimensionality, Basic properties of two dimensional semiconductor nanostructures, square quantum wells of finite depth, parabolic and triangular quantum wells.

**UNIT-III**

Introduction to methods of fabrication of nanomaterials, different approaches, physical vapour deposition, chemical vapour deposition, Molecular Beam Epitaxy, Ion Implantation, Formation of Silicon Dioxide-dry and wet oxidation methods.

**UNIT-IV**

Introduction to characterization of nanostructures, tools used for of nano materials characterization: Principle of operation of Scanning Tunnelling Microscope, Atomic Force Microscope, Scanning Electron microscope, Transmission Electron Microscope.

Text Books:

1. J.M. Martinez-Duart, R.J. Martin Palma, F. Agulle Rueda Nanotechnology for Microelectronics and optoelectronics, Elsevier, 2006
2. W.R. Fahrner, Nanotechnology and Nanoelctronics, Springer, 2005

References:

1. Chattopadhyay, Banerjee, Introduction to Nanoscience & Technology, PHI, 2012
2. George W. Hanson, Fundamentals of Nanoelectronics, Pearson Education, 2009.
3. K. Goser, P. Glosekotter, J. Dienstuhl, Nanoelectronics and nanosystems, Springer 2004.
4. Murty, Shankar, Text book of Nanoscience and Nanotechnology, Universities Press, 2012.
5. Poole, Introduction to Nanotechnology, John Wiley, 2006.
6. Supriyo Dutta, Quantum Transport- Atom to transistor, Cambridge, 2013.

| ECP-14A | Microwave Theory and Techniques | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hr.** |
| **Course Outcomes** | | | | | | | |
| **CO1** | Learner will be able to mathematically design basic resonator cavities and will be able to measure microwave parameters such as impedance, frequency and VSWR etc | | | | | | |
| **CO2** | Learner will learn the conventional methods to generate the microwaves. | | | | | | |
| **CO3** | Learner will know about the importance of scattering parameters along with its applications<br>in the analysis of basic microwave components. | | | | | | |
| **CO4** | Learner will learn about transferred electron and avalanche transit time devices in detail. | | | | | | |

**UNIT-I**

**Introduction to Microwaves**-History of Microwaves, Microwave Frequency bands, Applications of Microwaves: Civil and Military, Medical, EMI/ EMC, Effect of Microwaves on Human Body.
Mathematical Model of Microwave Transmission-Concept of Mode, Features of TEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave Transmission.
Review of waveguides in brief, Coaxial Transmission Line, Strip line, Microstrip line.
Microwave Resonators: Cavity Resonators: Rectangular, Cylindrical, and Coaxial, Excitation and Coupling of cavities, Q factor.

**UNIT-II**

**Microwave Measurements**: Measurement of frequency, impedance (using slotted section) Attenuation, power, dielectric constant, measurement of V.S. W. R., Insertion loss and Permeability.
Microwave Generators: Construction, characteristics, operating principle and typical applications of Klystron(two cavity, multicavity), Reflex Klystron, Magnetron(Cylindrical magnetron and description of Πmode applications) and Traveling Wave Tube(TWT).

**UNIT-III**

**Matrix Description of Microwave Circuits**: Scattering Matrix: properties, measurement of scattering coefficients, scattering matrices for common microwave systems.
Passive and Active Microwave Devices- Microwave passive components: Directional Coupler, Power Divider, E Plane and H-Plane Tee, Magic Tee, Attenuator, Isolators, Circulator and Phase Shifter.
Microwave Active Components: Diodes, Transistors, Design Considerations of Filters, Amplifiers, Oscillators and Mixers (in Brief).

**UNIT-IV**

**Solid State Microwave Devices**: Transferred Electron Devices-Gunn Diode: Negative Differential Resistance Phenomenon, High Field Domain Formation. Avalanche Transit Time Devices: IMPATT, TRAPATT, BARITT diodes, Tunnel Diode, PIN Diode, Parametric amplifiers
Text Book: David M. Pozar, Microwave Engineering, John Wiley and sons Inc.

Reference Books:

1. Samuel Y. Liao, Microwave Devices and Circuits, Prentice-Hall of India.
2. Das. Annapurna & Sisir K. Das, Microwave Engineering, Tata McGraw-Hill.
3. R.E. Collins, Microwave Circuits, McGraw Hill.

| ECP-15A | EMBEDDED SYSTEMS | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time(Hrs)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Course Outcomes** | | | | | | | |
| **At the end of the course students will be able to** | | | | | | | |
| CO1 | Acquire knowledge about different types of Microcontrollers and various Embedded System design examples of real- life problems. | | | | | | |
| CO2 | Understand the PIC, AVR, ARM and SHARC architectures. | | | | | | |
| CO3 | Understand different types of I/O devices, Timer Devices and Communication Interfaces. | | | | | | |
| CO4 | Acquire knowledge about the design of RTOS and various operating systems. | | | | | | |

**UNIT I**

**INTRODUTION**: Different types of Microcontrollers, 4-bit, 8-bit, 16-bit, and 32-bit Microcontrollers, Processor Architectures: Harvard & Princeton, CISC & RISC, Microcontrollers Memory Types, Microcontrollers Features, Criteria for Choosing a Microcontroller, Applications of Microcontrollers, Embedded System**:** Definition, Embedded Processors; Hardware Units, Devices and Software Tools in a System, Embedded System on Chip, Complex Systems Design and Processors, Design Challenges, Design Process and Design Examples.

**UNIT II**

**PIC MICROCONTROLLER**: Introduction to PIC16 Microcontroller Family, Features of PIC16C74, Architecture and Pin diagram of PIC16C74, Pipelining, Program Memory Considerations, Register File Structure, Addressing Modes, Instruction Sets; Advanced Architectures**:** Only Brief General Architecture of AVR, ARM and SHARC.

**UNIT III**

**COMMUNICATION INTERFACES:** I/O Devices Types and Examples, Serial Communication Devices, Parallel Device Ports, Wireless Devices, Timer and Counting Devices, Distributed Networked Embedded System Architecture, Serial Bus Communication Protocols-$I^2C$, CAN, USB, FireWire and Advanced Buses; Parallel Bus Device Protocols- ISA, PCI, ARM and Advanced Buses; Network Protocols-HTTP, TCP, UDP, IP and Ethernet; Wireless and Mobile System Protocols- IrDA, Bluetooth, 802.11 and Zigbee; Device Drivers.

**UNIT IV**

**RTOS**: Architecture of Kernel, Processes, Threads, Task and Thread States, Task and Data, Distinction Between Function, ISR, IST and Task; Semaphores, Mutex, Event Registers, Pipes, Signal, Timers, Memory Management, Priority Inversion Problem, Disabling and Enabling Function, Queues and Mailboxes, Pipe and Sockets Functions;

Basic Design using a RTOS, RTOS Task-Scheduling Model, OS Standards: POSIX, Off- the-Shelf Operating System, Embedded Operating Systems, Real –Time Operating Systems, Handhold Operating Systems.

**Text Books:**

1. Raj Kamal, “Embedded systems architecture, programming and design”, 3rd Ed., McGraw-Hill Companies.

2. John. B. Peatman, “Design with PIC Microcontroller”, Pearson Education, 2003.
3. Dr. K.V.K.K. Prasad, “Embedded/Real-Time Systems: Concepts, design and programming”, DreamTech Press.

**References Books:**


1. Myke Predko, “Programming and Customizing the 8051 Microcontroller”, TMH.
2. M.A. Mazidi, R. D. McKinlay,Causey,” The PIC microcontroller and Embedded Systems using assembly and C for PIC18”, 2nd Ed., Pearson.
3. D.P. Kothari, Shriram K. Vasudevan, Sundaram R. M. D., Murali N., “Embedded System”, New Age International (P) Limited, Publishers.
4. Shibu K V, “introduction to Embedded Systems”, 2nd Ed., McGraw Hill Education(India) private Limited.


**Note: Separate question paper template will be provided to the paper setter for setting the question paper of end term semester examinations.**

| ECP-16A | ROBOTICS | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time(Hrs)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Course Prerequisites** | Transducers and Microprocessors. | | | | | | |
| **Course Objectives** | To enlighten the students about the fundamentals of robotic systems. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **At the end of this course the student should be able to understand** | | | | | | | |
| **CO1** | The basic concepts related to the Robot, parts of Robots, End Effectors and to make familiar with the various Drive systems for Robot. | | | | | | |
| **CO2** | The operation of various Sensors and their Applications in Robots. | | | | | | |
| **CO3** | The Machine Vision and its Applications, and various Control Systems used in Robots. | | | | | | |
| **CO4** | The Robot Programming, Artificial Intelligence, Fuzzy Logic, Safety Standards of Robots and Industrial and Non-Industrial applications of Robots. | | | | | | |

## UNIT I

**FUNDAMENTALS OF ROBOT:** Definition, History and Development in Robot Technology, Robot Technology: Characteristics, Basic Components, Robot Anatomy, Robot Generations, Robot Selection, Present and Future Applications.

**ROBOTS DRIVE SYSTEMS AND END EFFECTORS**: Robot Classification: Arm Geometry, Degrees of Freedom, Power Sources, Types of Motion, Path Control; Robot End Effectors: Mechanical Grippers, Vacuum, Magnetic, Adhesive; Special Purpose Grippers, Process Tooling, Compliance, Robot Drive Systems: Hydraulic, Pneumatic and Electric System.

## UNIT II

**SENSORS :** Requirements of a Sensor, Sensor Classification; **Principle, Advantages, Disadvantages and Applications of the following Sensors**: Position Sensors - Potentiometer, Encoder, LVDT, Resolvers, LMDT and Hall–Effect Sensors; Velocity Sensors: Encoder, Tachometer and Differentiation of position signal; Acceleration Sensors, Force, Pressure Sensors: Piezoelectric, Force Sensing Resistor, Strain Gauge and Antistatic Foam; Torque Sensors, Micro Switches, Visible Light and Infrared Sensors, Touch and Tactile Sensors, Proximity Sensors: Magnetic, Optical, Ultrasonic, Inductive, Capacitive and Eddy Current; Range Finder: Ultrasonic, Light-base and GPS; Sniff Sensors, Taste Sensors, Vision Sensors, Voice Recognition Devices, Voice Synthesizers, RCC.

## UNIT III

**MACHINE VISION AND CONTROL SYSTEM:** Visual Sensing, Architecture of Robotics Vision System, Machine Vision: Image Acquisition - Vidicon Tube and CCD; Digitization, Image Processing: Spatial Domain Operations, Noise Reduction and Edge Detection etc.; Image Analysis: Object Recognition by Features-Template Matching, Discrete Fourier Descriptors and Computed Tomography; Depth Measurement with Vision System, Image Interpretation, Segmentation by Region Growing and Region Splitting, Image Data Compression, Machine Vision Application, Other Optical Methods; Control Systems: Basic Robot Control System, PLC, PID, CNC, MPU, and URC.

## UNIT IV

**ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND ROBOTS APPLICATIONS:** Robot Programming: Programming Methods and Languages, Levels of Robot Programming, Space Position Programming, and Program Statements; Elements of Artificial Intelligence, System Architecture; Fuzzy Logic Control, Application of Fuzzy Logic in Robotics; Robot Safety, Safety Standards; Industrial Applications: Automation in Manufacturing, Robot Applications: Material Handling, Processing Application, Assembly Application and Inspection Application; Evaluating the Potential of a Robot Application, Future Applications, Challenge, Innovations; Non-Industrial Application.

**Text Books:**


1. James G. Keramas, "Robot technology fundamentals", Delmar Publishers.
2. Saeed B. Niku, "Introduction to robotics analysis, control and applications", 2nd ed., Wiley India.
3. R. K. Mittal, I. J. Nagrath, "Robotics and Control", TMH Education Pvt.


**Note: Separate question paper template will be provided to the paper setter for setting the question paper of end term semester examinations.**

| | | | | | | |
|---|---|---|---|---|---|---|
| **ECP-17A** | **Digital Image Processing** | | | | | |
| | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **75** | **25** | **100** | **3 Hr.** |
| **Course Outcomes** | | | | | | |
| **CO1** | Student will be able to explain basic concepts of image processing | | | | | |
| **CO2** | Student will be able to design evaluate image enhancement techniques | | | | | |
| **CO3** | Student will be able to analyze various compression and morphological operations | | | | | |
| **CO4** | Student will be able to describe various video processing systems | | | | | |

## Unit – I

**Digital image processing fundamentals:** Introduction, Image processing applications, Fundamental Steps in Digital Image Processing, Image Sampling and Quantization, Relationships between pixels, Color Fundamentals, color models.

## Unit - II

**Image Enhancement:** Basics of intensity Transformations, Histogram processing, Spatial Domain filtering – Basics of Spatial Filtering, Smoothing and Sharpening Spatial Filtering.
Frequency Domain Filtering- Sampling and Fourier Transform of sampled functions, 2-D Sampling, Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.

## Unit - III

**Image Compression:** Fundamentals, Image Compression models, Error Free Compression – Huffman Coding, Arithmetic Coding, LZW Coding, Lossy Compression – Block transform coding.
**Morphological Image Processing:** Introduction, Erosion and Dilation, Opening and Closing, Hit or Miss Transformations, Boundary Extraction. Image Segmentation: Fundamentals of image segmentation, Point, Line, and Edge Detection.

## Unit - IV

**Video Processing:** video formation, Video Frame classifications- I, P and B frames, Application of motion estimation in video coding, Patterns and Pattern classes - Recognition based on matching.

**Text Books:**
1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2018.

**Reference Books:**
1.Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011
2. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.
3. M. Tekalp, Digital Video Processing. Signal Processing Series, Prentice Hall, 1995.
4. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.

**Note: Question paper template will be provided to the paper setter.**

| ECP-14LA | **Microwave Communication Lab** | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture (Hrs.) | Tutorial (Hrs.) | Practical (Hrs.) | Credit | Practical | Minor Test | Total | Time |
| - | - | 4 | 2 | 60 | 40 | 100 | 3 Hrs. |

**Course Outcomes (CO)**
To give the students an idea about the study and analysis of components used in Microwave Engg.

| | |
|---|---|
| **CO1** | Students will learn the steps to analyze microwave components. |
| **CO2** | Students will be able to find the characteristics of microwave components. |
| **CO3** | Students will learn the steps to analyze various antennas. |
| **CO4** | Students will be able to find the characteristics of various antennas. |

**List of Experiments:**

1. To study microwave components.
2. To study the characteristics of the reflex Klystron tube and to determine its electronic tuning range.
3. To determine the frequency and wavelength in a rectangular waveguide working in TE 10 mode.
4. To determine the standing wave ratio and reflection coefficient.
5. To study the I-V characteristics of gunn diode.
6. To study the magic Tee.
7. To study the isolator and attenuator.
8. To measure the coupling coefficient and directivity of a waveguide directional coupler.
9. To measure the polar pattern and the gain of a waveguide horn antenna.
10. To measure the insertion loss and attenuation.

| ECP-15LA | Embedded Systems Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture (Hrs.)** | **Tutorial (Hrs.)** | **Practical (Hrs.)** | **Credit** | **Practical** | **Minor Test** | **Total** | **Time** |
| **-** | **-** | **4** | **2** | **60** | **40** | **100** | **3 Hrs.** |

| **Course Outcomes (CO)**<br>**To give the students an idea about the 8051/PIC/AVR/ARM microcontrollers** | |
|---|---|
| **CO1** | To familiarization with 8051, PIC, AVR and ARM Microcontrollers. |
| **CO2** | Ability to write an embedded C language and assembly language program for 8051, PIC and AVR Microcontrollers. |
| **CO3** | Ability to interfacing the various Peripheral to 8051, PIC and AVR Microcontrollers. |
| **CO4** | Ability to design the embedded systems based on 8051, PIC and AVR Microcontrollers. |

**List of Experiments**

1. Write an embedded C program using 8051/PIC/AVR Microcontroller for interfacing DC motor to rotate clockwise and anticlockwise directions.
2. Write an embedded C program using 8051/PIC/AVR Microcontroller for interfacing stepper motor to rotate clockwise and anticlockwise directions.
3. Write an embedded C program using 8051/PIC/AVR Microcontroller for interfacing LCD to display message “WELCOME” on LCD screen.
4. Write an embedded C program using 8051/PIC/AVR Microcontroller for interfacing a switch and a buzzer at two different pins of a Port such that the buzzer should sound as long as the switch is pressed.
5. Write an embedded C program using 8051/PIC/AVR Microcontroller for interfacing keypad to port P0.Whenever a key is pressed; it should be displayed on LCD screen.
6. Write an embedded C program using 8051/PIC/AVR Microcontroller for interfacing LEDs to glow them in different pattern.
7. Write an embedded C program for 8051/PIC/AVR Microcontroller to display 0 to 9 on 7 segment display.
8. Write an embedded C program using 8051/PIC/AVR Microcontroller for interfacing RTC module to display current date and time on LCD screen
9. Write an embedded C program using 8051/PIC microcontroller for interfacing temperature sensor LM35 to display the current temperature on LCD screen.
10. Design an embedded system for traffic light controller using 8051/PIC Microcontroller

.

| ECP-16LA | Robotics lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture (Hrs.)** | **Tutorial (Hrs.)** | **Practical (Hrs.)** | **Credit** | **Practical** | **Minor Test** | **Total** | **Time** |
| **-** | **-** | **4** | **2** | **60** | **40** | **100** | **3 Hrs.** |

| | |
|---|---|
| **Course Outcomes (CO):**<br>**To expose the students to the most recent technological developments in industrial Robot.** | |
| **CO1** | **To familiarization with FIRE BIRD Robot.** |
| **CO2** | **Abilities to interfacing various peripherals.** |
| **CO3** | **Student will be able to write embedded C language programming..** |
| **CO4** | **Ability to design the automatic system for robotics based application.** |

**List of Experiments**:

1. To get familiar with the AVR Studio 4.17 IDE and Fire Bird Robot.
2. Write a program for I/O interfacing to sense the pressing of push button Switch.
3. Write a program to alternately blink the set of LED
4. Write a program to display two digit numbers on LCD.
5. Write a program for obstacle detection of Robot
6. Write a program for controlling the speed of Fire Bird Robot.
7. Write a program for PWM based speed control of motor.
8. Write a program to design white line Follower Robot
9. To implement and design social distancing indicator and alarming system.
10. To Study implement the temperature based Fan speed controller.

| ECP-17LA | Digital Image Processing Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture (Hrs.) | Tutorial (Hrs.) | Practical (Hrs.) | Credit | Practical | Minor Test | Total | Time |
| - | - | 4 | 2 | 60 | 40 | 100 | 3 Hrs. |

**Course Outcomes (CO)**

**To give the students an idea about the study and analysis of digital image processing**

| | |
|---|---|
| **CO1** | Students will be able to explain the basics of Digital Image processing |
| **CO2** | Student will be able to explain sampling and quantization of digital image. |
| **CO3** | Student will be able to analyze the image enhancement operations on digital image. |
| **CO4** | Students will be able to analyze various image analysis and computer vision algorithm |

List of Experiments

1. Study of Image processing toolbox of MATLAB.
2. WAP to read and show various images of at least five different formats.
3. WAP to extract R, G, B component of Color Image.
4. WAP to convert a color image into gray scale and save it in new format.
5. WAP to invert a gray scale image.
6. WAP to implement Morphological operations on an image.
7. WAP to implement Histogram equalization.
8. WAP to implement various edge detection algorithms.
9. WAP to implement image segmentation.
10. WAP to implement boundary extraction of basic structure.

| ECP-18A | Wireless & Mobile Communication | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 Hr. |
| Purpose | To introduce the concepts of wireless / mobile communication using cellular environment. To make the students to know about the various modulation techniques, propagation methods, and multi access techniques used in the mobile communication. | | | | | | |
| Course Outcomes | | | | | | | |
| CO 1 | It deals with the fundamental cellular radio concepts and generations of modern wireless communication. | | | | | | |
| CO 2 | This also demonstrates the principle of trunking efficiency and how trunking and interference issues between mobile and base stations combine to affect the overall capacity of cellular systems. | | | | | | |
| CO 3 | It provides idea about Multiple access techniques used in wireless communication. | | | | | | |
| CO 4 | It presents different ways to Wireless Standards and mobility management. | | | | | | |

**Unit–I**

**Introduction to Wireless Communication Systems:** Evolution of mobile radio communications, examples of wireless comm. systems, paging systems, Cordless telephone systems, comparison of various wireless systems.

**Modern Wireless Communication Systems: Second generation cellular networks, third generation wireless networks, wireless in local loop, wireless local area networks, Blue tooth and Personal Area networks.**

**Unit–II**

**Introduction to Cellular Mobile Systems**: Spectrum Allocation, basic Cellular Systems, performance Criteria, Operation of cellular systems, analog cellular systems, digital Cellular Systems.

**Cellular System Design Fundamentals: Frequency Reuse, channel assignment strategies, handoff Strategies, Interference and system capacity, tracking and grade off service, improving coverage and capacity.**

**Unit– III**

**Multiple Access Techniques for Wireless Communication**: Introduction to Multiple Access, FDMA, TDMA, Spread Spectrum multiple Access, space division multiple access, packet ratio, capacity of a cellular systems.

**Unit-IV**

Wireless Standards-GSM, IS-95, UMTS-IMT-2000, Signaling, Call Control, Mobility Management and location Tracing.

### Suggested Books:

1. Theodore S.Reppeport, Wireless Communications Principles and Practice, IEEEPress, Prentice Hall.
2. William C.Y.Lec, Mobile Cellular Telecommunications, Analog and Digital Systems, Mc-Graw Hill Inc.
3 Kamilo Feher, Wireless Digital Communications, Modernization & Spread SpectrumApplications, Prentice Hall of India, New Delhi.
4 Kaveh Pahlavan and Allen H. Levesque " Wireless Information Networks", WileySeries, John Wiley and Sons Inc.

| ECP-19A | Bio-Medical Signal Processing | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | - | - | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | **To understand the concept of Bio-Medical Signal Processing.** | | | | | | |
| **Course Outcomes<br>At the end of this course, student will be able to** | | | | | | | |
| **CO 1** | Interpret signals and systems | | | | | | |
| **CO 2** | Acquire Biomedical Signals such as ECG | | | | | | |
| **CO 3** | Apply adaptive filtering algorithms in biomedical applications | | | | | | |
| **CO 4** | Analyze different kinds of events and waveforms of biomedical origin | | | | | | |

**Unit – I**

**Signals and Information**: Definitions and properties of Laplace transform, Basic of DFT and FFT, z-transform, Sampling theorem.
**Linear Time-Invariant (LTI) Systems**: definitions and properties; causality, stability, impulse response, convolution, poles and zeros, frequency response, group delay, phase delay, Applications of Digital Signal Processing.

**Unit – II**

**Introduction to Biomedical Signal**: General measurement and diagnostic system, classification of signals, introduction to biomedical signals, Biomedical signal acquisition and processing.
**ECG**: ECG signal origin, ECG parameters-QRS detection different techniques, ST segment analysis, Arrhythmia, Arrhythmia analysis, Arrhythmia monitoring system.

**Unit – III**

**Adaptive Filtering**: Introduction, General structure of adaptive filters, LMS adaptive filter, adaptive noise cancellation, cancellation of ECG from EMG signal, Cancellation of maternal ECG in fetal ECG.
**EEG**: EEG signal characteristics, Sleep EEG classification and epilepsy.

**Unit – IV**

**Event Detection and waveform analysis:** Need for event detection, Detection of events & waves, Correlation analysis of EEG signals, Identification of heart sounds, Morphological analysis of ECG waves.
**Frequency Domain Analysis:** Introduction, Spectral analysis, linear filtering, Removal of high frequency noise (power line interference), motion artifacts (low frequency) and power line interference in ECG.

**Text Book:**


1. Biomedical Signal Analysis" A case study approach, Rangaraj M Rangayyan, John Wiley publications.


**Reference Books:**


1. "Biomedical Signal Processing Time and Frequency Domains Analysis (Volume I)", Arnon Cohen, CRC press.
2. "Biomedical Signal Processing Principles and Techniques" D.C.Reddy, Tata Mc Graw-Hill
3. "Biomedical Digital Signal Processing", Willis J. Tompkins, PHI

| ECP-20A | Machine Learning | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| Lecture | Tutorial | Practical | Major Test | Minor Test | Total | Time |
| 3 | 0 | 0 | 75 | 25 | 100 | 3 Hr. |
| **Course Outcomes** | | | | | | |
| **CO1** | Recite and understand the knowledge of classification and associated algorithms | | | | | |
| **CO2** | Explain and apply algorithms of statistical pattern recognition and supervised Learning | | | | | |
| **CO3** | Explain, implement and apply algorithms of non-parametric learning, feature extraction and selection | | | | | |
| **CO4** | Understand, explain and apply un-supervised learning, estimation and comparison of different classifiers | | | | | |

## UNIT-I

**Classification:** The Classification Process, Features, Training and Learning, Supervised Learning and Algorithm Selection, Approaches to Classification, Examples.

**Nonmetric Methods:** Introduction, Decision Tree Classifier, Information, Entropy, Impurity, Information Gain, Decision Tree Issues, Strengths and Weaknesses, Rule-Based Classifier, Other Methods.

## UNIT-II

**Statistical Pattern Recognition:** Measured Data and Measurement Errors, Probability Theory, Simple Probability Theory, Conditional Probability and Bayes' Rule, Naive Bayes Classifier, Continuous Random Variables, The Multivariate Gaussian, The Covariance Matrix, The Mahalanobis Distance.

**Supervised Learning:** Parametric and Non-parametric Learning, Parametric Learning, Bayesian Decision Theory, Discriminant Functions and Decision Boundaries, MAP (Maximum A Posteriori) Estimator.

## UNIT-III

**Nonparametric Learning:** Histogram Estimator and Parzen Windows, k-Nearest Neighbor (k-NN) Classification, Artificial Neural Networks, Kernel Machines.

**Feature Extraction and Selection:** Reducing Dimensionality, Preprocessing, Feature Selection, Inter/Intraclass Distance, Subset Selection, Feature Extraction, Principal Component Analysis, Linear Discriminant Analysis.

## UNIT-IV

**Unsupervised Learning:** Clustering, k-Means Clustering, Fuzzy c-Means Clustering, (Agglomerative) Hierarchical Clustering.

**Estimating and Comparing Classifiers:** Comparing Classifiers and the No Free Lunch Theorem , Bias and Variance, Cross-Validation and Resampling Methods: The Holdout Method , k-Fold Cross-Validation, Bootstrap, Measuring Classifier Performance, Comparing Classifiers, ROC Curves, McNemar's Test, Other Statistical Tests, The Classification Toolbox, Combining Classifiers.

**Text/References Books:**

**1.** Geoff Dougherty: Pattern Recognition and Classification An Introduction, 2013, Springer.

2. Christopher M. Bishop: Pattern Recognition and Machine Learning, Springer.

| ECP-21A | Artificial Intelligence | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hr.** |

| **Course Outcomes** | |
|---|---|
| **CO1** | To familiarize the students with the fundamental concepts of Artificial Intelligance. |
| **CO2** | Students will able to learn the detail knowledge of Supervised and Unsupervised Learning. |
| **CO3** | After this unit students will be able to understand the concepts of Genetic Algorithm and Object Detection and Tracking |
| **CO4** | Students will be able to understand the concept of Artificial Neural Networks and reinforcement learning. |

UNIT-I

Introduction to Artificial Intelligence, need of AI, Applications of AI, Branches of AI, Defining intelligence using Turing Test, Classification, Preprocessing data, Label encoding, Logistic Regression classifier, Naïve Bayes classifier, Support Vector Machines.

UNIT-II

Regression, Building a single variable regressor, Building a multivariable regressor, Supervised and Unsupervised Learning, Detecting Patterns with Unsupervised Learning, Clustering data with K-Means algorithm, Estimating the number of clusters with Mean Shift algorithm,

UNIT-III

Genetic Algorithms, Fundamental concepts in genetic algorithms, Generating a bit pattern with predefined parameters Object Detection and Tracking: Frame differencing, Tracking objects using colorspaces, Object tracking using background subtraction, Face detection and tracking, Eye detection and tracking.

UNIT-IV

Artificial Neural Networks, Building a Perceptron based classifier, Constructing a single layer neural network, Constructing a multilayer neural network, Reinforcement Learning, Reinforcement learning versus supervised learning, Building blocks of reinforcement learning.

Text Book:

1. Introduction to Artificial Intelligence by Philip C. Jackson · 1974

Reference Book:

2. Artificial Intelligence by Chris Neil · 2020
3. Artificial Intelligence with Python by Prateek Joshi.

| ECP -22A | Internet of Things | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 Hr. |
| Course Outcomes | | | | | | | |
| CO1 | Understand what IoT technologies are used for today, and what is required in certain scenarios. | | | | | | |
| CO2 | Understand the types of technologies that are available and in use today and can be utilized to implement IoT solutions. | | | | | | |
| CO3 | Understand the type of protocols and challenges for designing IoT systems. | | | | | | |
| CO4 | Apply these technologies to tackle scenarios in teams of using an experimental platform for implementing prototypes and testing them as running applications. Understand operating system requirements of IOT. | | | | | | |

**Unit 1**

**Introduction to IoT:** Defining IoT, Characteristics of IoT, Functional blocks of IoT, Physical and logical design of IoT, Smart cities and IoT revolution, ,Difference between IoT and M2M, M2M and peer networking concepts Ipv4 and IPV6, Software Defined Networks SDN,

**Unit 2**

**Developing IoTs:** IoT design methodology, case study on IoT system for weather monitoring. IoT system Management,

Developing IoT applications through embedded system platform: Introduction to sensors, IoT physical devices and endpoints, Raspberry pi, Raspberry pi interfaces, Arduino, arduino interfaces.

**Unit 3**

**Protocols for IoT-** messaging protocols, transport protocols, Ipv4, Ipv6, URI, Cloud for IoT: IoT with cloud, challenges, introduction to fog computing, cloud computing,

Challenges in IoT: Design challenges, development challenges, security and legal considerations.

**Unit 4**

**Logic design using Python:** Introduction to python, data types, data structures, control flow, functions, modules, file handling and classes., implementing IotT concepts with python,

Applications of IoT, Connected cars IoT Transportation, Smart Grid and Healthcare sectors using IoT,

**References:**


1) A Bahaga, V. Madisetti, "Internet of Things- Hands on approach", University press, 2014.
2) S.K.Vasudevan, A.S.Nagarajan, "Internet of Things", Wiley, 2019.
3) CunoPfister, "Getting started with Internet of Things", Maker Media, 1st edition, 2011. Samuel Greenguard, "Internet of things", MIT Press, 2015.


**Web resources:**

1) http://www.datamation.com/open-source/35-open-source-tools-for-the-internet-of-things-1.html
2) https://developer.mbed.org/handbook/AnalogIn
3) http://www.libelium.com/50_sensor_applications
4) M2MLabs Mainspring http://www.m2mlabs.com/framework Node-RED http://nodered.org/

| ECP-23A | Error Correcting Codes | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **75** | **25** | **100** | **3 Hr.** |
| **Course Outcomes** | | | | | | |
| **CO1** | Student will be able to evaluate linear codes | | | | | |
| **CO2** | Student will be able to evaluate cyclic codes | | | | | |
| **CO3** | Student will be able to evaluate BSH and RS codes | | | | | |
| **CO4** | Student will be able to evaluate convolution codes | | | | | |

## Unit- I

**Basic concepts of linear codes:** Three fields, linear codes , generator and parity matrix, dual codes, weights and distances, puncturing codes, extending c odes, shortening codes, direct sums,permutation equivalent codes, Golay codes, RM Codes

## Unit- II

**Cyclic Codes**: polynomials and euclidean algorithm, primitive elements, finite fields, subfields, field automorphism. clotomic cosets and minimal polynomials, factoring $x^n$ -1, zeros of cyclic code, minimum distance of cyclic codes.

## Unit -III

**BCH and RS codes:** BCH codes, RS Codes, generalized RS codes, decoding BCH codes,burst error, concatenated and interleaving codes.

## Unit-IV

**Convolution codes:** generator matrices and encoding, veterbi decoding: state diagram, trellis, diagram and viterbi algorithm, canonical generator matrices, free distance.
**Soft decision and iterative decoding: A**WGN, soft decision viterbi decoding, general viterbi algorithm, two way app decoding.

**Text Books:**
1.W. Cary Huffman, Fundamentals of Error-Correcting Codes by Cambridge University Press

**Reference Books:**
1. Ranjan Bose, Information Theory and Coding, McGraw Hill
2. W. Wesley Peterson and E. J. Weldon, *Error-Correcting Codes*, *The MIT Press*

**Note: Question paper template will be provided to the paper setter.**

| ECP-24A | Satellite Communication | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hr.** |
| **Purpose** | **To familiarize the students with the concepts of Satellite communication and various terms, laws and multiple access schemes used in its working.** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **To understand the concept of basics of satellite communication and various basic laws and terms of satellite communication.** | | | | | | |
| **CO2** | **To understand the concept and processes of various communication satellites used in satellite communication.** | | | | | | |
| **CO3** | **To familiarize with the concept and design issues of satellite link design and satellite access.** | | | | | | |
| **CO4** | **To familiarize with the concepts of Multiple access schemes used in satellite communication.** | | | | | | |

**Unit -I**

**SATELLITE ORBITS:** Orbital Mechanics- Kepler's laws ,locating the satellite in the Orbit, locating the satellite with respect to the earth, Orbital elements, look angle determination, Sub satellite point, Azimuth and elevation angle calculation, Orbital perturbations, Longitudinal and Inclination changes; Launches and launch vehicles-ELV's, Placing the satellite into geostationary orbit, Doppler shift, range variations, solar eclipse, sun transit outage.

**Unit -II**

**COMMUNICATION SATELLITES:** Satellite Subsystems, Attitude and Orbit Control system(AOCS), Telemetry, Tracking, Command and Monitoring (TTC&M), Power System, Communication Subsystems-description, Transponders, satellite antennas-basic antenna types, basic antennas in practice.

**Unit -III**

**Satellite link design and Satellite access:** Basic transmission theory**,** system noise temperature and G/T ratio; Downlink design-link budget; Uplink design; design for specified C/N, uplink and downlink attenuation in rain, communication link design procedure; system design examples.

**Unit –IV**

**Multiple access schemes:** FDMA, TDMA, CDMA, DAMA; VSAT systems-basic techniques, VSAT earth station engineering, system design; DBS systems-C-band and Ku band home TV, digital DBS; satellite mobile systems; GPS

**Text Books:**

1. Timothy Pratt, Satellite Communications, Wiley India edition

**Reference Books:**

2. Anil K Maini, Satellite Communication, Wiley India edition.
3. Siegmund M. Redl, Mathias K. Weber, Malcolm W. Oliphant, "An Introduction to GSM", Artech House Publishers, 1995.
4. Kraus, J.D., "Antennas", II Edition, John Wiley and Sons, NY, 1977. 5. Collin, R.E. and Zucker, F., - "Antenna theory: Part I", Tata McGraw Hill, NY, 1969.

| ECP-25A | High Speed Electronics | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **75** | **25** | **100** | **3 Hour** |
| **Course Outcomes** | | | | | | | |
| **CO 1** | **Understand significance and the areas of application of high-speed electronics circuits.** | | | | | | |
| **CO 2** | **Understand the properties of various components used in high speed electronics** | | | | | | |
| **CO 3** | **Design High-speed electronic system using appropriate components.** | | | | | | |
| **CO 4** | **To be able to understand the effect of scaling on high speed VLSI circuits.** | | | | | | |

## UNIT-I

Transit time of charge carriers, junction capacitances, ON-resistances and their dependence on the device geometry and size, carrier mobility, doping concentration and temperature. Contact resistance and interconnection/interlayer capacitances in the Integrated Electronics Circuits.

## UNIT-II

Introduction to high-speed digital design: Frequency, time and distance - Capacitance and inductance effects - High seed properties of logic gates - Speed and power - Modelling of wires -Geometry and electrical properties of wires - Electrical models of wires - transmission lines - lossless LC transmission lines - lossy LRC transmission lines

## UNIT-III

Devices: Passive and active, Lumped passive devices, Active : low frequency and high frequency models RF Amplifier Design, Stability, Low Noise Amplifiers, Broadband Amplifiers and Power Amplifiers, Class A, B, AB and C, D, E .

## UNIT-IV

Impact of scaling on High Speed VLSI Circuit, Inter-Die Variation, Intra-Die Variation, Fail Causes Optimization Techniques for High Speed VLSI: Mathematic Optimization, Circuit optimization, CAD tool for optimization

Books:


1. Stephen H. Hall, Garrett W. Hall, James A. McCall "High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices", August 2000, Wiley-IEEE Press
2. . Kerry Bernstein & et. al., High Speed CMOS Design Styles, Kluwer, 1999
3. William S. Dally & John W. Poulton; Digital Systems Engineering, Cambridge University Press, 1998
4. Howard Johnson & Martin Graham; High Speed Digital Design: A Handbook of Black Magic, Prentice Hall PTR, 1993
5. Masakazu Shoji; High Speed Digital Circuits, Addison Wesley Publishing Company, 1996
6. William S. Dally & John W. Poulton; Digital Systems Engineering, Cambridge University Press, 1998
7. Howard Johnson & Martin Graham; High Speed Digital Design: A Handbook of Black Magic, Prentice Hall PTR, 1993
8. Thomas H. Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", CambridgeUniversity Press, 2004, ISBN 0521835399.
9. Behzad Razavi, "RF Microelectronics", Prentice-Hall 1998, ISBN 0-13-887571-5.
10. Guillermo Gonzalez, "Microwave Transistor Amplifiers", 2nd Edition, Prentice Hall.

11. Kai Chang, “RF and Microwave Wireless systems”, Wiley.
12. R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011 Course Outcomes:

| ECP-26A | Software Defined Radio | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | **To understand the underlying principles of Software Defined Radios and Cognitive Radio Networks.** | | | | | | |
| **Course Outcomes** | | | | | | | |
| CO1 | Understand the principles behind the Software Defined Radios over the conventional Cognitive Radios | | | | | | |
| CO2 | Ability to analyze Software Defined Networking protocols and cognitive radio techniques | | | | | | |
| CO3 | Understand the data traversal over SDN | | | | | | |
| CO4 | Design algorithms for Software Defined Radio and cognitive radio environments | | | | | | |
| CO5 | Understand the various types of key routing and switching techniques used in adaptive networks. | | | | | | |

**UNIT I**

**SOFTWARE DEFINED RADIO CONCEPTS**

Need for Software Radios - Characteristics and Benefits of a Software Radio - Design Principles of a Software Radio - RF Receiver Front-End Topologies - Importance of the Components to Overall Performance - Transmitter Architectures and Their Issues - Noise and Distortion in the RF Chain ADC and DAC Distortion - Flexible RF Systems

**UNIT II**

**SDR AS A PLATFORM FOR COGNITIVE RADIO**

Hardware Architecture: Baseband Processors - Hardware Architecture: Multi-Core Systems - Software Architecture: Design Philosophies - GNU Radio - Software Communications Architecture - Application Software - Component Development - Waveform Development - Cognitive Waveform Development

**UNIT III**

**COGNITIVE RADIO: TECHNOLOGIES REQUIRED**

Software Capable Radios - Software Programmable Radios - SDR Examples - Aware Adaptive and CRs - Radio Capabilities and Properties Comparison - Spectrum Awareness and Frequency Occupancy - Software Technology - Funding and Researches in CRs - Directions and Standards

**UNIT IV**

**OBJECT ORIENTED REPRESENTATION OF RADIOS**

Introduction to Network Resources - Network Resources - Object Oriented Programming - Object Request Broker Architecture - Object Brokers and Software Radios - Mobile Application Environments - Security in Software Radios - Joint Tactical Radio Systems - SCA Architectures.

REFERENCES

1. Software Radio: A Modern Approach to Radio Engineering By Jeffrey H. Reed Pearson Education Low Price Edition
2. “Cognitive Radio Technology”, Bruce A Fette, Academic Press, 2009
3. Cognitive Radio Networks by Wyglinski, Alexander M. Nekovee, Maziar, Hou, Y. Thomas, 2010 Elsevier.
4. “Cognitive Radio, Software Defined Radio and Adaptive wireless system, Huseyin Arslan , Springer, 1 edition ,September 24, 2007

| ECP-18LA | Wireless Communication Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture (Hrs.)** | **Tutorial (Hrs.)** | **Practical (Hrs.)** | **Credit** | **Practical** | **Minor Test** | **Total** | **Time** |
| **-** | **-** | **4** | **2** | **60** | **40** | **100** | **3 Hrs.** |

**Course Outcomes (CO)**
To give the students an idea about the Wireless communication theory and technology using the NI-Labview software and RF communication module.

| | |
|---|---|
| **CO1** | To study the wireless communication using NI-Labview |
| **CO2** | To learn about the functioning of Universal Software Radio Peripheral (USRP) |
| **CO3** | To learn the implementation of different analog modulation schemes using the USRP |
| **CO4** | To learn the implementation of different digital modulation schemes using the USRP. |

**List of Experiments:**

1. Introduction to NI-LabVIEW and familiarization with its basic functions.
2. Study of modulation toolkit and its usage in Wireless Communication.
3. Study the interfacing of hardware (USRP module) with the PC and configuring the same.
4. Implementation of AM using Software Defined Radio (SDR).
5. Implementation of FM using SDR with application such as transfer of files
6. Implementation of M-PSK transmitter using SDR concept.
7. Implementation of M-PSK receiver using SDR
8. Implementation of M-QAM transmitter using SDR.
9. Demonstrates the use of the Bluetooth functions to set up data transfer via Bluetooth between a server VI and a client VI.
10. Design two-dimensional convolution to perform image edge detection.
11. Implementation of M-QAM receiver using SDR.
12. Implementation of PSK Modulation system with Convolutional Coding.
13. Implementation of FSK Modulation system with BCH Coding.
14. Implementation of QAM Modulation system with Golay Coding

| ECP-19LA | Biomedical lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture (Hrs.)** | **Tutorial (Hrs.)** | **Practical (Hrs.)** | **Credit** | **Practical** | **Minor Test** | **Total** | **Time** |
| **-** | **-** | **4** | **2** | **60** | **40** | **100** | **3 Hrs.** |
| **Course Outcomes (CO)**<br>**At the end of the course, student will be able to** | | | | | | | |
| **CO1** | **Elaborate various biomedical signals** | | | | | | |
| **CO2** | **Acquire and simulate ECG ,EMG and EEG biomedical signals** | | | | | | |
| **CO3** | **Simulate ECG Pulse missing detector** | | | | | | |
| **CO4** | **Demonstrate the functions of defibrillator and pacemaker** | | | | | | |

**List of Experiments:**

1. Familiarization of various biomedical signals.
2. To simulate Electrocardiogram Waveform
3. To simulate Electroencephalogram Signal
4. To simulate Electromyogram Signal
5. To Simulate Defibrillator
6. To simulate Pacemaker
7. To simulate Haemodialysis Machine
8. To simulate Biopotential Amplifier
9. To simulate ECG Pulse missing detector.
10. To simulate 12 Lead ECG Signals.

| ECP-20LA | Machine Learning Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture (Hrs.)** | **Tutorial (Hrs.)** | **Practical (Hrs.)** | **Credit** | **Practical** | **Minor Test** | **Total** | **Time** |
| **-** | **-** | **4** | **2** | **60** | **40** | **100** | **3 Hrs.** |
| **Course Outcomes (CO)**<br>**At the end of the course, student will be able to** | | | | | | | |
| **CO1** | Elaborate machine learning fundamentals | | | | | | |
| **CO2** | Implement different classification/regression algorithms | | | | | | |
| **CO3** | Design and develop artificial neural networks for different applications | | | | | | |
| **CO4** | Develop clustering algorithms | | | | | | |

List of Experiments:

1. To get familiarize with machine learning.
2. Implement and demonstratethe FIND-Salgorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file
3. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithmto output a description of the set of all hypotheses consistent with the training examples.
4. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
5. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
6. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
7. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in MATLAB/Python/Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set

8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add MATLAB/Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. MATLAB/Java/Python ML library classes can be used for this problem
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

| ECP-21LA | Artificial Intelligence Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Practical** | **Minor test** | **Total** | **Time** |
| **0** | **0** | **4** | **2** | **60** | **40** | **100** | **3 Hr.** |
| **Course Outcomes**<br>**At the end of the course student will be able to** | | | | | | | |
| **CO1** | Implement AND/OR&NOT gate using single layer perception | | | | | | |
| **CO2** | Implement XOR gate using multilayer perception | | | | | | |
| **CO3** | Demonstrate the function of fuzzification/defuzzification processes | | | | | | |
| **CO4** | Demonstrate different case studies in the domain | | | | | | |

List of Experiments:

1. Implementation of AND/OR/NOT Gate using Single Layer Perceptron
2. Implementation of XOR Gate Using Multi-Layer Perceptron/ Error Back Propagation
3. Implementation of XOR Gate Using Radial Basis Function Network
4. Understanding the concepts of Perceptron Learning Rule
5. Understanding the concepts of Hebbiann Learning Rule
6. Understanding the concepts of Correlation Learning Rule
7. Understanding the working of Kohonen's Self Organising Maps
8. Understanding the functioning of Fuzzification process
9. Implementation of different method of Defuzzification process
10. Case study explaining function of Fuzzy Inference System
11. Case study explaining function of Optical Character Recognition

| ECP-22LA | Internet of Things Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Practical** | **Minor test** | **Total** | **Time** |
| **-** | **0** | **4** | **2** | **60** | **40** | **100** | **3 Hr.** |
| **Course Outcome: Students will be able to get the idea of Internet of Things technology.** | | | | | | | |
| **CO1** | **Student will be able to get familiarize with Arduino and Raspberry Pi** | | | | | | |
| **CO2** | **Student will be able to implement interfacing different sensorss with Arduino and Raspberry Pi** | | | | | | |
| **CO3** | **Student will be able to understand the concept of cloud** | | | | | | |
| **CO4** | **Student will be able to design module based on Internet of Things application** | | | | | | |

**List of Experiments**

1. Familiarization with concept of IoT, Arduino/Raspberry Pi and perform necessary software installation.
2. To interface LED/ Buzzer using relay with Arduino/Raspberry Pi and write a program to turn ON/OFF LED/Buzzer.
3. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed.
4. To interface Analog sensors( Temperature/Humidity/ Ultrasonic) with Arduino/Raspberry Pi and write a program to display sensors data on the computer screen.
5. To interface OLED with Arduino/Raspberry Pi and write a program to print sensor data on it.
6. To interface sensor with Arduino/Raspberry Pi and write a program to turn ON/OFF Relay when sensor data is detected.
7. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON/OFF motor when push button is pressed.
8. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data on smart phone using Bluetooth.
9. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when a 1/0 is received from smartphone using Bluetooth.
10. Write a program to upload sensor data on cloud.
11. Write a program to retrieve sensor data from cloud.

Components required-

1. Arduino with cable
2. Raspberry Pi with cable and memory card
3. Node MCU
4. Sensors-IR, LDR, DHT11 sensor, Push button, Pressure senser, Temperature sensor, Vibration, Rotation, Location, Torque, Sound, Weight etc.
5. Actuators-LED, Buzzer, Relay Switch, Motors, Motor Drivers, OLED, Display, Linear Actuator,
6. Bluetooth Module, Wi-fi Module, Ethernet Module
7. Smart Phone
8. Computer
9. Power Supply-5V, 12V, 3.3V
10. Internet facility

| ECP-23LA | Augmented Reality/Virtual Reality Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture (Hrs.) | Tutorial (Hrs.) | Practical (Hrs.) | Credit | Practical | Minor Test | Total | Time |
| - | - | 4 | 2 | 60 | 40 | 100 | 3 Hrs. |
| **Course Outcomes (CO)**<br>**To expose the students to the most recent technology i.e. Augmented Reality and Virtual Reality.** | | | | | | | |
| **CO1** | **Student will be able to familiarization of basics of Augmented Reality and Virtual Reality** | | | | | | |
| **CO2** | **Student will be able to Design 3D Objects** | | | | | | |
| **CO3** | **Student will be able to get an idea about the Vuforia .** | | | | | | |
| **CO4** | **Student will be able to design Game in Unity 3D Project.** | | | | | | |

List of Experiments

1. To get familiarization with the basics of AR/VR
2. Introduction to Unity 3D, and its game objects, materials, cameras, standard assets, asset store, adjusting size, position and rotation of game objects .
3. Program to Design 3D Modelling, Importing 3D models in Unity 3D, and to add buttons.
4. Program to Design of animating 3D models, adding material to 3d models
5. Program to Design User Interface using Unity 3D and customizing the colour, size, background, text etc. of the UI elements
6. To learn about Scripting, Adding scripts to game objects, controlling objects with scripts, button functionality with scripting.
7. Program to design Prefabs/Physics Elements, Creating prefabs, adding physics to game objects.
8. To learn about Vuforia SDK, Vuforia integration with Unity 3D, selecting a perfect image for AR development.
9. To design 2D game on Unity 3D
10. To learn about Scene Management in Augmented Reality Applications, MultiScene Arrangement in Augmented Reality Applications

Note: the above mentioned experiments are not limited. Teacher may introduce new experiments

**Bachelor of Technology (Textile Technology) (Credit Based)**
**Scheme of Studies/Examination (Modified)**
**Semester III (w.e.f. session 2021-2022)**

| Sr. No. | Course No./Code | Subject | L:T:P | Hours/ Week | Credits | Examination Schedule (Marks) | | | | Duration of Exam (Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Major Test | Minor Test | Practical | Total | |
| 1 | HTM-901A | Universal Human Values II : Understanding Harmony | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | PCC-TEX-203A | Yarn Manufacturing-I | 3:1:0 | 4 | 4 | 75 | 25 | 0 | 100 | 3 |
| 3 | PCC-TEX-205A | Fabric Manufacturing-I | 3:1:0 | 4 | 4 | 75 | 25 | 0 | 100 | 3 |
| 4 | PCC-TEX-207A | Textile Chemical Processing-I | 3:1:0 | 4 | 4 | 75 | 25 | 0 | 100 | 3 |
| 5 | PCC-TEX-209LA | Textile Fibre - I Lab | 0:0:4 | 4 | 2 | - | 40 | 60 | 100 | 3 |
| 6 | PCC-TEX-211LA | Yarn Manufacturing-I Lab | 0:0:2 | 2 | 1 | - | 40 | 60 | 100 | 3 |
| 7 | PCC-TEX-213LA | Fabric Manufacturing-I Lab | 0:0:2 | 2 | 1 | - | 40 | 60 | 100 | 3 |
| 8 | PCC-TEX-215LA | Textile Chemical Processing-I Lab | 0:0:2 | 2 | 1 | - | 40 | 60 | 100 | 3 |
| **Total** | | | | **25** | **20** | **300** | **260** | **240** | **800** | |
| 9 | *MC-901A | Environmental Sciences | 3:0:0 | 3 | - | 75 | 25 | 0 | 100 | 3 |

*MC-901A is a mandatory credit-less course in which the students will be required to get passing marks in the major test.

| HTM-901A | Universal Human Values II: Understanding Harmony | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3.0** | **75** | **25** | **100** | **3 Hours** |
| **Purpose** | Purpose and motivation for the course, recapitulation from Universal Human Values-I | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO 1** | Development of a holistic perspective based on self-exploration about themselves (human being),family, society and nature/existence. | | | | | | |
| **CO 2** | Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence. | | | | | | |
| **CO 3** | Strengthening of self-reflection. | | | | | | |
| **CO 4** | Development of commitment and courage to act. | | | | | | |

**Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' andExperiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment ofaspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at variouslevels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrarinessin choice based on liking-disliking

**Module 2: Understanding Harmony in the Human Being - Harmony in Myself!**

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

**Module 3: Understanding Harmony in the Family and Society- Harmony in Human-HumanRelationship**

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as thefoundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the othersalient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution,Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- fromfamily to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

**Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels ofexistence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" canbe used), pollution, depletion of resources and role of technology etc.

**Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics**

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.



Rajat kumar Baldua

(Dr. Rajat Kumar Baldua)

**READINGS:**

**Text Book**

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010

**Reference Books**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J CKumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

**MODE OF CONDUCT**

Lecture hours are to be used for lecture/practice sessions.

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Practice hours are to be used for practice sessions.

While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elementsto help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions, the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration. Scenariosmay be used to initiate discussion. The student is encouraged to take up" ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Practice experiments are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based onbasic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.

This course is to be taught by faculty from every teaching department, including HSS faculty. Teacher preparation with a minimum exposure to at least one 8-day FDP on Universal Human Values is deemed essential.



Rajat kumar Baldua

(Dr. Rajat Kumar Baldua)

**ASSESSMENT:**

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.

Example:

Assessment by

faculty mentor: 5 marks

Self-assessment: 5 marks

Assessment by peers: 5 marks

Socially relevant project/Group Activities/Assignments: 10 marks

Semester End Examination: 75 marks

The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.



(Dr. Rajat Kumar Baldua)

| Programme Name | Bachelor of Technology in Textile Technology | Semester VII |
|---|---|---|
| **Course Title** | **TECHNICAL TEXTILES - I** | |
| **Course Code** | **PCC-TEX-401A** | |
| **Course Purpose** | - To make student aware of non-apparel functions performed by textile substrates | |
| **Course Outcomes** | After completing this course, students will be able to:<br>CO1 – Define and classify the technical textile.<br>CO2 – Explain the properties of technical textile materials. CO3– Explain the functioning and applications of textile material infiltration, geotextile and transportation.<br>CO4 – Design the fabric for technical textile application | |
| **Prerequisite** | Knowledge of textile materials and their production methods. | |

**PCC-TEX-401A**

**TECHNICAL TEXTILES - I**

**L T P**
**4 1 -**

**Sessional: 25 Marks**
**Exam: 75 Marks**
**Total: 100 Marks**
**Time: 3 hrs**

**Note-** *Nine questions will be set in the question paper i.e. two from each unit. The students will be required to attempt one question from each unit. Question no. 1 is compulsory. It is objective type 10 questions of multiple choices covering the entire four units.*

**Unit I**

Introduction, definition and growth of technical textiles, Classification of Technical Textiles. Brief idea about technical fibres. Role of yarn construction, fabric construction and composite materials. Differentiate technical textile from traditional textile. Present market and future market trends of technical textile.

**Unit II**

**Filtration:**

Textile and other filter media for dry and wet filtration. Filtration parameters. Theory of dust collection and solid liquid separation. Filtration requirements. Role of fibre, fabric construction and finishing treatments. Concept of pore size and particle size. Nano filters. Fabric test equipments. Types of nonwoven filter media available in market and their usages and efficiencies.

**Unit III**

**Geotextiles:**

Scope, definition, Types of geo textiles and their uses. Functions and application areas of Geotextiles. Essential properties. Fibre and fabric selection criteria for geotextile applications. Advantages and disadvantages of woven, non-woven geotextiles, Mechanics of reinforcement, filtration and drainage by Geotextiles.

**Natural fibre Geotextiles**.

Methods of long term prediction of geotextile life and survivability in soil. Geotextile testing and evaluation.



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**Unit IV**

**Textiles in Transportation:**

Introduction to automotive textile. Application of textiles in automobiles. Fibre requirements. Textile in passenger cars, tyres, airbags, seat belts, hoses and filters. Requirement and design options Textiles in other road vehicles. Railway application. Application in aircraft and marine. Textile as structural elements in transport vehicles.

**Suggested Text Books & References**


1. "Handbook of Technical Textiles", Ed. A R Horrcks and S C Anand, Woodhead Publication Ltd, Cambridge, 2000
2. "Handbook of Industrial Textiles", Ed. Sabit Adanur, Technomic Publishing Co. INC




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| Programme Name | Bachelor of Technology in Textiles Technology | Semester VII |
|---|---|---|
| Course Title | ADVANCED CHEMICAL PROCESSING | |
| Course Code | PCC-TEX-403A | |
| Purpose | -To study the advance chemical processes and computer colour matching(CCM) system for textile materials | |
| Course Outcomes | After completing this course student will be able to:<br>CO1- Adapt the advance and ecofriendly methods of pretreatment and dyeing processes for superior processing quality.<br>CO2-Explain the novel printing techniques and functional finishes. CO3-Understand the various light sources and colour matching functionsused in CCM.<br>CO4-Understand the working principle and use of spectrophotometer in colour matching and recipe prediction for textile materials. | |
| Prerequisite | Basic knowledge of textile chemical processing | |

**PCC-TEX-403A**

**ADVANCED CHEMICAL PROCESSING**

| | |
|---|---|
| **L T P** | **Sessional: 25 Marks** |
| **4 1 -** | **Exam: 75 Marks** |
| | **Total: 100 Marks** |
| | **Time: 3 hrs** |

**Note**-*Nine questions will be set in the question paper i.e. two from each unit. The students will be required to attempt one question from each unit.* ***Question no. 1 is compulsory. It is objective type 10 questions of multiple choices covering the entire four units.***

**Unit I:**

Continuous open width processing, use of eco-friendly enzymes in wet processing, Super critical $CO_2$ dyeing, New reactive and disperse dyes, Grading and methods to determine fastness relating to washing, light, perspiration, sublimation and hot-pressing treatment.

**Unit II:**

Novel printing techniques like Ink Jet printing or digital printing, zero formaldehyde easy-care finishes, polysiloxanes based softener, Breathable water-proof fabrics, Antimicrobial finishing of textiles, Self-cleaning and Low wet pick-up techniques.

**Unit III:**

Fundamentals of colour science, Sources of natural and artificial light, CIE illuminants, absorption and scattering of light, Beer-Lambert law, Additive and subtractive mixing, Standard observer color matching function, Tristimulus values, Chromaticity coordinates, Kubelka-Munk equation, Metameres.

**Unit IV:**

Principle of spectrophotometer, Colorimeter, Munsell system of color specification, Whiteness and yellowness indices, Computer aided color matching and recipe prediction.



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**Suggested Text Books & References**


1 “Instrumental Colour Measurements and Computer Aided Colour Matching for Textiles”, Shah H.S. & Gandhi R.S., Mahajan Book Distributors.
2 “Computer Colour Analysis: Textile Applications” by Sule A.D.
3 “Computer Aided Colour Matching”, by Shore J, SDC U.K 1998, ISBN.
4 “Textile Finishing”, Heywood D.,
5 “Chemical Finishing of Textiles”, by Schindler W.D & and Hauser P.J.
6 Colourage Journal.
7 Asian Dyer
8 Asian Textile Journal
9 Man-made Textiles in India
10 AATCC Technical Manual.




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| Programme Name | Bachelor of Technology in Textile Technology | Semester VII |
|---|---|---|
| Course Title | PROCESS CONTROL IN SPINNING & WEAVING | |
| Course Code | PEC-TEX-409A | |
| Purpose | To study the process controls in spinning and weaving for achieving desired quality and efficiency | |
| Course Outcomes | After completing this course, students will be able to:<br>CO1- Understand the approach and methodology of process control.<br>CO2- Identify various performance parameters to control spinning process.<br>CO3-Identify various performance parameters for controlling weaving process.<br>CO4-Calculate the machine productivity index, efficiency, labour and machine allocation in spinning and weaving. | |
| Prerequisite | Knowledge of textile manufacturing and process | |

**PEC-TEX-409A**

**PROCESS CONTROL IN SPINNING & WEAVING**

| L | T | P | | |
|---|---|---|---|---|
| 3 | 1 | - | | **Sessional: 25 Marks** |
| | | | | **Exam: 75 Marks** |
| | | | | **Total: 100 Marks** |
| | | | | **Time: 3 hrs** |

**Note-** *Nine questions will be set in the question paper i.e. two from each unit. The students will be required to attempt one question from each unit. Question no. 1 is compulsory. It is objective type questions of multiple choices covering the entire four units.*

**Unit I**

Introduction, importance of process control in spinning, key variables, establishing norms, collection & interpretation of data for process control, maximizing quality & cost evaluation of fibre quality, linear programming for cotton mixing, yarn realization, estimation & control of yarn realization, waste & their norms.

**Unit 2**

**Process control in preparatory**: Control of cotton contamination, control of cleaning efficiency and waste in blow room and card, comber, control of neps in sliver at card draw-frame and comber stage.
**Process control at yarn stage**: Control of yarn imperfections and faults in yarns, control of yarn count and count CV%., control of strength, and strength CV%., control of periodic mass variations, package faults, calculations pertaining to production, productivity indices and evaluation of indices in spinning efficiency and machine allocation in preparatory and ring spinning

**Unit 3**

**Weaving:**
Approach, methodology and scope for process control in weaving.
**Process control in winding**: Knot quality, efficient removal of yarn faults and the control of productivity.
**Process control in warping**: Control of end breaks, tension levels, quality and the productivity in warping.
**Process control in sizing**: Choice and the control of size pick-up, yarn stretch and moisture in sized yarns. Improving weavability of the sized yarn and the control of productivity and size losses.
**Process control in pirn winding**: Minimizing end breaks and stoppages. Improving the build of the pirn and the productivity. Process control in Loomshed



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**Unit 4**

**Productivity**

Definition, idea of productivity calculations of weaving mill and factors affecting productivity, productivity indices used in weaving, relation between machine allocation and machine efficiency, calculations pertaining to production, efficiency and machine allocation in winding, warping, pirn winding, sizing and loom shed.

Material handling in spinning / weaving department, humidification and air-conditioning provisions, ventilation & air changes

**Suggested Text Books & References**


1. Garde A R and Subramanian T A, "Process Control in Cotton Spinning," ATIRA, Ahmedabad, 2nd Ed., 1978.
2. Paliwal M C and Kimothi P D," Process Control in weaving", ATIRA, Ahmedabad 2ndEd, 1978.
3. Gokhale S V and Modi J R, "Process and Quality Control in Chemical Processing of Textiles", ATIRA, Ahmedabad, 1992
4. Ratanam T V, "Quality control in spinning", SITRA, Coimbatore, 1994.
5. Salhotra K R, Chattopadhyay R and Ishtiaque S M, "Process control in spinning", IIT, Delhi, CD cell, 2001
6. Thilagvathy G. and Kartik T., "Process control and yarn quality in spinning




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| Programme Name | Bachelor of Technology in Textile Technology | Semester VII |
|---|---|---|
| Course Title | Process Control in Garment | |
| Course Code | PEC-TEX-411A | |
| Purpose | -To understand the concept of automation based garment manufacturing.<br>-To study quality control aspects in garment manufacturing. | |
| Course Outcome | After completing this course students will be able to:<br>CO1: Understand latest garment manufacturing technologies.<br>CO2: Discuss the concept of production, planning and control.<br>CO3: Select the sewing thread, stitch and seam for various applications.<br>CO4: Describe quality control aspects of needle, sewing thread, stitch and seam.<br>CO5: Understand the quality management in garment industry. | |
| Prerequisite | Students should have basic knowledge of Garment Technology. | |

**PEC-TEX-411A**

**PROCESS CONTROL IN GARMENT**

| L | T | P |
|---|---|---|
| 3 | 1 | - |

Sessional: 25 Marks
Exam: 75 Marks
Total: 100 Marks
Time: 3 hrs

**Note-** *Nine questions will be set in the question paper i.e. two from each unit. The students will be required to attempt one question from each unit. Question no. 1 is compulsory. It is objective type 10 questions of multiple choices covering the entire four units.*

**UNIT-I**

Automation in Garment Industry- Latest machinery in design, pattern making, marker making, cutting, sewing, embroidery and programmable machines.
Production planning in garment manufacturing-Apparel production systems and their comparative assessment, Quantitative Production Analysis viz. check list, Ergonomics in apparel industry.

**UNIT-II**

Stitch application for woven and knitted garment, Proper stitch formation.
Common seam quality defect: Seam rupture on stretch knits, Seam grinning, Skipped stitches, Stitch Cracking and Seam slippage.
Seam puckering: Types, major causes and solution to puckering.

**UNIT-III**

Sewing Thread selection: Right thread to optimize seam quality, fibre type, thread construction, thread size. Advantages of core-spun sewing thread, Quality aspect of industrial sewing thread, Needle size, needle numbering system, Needle cutting, Causes and remedies
Quality parameters for assessing sewability.

**UNIT-IV**

Define Quality, Quality Control and Quality Assurance, Different quality control methods used in garment industry, Quality tools viz. Control charts, Pareto charts, Fish bone diagram, Scatter plots, Histogram and Six Sigma
Inspection systems–raw material inspection, in process inspection, final inspection, Inspection standards

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**Suggested Text Books & References**

1. An Introduction to Quality Control for Apparel Industry by PV Mehta
2. Managing Quality for Apparel Industry by PV Mehta & SK Bhardwaj
3. Garment Technology, NCUTE Publication
4. Testing and Quality Management (Vol-1) by V.K. Kothari



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| Programme Name | Bachelor of Technology in Textile Technology | Semester VII |
|---|---|---|
| Course Title | Process Control in Chemical Processing | |
| Course Code | PEC-TEX-413A | |
| Purpose | To understand the various aspects of process and quality control in wet processing of textiles. | |
| Course Outcome | After completing this course students will be able to:<br>CO1: Understand process control parameters in grey fabric.<br>CO2: Discuss the process control parameters in pretreatment process.<br>CO3: Explain quality control parameters for dyeing, printing and finishing.<br>CO4: Summarise evaluation test methods for dyes, chemicals, auxiliaries and pretreated fabrics. | |
| Prerequisite | Students should have knowledge of Textile Chemical Processing I and Textile Chemical Processing II | |

**PEC-TEX-413A**

**PROCESS CONTROL IN CHEMICAL PROCESSING**

| L | T | P | |
|---|---|---|---|
| 3 | 1 | - | Sessional: 25 Marks |
| | | | Exam: 75 Marks |
| | | | Total: 100 Marks |
| | | | Time: 3 hrs |

**Note-** *Nine questions will be set in the question paper i.e. two from each unit. The students will be required to attempt one question from each unit. Question no. 1 is compulsory. It is objective type 10 questions of multiple choices covering the entire four units.*

**Unit I**

Importance of process and quality control in chemical processing. Quality of grey fabrics, selvedge quality, stains in grey fabric, overall assessment of quality of grey fabrics.
Stitching of grey pieces, common stitching defects and method for assessing stitching quality.
Process control in shearing and cropping.

**Unit II**

**Singeing -** Process control in singeing, parameters to control the singeing process
**Desizing -** Enzyme desizing, parameters to control the enzyme desizing process
**Scouring -** Parameters to control the pressure boil scouring
**Mercerizing –** Parameters to control the mercerization process,
**Bleaching –** Sodium hypochlorite & Hydrogen peroxide, treatment on J-Box, pad roll bleaching, washing and drying.
Process control in Heat Setting process.

**Unit III**

**Process control in Dyeing -** Fiber and yarn package dyeing.
**Fabric dyeing -** Satisfying basic needs, selection of dyes, process control in jigger dyeing, high temperature beam or jet dyeing, continuous dyeing.
**Process control in Printing**: Selection of thickening agent and preparation of printing paste, printing recipe, printing, fixation, after treatments.
**Process control in Finishing**: Stenter or felt calendar for temporary finishes. durable finishes: resin finishing, calendaring, weight reduction and carbonization.



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**Unit IV:**

**Evaluation of dyes, textile chemicals and auxiliaries** - Dyestuff performance test, Wetting agents, Levelling Agents, Cross linking Agents, Thickeners & Binders for printing, OBA, Softeners etc. **Evaluation of processed fabric at different stages**: desizing, scouring, bleaching mercerization, heat setting, dyed printed and finished fabric.

**References**


1. ATIRA / BTRA Books and Journals.
2. "Process Control in Processing" by ATIRA.
3. Testing and Quality Management – Vol.-I by Dr. V.K. Kothari, IAFL Publication, S-351, Greater Kailash Part-I, New Delhi.




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| Programme Name | Bachelor of Technology in Textile Engineering | Semester – VII |
|---|---|---|
| **Course Code** | **OEC-TEX-415A** | |
| **Course Title** | **Fundamental of Management** | |
| **Purpose** | To study the principles and practices of management. | |
| **Course Outcomes** | After completing this course, students will be able to:<br>CO1 – Understand the concept of Financial management.<br>CO2– Enumerate the various functions performed by personnel management.<br>CO3 – Get idea of production management.<br>CO4 – Describe nature, scope and importance of marketing management | |
| **Prerequisites** | Basic idea of fundamental of management | |

## OEC-TEX-415A

## FUNDAMENTAL OF MANAGEMENT

**L T P**
**4 1 -**

**Sessional: 25 Marks**
**Exam: 75 Marks**
**Total: 100 Marks**
**Time: 3 hrs**

***Note:***
*Nine questions will be set in the question paper i.e. two from each unit. The student will be required to attempt one question from each unit. Question No.1 is compulsory. It is objective type 15 questions of multiple choice covering all the four units.*

### UNIT-I Financial Management

Introduction of Financial Management, Objectives of Financial Decisions, Status and duties of Financial Executives. Financial Planning – Tools of financial planning. Management of working capital, Factors affecting requirements of working capital. Capital structure decisions. Features of appropriate capital structure. Sources of finance.

### UNIT-II Personnel Management

Personnel Management – Meaning, Nature and Importance; Functions of Personnel Management – (a) Managerial Functions and (b) Operative functions. Job Analysis: Meaning and Importance; Process of Job Analysis; Job Description and Job specification. Human Resource Development- Meaning and concept.

### UNIT-III Production Management

Production Management: Definition and Objectives
Plant location: Ideal plant location. Factors affecting plant location. Plant
Layout: Ideal plant layout, factors affecting plant layout.
Work Measurement: Meaning, Objectives and Essentials of work measurement.
Production Control: Meaning and importance of production control and steps involved in production control.

### UNIT-IV Marketing Management

Modern Nature, scope and importance of marketing management. Marketing concepts. Role of marketing in economic development. Marketing Mix. Marketing Information System. Meaning, nature and scope of International Marketing.



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**Suggested Text Books and References**


1. Principles and Practice of Management - R.S. Gupta, B. D. Sharma, N.S. Bhalla. (Kalyani Publishers)
2. Organization and Management - R.D. Aggarwal (Tata Mc Graw Hill)
3. Principles & Practices of Management – L.M. Prasad (Sultan Chand & Sons)
4. Management – Harold, Koontz and Cyrilo Donell (Mc.Graw Hill).
5. Financial Management - I.M. Pandey (Vikas Publishing House, New Delhi)
6. Management - James A.F. Stoner & R. Edward Freeman, PHI.
7. Marketing Management- Philip Kotler, PHI




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|---|---|---|
| **Programme Name** | **Bachelor of Technology in Textile Engineering** | **Semester – VII** |
| **Course Code** | **OEC-TEX-417A** | |
| **Course Title** | **Statistics Analysis** | |
| **Purpose** | To study different statistical tools useful for solving engineering problems. | |
| **Course Outcomes** | After completing this course, students will be able to:<br>CO1-Apply fundamentals of statistics in solving engineering problems. CO2-Understand concepts of probability theory and probability distributionsCO3-Test for statistical hypothesis and its significance<br>CO4-Make use of control chart and ANOVA to solve the statistical problems.<br>CO4- Analyse correlation and regression of given data. | |
| **Prerequisites** | Knowledge of Mathematics | |

**OEC-TEX-417A**

**STATISTICAL ANALYSES**

**L T P**
**4 1 -**

**Sessional: 25 Marks**
**Exam: 75 Marks**
**Total: 100 Marks**
**Time: 3 hrs**

***Note:***
*Nine questions will be set in the question paper i.e. two from each unit. The student will be required to attempt one question from each unit. Question No.1 is compulsory. It is objective type questions of multiple choice covering all the four units.*

**Unit I**

**Foundations of statistics**:
Basic concepts of statistics, collection sampling, classification and graphical representation of data, Measures of central tendency. Numerical problems.

**Sampling Theory**:
Population and sample, types of sampling, sampling classification and graphical representation of data, measures of central tendency, control charts.

**Unit II**

Measures o f Dispersion Range, Quartile deviation, standard deviation, moments, skewness and kurtosis (Definition, properties and associated numerical only).Theory of Probability Different approaches to probability, Additive and Multiplicative, Laws of probability, Baye's theorem.

**Unit III**

**Tests of hypothesis and significance**:
Definition of Statistical hypothesis, Null hypothesis. Type me and II errors and Levels of significance, Standard error and sampling distribution, Tests of significance for Large and small Samples (discussion). Problems based on $\chi 2$-test for goodness of fit, Student's t-Test and Analysis of variance (one way and two way classifications.

**Unit 4**

**Regression & correlation**:
Karl Pearson's coefficient of correlation, Rank correlation coefficient and lines of regression, Numerical problems, factorial design and analysis.



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**Suggested Text Books and References**


1. Ray and Sharma, “Mathematical Statistics”
2. Bowker, A.H., and Lieberman, G.J., “Engineering statistics”, Prentice Hall, N.J.1972
3. Murray P Spiegel, “Theory & Problems of Probability & Statistics”
4. Bhattacharya, G.K., and Johnson, R.A.,” Statistical concepts and methods”, John Wiley, New Delhi, 2002.
5. Hogg, R.V, Elliot, A.T., ”Probability and Statistical Inference”, Pearson Education, 6th Edition




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| Programme Name | Bachelor of Technology in Textile Engineering | Semester – VII |
|---|---|---|
| **Course Code** | **OEC-TEX-419A** | |
| **Course Title** | **Theory and Design of Textile Machinery** | |
| **Purpose** | | |
| **Course Outcomes** | CO1- To know about various machine parts, its mechanisms,<br>CO2- Illustrate benefits of different cams and follower motions scheme<br>CO3- To impart Knowledge on kinematic properties of gears<br>CO4- To understand the design of several types of belt and chain drives | |
| **Prerequisites** | | |

**OEC-TEX-419A**

**THEORY AND DESIGN OF TEXTILE MACHINERY**

| L | T | P | |
|---|---|---|---|
| 4 | 1 | - | Sessional: 25 Marks<br>Exam: 75 Marks<br>Total: 100 Marks<br>Time: 3 hrs |

***Note:***

*Nine questions will be set in the question paper i.e. two from each unit. The student will be required to attempt one question from each unit. Question No.1 is compulsory. It is objective type questions of multiple choice covering all the four units.*

**Unit I**

**Basic concepts**: Kinematics of machine, kinematics link and their different type, types of kinematics pair, degree of freedom, kinematics chain, mechanism and inversion of four bar chain, single slider and double slider crank mechanism.

**Velocity Analysis**: Motion of a link, velocity of a point on a link by relative velocity method, velocities of four bar mechanism, single slider crank mechanisms, rubbing velocity at a pin joint. Velocity of a point on a link by instantaneous centre method, properties and types of I-centre, Kennedy theorem and methods of locating I-centres in a mechanism.

**Unit II**

**Belt, rope and chain drive**: Types of belt drives, velocity ratio, law of belting, concept of slip and creep, length of belt, ratio of driving tensions for flat belt and vbelt, power transmitted, effect of centrifugal tension on power transmission, condition for maximum power transmission, initial tension in the belt. Use of Vbelt, rope, chain, chain length and angular speed ratio, relative advantage and disadvantage of chain and belt drives.

**Gears**: Classification of gears, terminology used in gear, law of gearing, velocity of sliding, forms of teeth, construction, properties and comparison of an involute and cycloidal teeth, effect of centre distance variation on the velocity ratio, length of path of contact, arc of contact, number of pairs of teeth in contact, interference, minimum number of teeth on the pinion and wheel to avoid interference, minimum number of teeth on the pinion for involute rack to avoid interference, undercutting, terminology of helical and worm gears.



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**Unit III**

**Gear trains**: Definition, types: simple, compound, reverted and epicyclic gear trains, velocity ratio of epicyclic and compound epicyclic gear trains.

**Cams and follower**: Types of cams and followers, cam terminology, types of motion of the follower, analysis of motion of the follower, analysis of motion of the follower for cams with specified contours.

**Unit IV**

**Flywheels**: Turning moment diagram for steam engine, four stroke internal combustion engines, fluctuation of energy, maximum fluctuation of energy, coefficient of fluctuation of energy, energy stored in flywheel, use of flywheel.

Application in Textiles: Belts, chains and gear drives in textile machines. Different types of cam and followers used in textile machines.

**Suggested Text Books and References**


1. Khurmi R.S and Gupta ―Theory of Machine‖ S. Chand Publisher, New Delhi.
2. Bansal R K, ―A text book of Theory of Machines‖, Laxmi Publication Pvt. Ltd, New Delhi.
3. Rattan S S, ―Theory of Machines‖, Tata McGraw Hill, New Delhi, 2001.
4. Ghosh A and Mallik A K, ―Theory of mechanism and machines‖, Affiliated East West Press Pvt. Ltd, New Delhi, 198
5. Bevan T, ―The Theory of Machines, CBS Publishers and Distributors, New Delhi, 2002




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| Programme Name | Bachelor of Technology in Textiles Technology | Semester VII |
|---|---|---|
| **Course Title** | **PCC-TEX-405LA** | |
| **Course Code** | **ADVANCED CHEMICAL PROCESSING LAB** | |
| **Purpose** | To provide hands-on experience to use Computer Colour Matching system in determination and evaluation of pretreated and dyed textile material. | |
| **Course Outcomes** | After completing this course student will be able to:<br>CO1. Make use of spectrophotometer for analysing properties of pretreated and dyed fabric sample.<br>CO2. Evaluate fastness properties using computer colour matching system. | |
| **Prerequisite** | Knowledge about basics of Textile Chemical Processing | |

**PCC-TEX-405LA**

**ADVANCED CHEMICAL PROCESSING LAB**

L T P
\- - 3

Practical/viva: 60 marks
Sessional: 40 marks
Total: 100 marks
Duration of Exam: 3 hours

**List of Experiment:**

1. Calibration of a UV-visible reflectance and transmission-based spectrophotometer.
2. Identification of dye on a dyed cotton sample.
3. Assessment of color strength (K/S) of dyed samples.
4. Estimation of colour strength difference.
5. Determination L, a, b values and construction of hue and shades based on that.
6. Comparison of bleaching methods using CCM.
7. Assessment of whiteness and yellowness index of a scoured and bleached fabric.
8. Determination of wash fastness of a dyed sample.
9. Determination of rubbing fastness of a dyed sample.
10. To identify & predict the recipe formulation of dyed sample.



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|---|---|---|
| **Programme Name** | **Bachelor of Technology in Textile Technology** | **Semester VIII** |
| **Course Title** | **TECHNICAL TEXTILES - II** | |
| **Course Code** | **PCC-TEX-402A** | |
| **Course Purpose** | To make student aware of non-aesthetic application of textiles i.e. medical textile, protective textile, sportech and e-textile. | |
| **Course Outcomes** | After completing this course, students will be able to:<br>CO1 – Explain the applications of textile material in medical field.<br>CO2–Understand the protective textile functions and their applications.<br>CO3 – Describe about sportech and agrotech.<br>CO4 – Illustrate the innovations in technical textiles. | |
| **Prerequisite** | Knowledge of Technical Textile- I | |

**PCC-TEX-402A**

**TECHNICAL TEXTILE - II**

| | | | |
|---|---|---|---|
| **L** | **T** | **P** | **Sessional: 25 Marks** |
| **4** | **1** | **-** | **Exam: 75 Marks** |
| | | | **Total: 100 Marks** |
| | | | **Time: 3 hrs** |

**Note-** *Nine questions will be set in the question paper i.e. two from each unit. The students will be required to attempt one question from each unit. Question no. 1 is compulsory. It is objective type questions of multiple choices covering the entire four units.*

**<u>Unit I:</u>**

**Medical Textiles:**

Introduction and classification of Medical Textiles, Fibres used for medical applications. Implantable – sutures, soft tissue implants, hard tissue implants, vascular implants. Non-implantable – surgical dressing, bandages. Extracorporeal devices, Healthcare and Hygiene products.

**<u>Unit II:</u>**

**Protective Textiles:**

Different types of protective clothing, Functional requirements of defense clothing including ballistic protection, parachute, temperature and flame retardant clothing, Chemical and Biological protective clothing, Clothing for extreme climatic conditions viz. high altitude clothing.

**<u>Unit III:</u>**

**Sportech** – Sport uniforms, sporting equipments, textiles in sport surfaces

**Agrotech** – General applications and fibres used in agriculture, horticulture, fishing and animal husbandry

**<u>Unit IV:</u>**

Applications and innovations in Technical Textile viz. e-textile, biomimetic, nano-technology



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**References and Text books**


1. "Handbook of Industrial Textiles", Ed. Sabit Adanur, Technomic Publishing Co. INC
2. "Handbook of Technical Textiles", Ed. A R Horrcks and S C Anand, Woodhead Publication Ltd, Cambridge, 2000
3. " Textiles for protection, Ed. Richard A. Scott, Woodhead Publication Ltd, Cambridge,
4. " Wearable Electronics and Photonics, Ed. Xiaoming Tao, Woodhead Publication Ltd, Cambridge




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| Programme Name | Bachelor of Technology in Textile Technology | Semester VIII |
|---|---|---|
| Course Title | POST EXTRUSION PROCESS | |
| Course Code | PEC-TEX-408A | |
| Course Purpose | To illustrate the students about various post-spinning process for synthetic fibers | |
| Course Outcomes | After completing this course, students will be able to:<br>CO1- Objective of post spinning operation<br>CO2- Understanding operations involved in post spinning<br>CO3- Concept of drawing and heat-setting<br>CO4-Understanding process of production of bulk yarn<br>CO5-Properties and applications of bulk yarn. | |
| Prerequisite | Knowledge of Textile Fiber –II | |

## PEC-TEX-408A

## POST EXTRUSION PROCESS

| L | T | P | |
|---|---|---|---|
| 4 | 1 | - | Sessional: 25 Marks |
| | | | Exam: 75 Marks |
| | | | Total: 100 Marks |
| | | | Time: 3 hrs |

**Note-** *Nine questions will be set in the question paper i.e. two from each unit. The students will be required to attempt one question from each unit.* ***Question no. 1 is compulsory.*** *It is objective type questions of multiple choices covering the entire four units.*

**Unit –I**

**Introduction**: Introduction and objective of post spinning operation. Operations involved in post spinning.
**Drawing**: Introduction of drawing filament/fibre: Theoretical considerations of drawing, Concept of neck drawing, Prediction of neck formation, Significance and stabilization of neck, drawing unit, draw behavior of thermoplastic polymers. Influence of drawing parameters on structure and properties of fibres. High speed spinning and spin draw process, drawing of pre-oriented yarns and draw-warping.

**Unit -2**

**Heat-setting**: Introduction and concept of heat-setting, Objective of heat-setting, Different nature of set, Heat-setting behavior of fibres, Methods of heat-setting, Influence of heat setting parameters on structure and properties of fibres, Settability and measurement of set.

**Unit 3**

**Tow conversion**: Introduction of Tow to Top conversion, Different methods for tow to top conversion.
**Bulk yarn**: Introduction of bulk yarn. Objectives of producing bulk yarns. Different methods of producing bulk yarns. Principles of manufacturing acrylic high bulk yarn.

**Unit 4**

**Yarn Texturing**: Concept and classification textured yarns. Different texturing methods and brief working principles of different texturing methods. Principles of false twist texturing. Material and Machine variables and their influence on the structure and properties of false twist textured yarn, Concept of air-jet texturing. Material and process variables in air-jet texturing and their influence on the structure and properties of air-jet textured yarns, Testing and evaluation of textured yarns, recent developments in texturing, Air entanglement process.



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**Suggested Text Books and References**

1. Gupta V B and Kothari V K, "Manufactured Fibre Technology", Chapman and Hall, London, 1999.
2. Vaidya A A, "Production of Synthetic Fibres"1nd Ed., Prentice Hall of India, New Delhi, 1988.
3. Hearle J W S, Hollick L and Wilson D K, "Yarn Texturing Technology", Woodhead Publishing Ltd., UK, 2002.
4. Goswami B C, Martindle J G and Scardino F L, "Textile Yarns Technology, Structure and Applications", Wiley-Interscience Publication, New York, 1976.
5. Mark H F, Atlas S M, Cernia E, "Man Made Fibre Science and Technology", 1st Ed., Vol. 1, 2, 3, Science Publishers, New York, 1967.



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| Programme Name | Bachelor of Technology in Textiles Technology | Semester VIII |
|---|---|---|
| Course Title | HIGH PERFORMANCE FIBRES | |
| Course Code | PEC-TEX-410A | |
| Purpose | To study the high performance fibers | |
| Course Outcomes | After completing this course student will be able to:<br>CO1-Understand polymerization, spinning properties and applications of aromatic polyamide and ordered polymeric fibers.<br>CO2-Explain manufacturing process, structure and properties of carbon fibers.<br>CO3-Describe manufacturing process of optical fibers, structure and properties of flexible chain high performance fibers and their application.<br>CO4-Understand glass fibers, membrane technology, plasma treatment, and fibers used in medical textiles. | |
| Prerequisite | Knowledge of Textile Fibers and basic chemistry | |

**PEC-TEX-410A**

**HIGH PERFORMANCE FIBRES**

| L | T | P | |
|---|---|---|---|
| 3 | 1 | - | Sessional: 25 Marks<br>Exam: 75 Marks<br>Total: 100 Marks<br>Time: 3 hrs |

**Note-** *Total nine questions will be set in the question paper i.e two questions from each unit. The student will be required to attempt one questions from each unit. Question No.1 is compulsory. There will be questions of multiple choice covering entire four units.*

**Unit I:**

**Fully aromatic polyamide or aramid fibers:** Nomex and Kevlar - Polymerization, spinning properties and applications

**Ordered Polymeric Fibers:** High molecular weight polyester, rigid rod and ladder polymers such as PBL, PBZT, PBO, PBI.

**Unit II:**

**Carbon Fibers:** Manufacturing of carbon fibres from PAN precursors, viscose and pitch fibres. Pre-oxidation, carbonization and graphitization. Chemical and structural changes in structure during these fibers. Structure and Properties of these fibers.

Liquid crystal fibres, Gel spinning

**Unit III:**

**Flexible Chain based high performance fibers:** High and ultramolecular weight polyethylene. Structure and properties of these fibers.

**Optical Fibers:** Definition, working principle of optical fibers, different materials used for



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manufacturing of optical fibers, different types of optical fibers. Manufacturing process of optical fibers and their applications. Hollow and profile fibres, design of spinnerets for such fibres.

**Unit IV:**

Glass fibres. PEEK fibers, Soyabean fibers etc. Membrane technology. Blended and bicomponent fibres. Medical textiles (fibers used in Medical textiles). Superabsorbent fibres.

Plasma modification. Radiation processing. Industrial tapes. Biaxially oriented films and film fibres. Barrier films and coatings.

**Suggested Text Books and References:**


1. P. Bajaj & A.K. Sengupta, "High performance fibers"
2. M. Lewin & J. Preston, "High Technology Fibers (Part A, B, C,D)"
3. Lewin & Pearce, "Handbook of Fiber Chemistry". CRC Press LLC; 2 edition (Feb 26 998)




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| **Programme Name** | **Bachelor of Technology in Textile Technology** | **Semester VIII** |
|---|---|---|
| **Course Title** | **NONWOVEN TECHNOLOGY** | |
| **Course Code** | **PEC-TEX-412A** | |
| **Purpose** | - To study the manufacturing process and applications of nonwovens structures | |
| **Course Outcomes** | After completing this course, students will be able to: CO1–Discover the nonwoven technology. Classify the nonwoven according to web formation techniques, bonding techniques and applications.<br>CO2–State the requirements of fibre properties for web formation.<br>CO3–Understand the process of needle punching, stitch bonding, adhesive bonding, hot calendaring and fusion bonding.<br>CO4 – Explain the finishing and applications of nonwoven in different sectors<br>CO5 – Identify the test methods for nonwoven products | |
| **Prerequisite** | **Knowledge of fibre properties and fabric formation.** | |

**PEC-TEX-412A**

**NONWOVEN TECHNOLOGY**

| L | T | P | |
|---|---|---|---|
| 3 | 1 | - | Sessional: 25 Marks |
| | | | Exam: 75 Marks |
| | | | Total: 100 Marks |
| | | | Time: 3 hrs |

**Note-** Nine questions will be set in the question paper i.e. two from each unit. The students will be required to attempt one question from each unit**.** Question no. 1 is compulsory. It is objective type questions of multiple choices covering the entire four units.

**UNIT-1**

**Web Formation Technique**

Introduction, need for nonwovens in present scenario. History behind its origin, Definition of nonwoven as per INDA and ADNA, major fibres which are used for manufacturing of nonwovens, classification of nonwoven. Flowchart of its manufacturing technology.

Various web laying methods viz: dry, wet laying technique, spun-bond technique and melt-blown technique and their operating variables and products formed. Concept SMS fabrics.

**UNIT-2**

**Bonding Techniques**

Stitch Bonding

Needle Punching: Needle design, needle board parameters, process involved, various factors influencing needle punching process, properties and applications.

Hydro-entanglement: Principle and process technology, properties and applications.

Thermal Bonding: Principle, technologies such as calender bonding, thorough air bonding, ultrasonic & IR bonding.



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Chemical Bonding: Chemical binders. Mechanism of chemical bonding. Factors that affect the properties of calendar bonded products.
Limitation, Application areas.

**UNIT-3**
**Finishing**

Dry finishing of nonwoven: Shrinkage, Wrenching, Creeping, and Glazing.

Wet finishing of nonwoven: Washing, Dyeing and Printing.

Chemical finishing: Antistatic, Antimicrobial, Water repellent, Flame retardant, Water absorbency.

Methods of applying chemical finishes.

Developing technologies: Plasma micro-encapsulation, biomimetic finishes and electrochemical finishes.

**UNIT-4**
**Test Methods**
Defects of nonwoven fabrics. Test methods for nonwovens: weight, thickness, pore size, porosity, tensile properties, liquid permeability, water vapour permeability, liquid absorption, thermal conductivity and insulation. Usage of non-woven in different sector of technical textiles.

**Suggested Text Books and References:**

1. Madhavamoorthy, P., Shetty, G. S., NONWOVEN, Mahajan Publishers Pvt. Ltd., 2005
2. Lunenschloss J and Albrecht W, “Non-woven Bonded Fabric”, Ellis and Harwood Ltd., UK(1985)
3. Krema Radco, “Manual of nonwovens”, Textile trade Press, UK (1971)
4. Albrecht W, Fuchs H and Kittelmann, “Nonwoven Fabrics”, Wiley-VCH Wenham (2003)



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| Programme Name | Bachelor of Technology in Textile Technology | Semester VIII |
|---|---|---|
| Course Title | COMPUTER AIDED DESIGN | |
| Course Code | PEC-TEX-414A | |
| Course Purpose | To explain the latest developments of CAD in apparel industry | |
| Course Outcomes | After completing this course, students will be able to:<br>CO1- Illustrate the concepts of CAD and its usage in garment manufacturing.<br>CO2- Discuss the computerized pattern making process.<br>CO3-Describe the computerized production planning and 3D technology in garment manufacturing.<br>CO4- Understanding concept of e-marketing in apparel industry. | |
| Prerequisite | Basics knowledge of computer and garment manufacturing process | |

**PEC-TEX-414A**

**COMPUTER AIDED DESIGN**

| L | T | P | | |
|---|---|---|---|---|
| 4 | 1 | - | | **Sessional: 25 Marks** |
| | | | | **Exam: 75 Marks** |
| | | | | **Total: 100 Marks** |
| | | | | **Time: 3 hrs** |

**Note-** *Nine questions will be set in the question paper i.e. two from each unit. The students will be required to attempt one question from each unit**.** Question no. 1 is compulsory. It is objective type 10 questions of multiple choices covering the entire four units.*

**Unit 1**

CAD definition, fundamentals of CAD - Introduction, general process of design, application of computers for design, benefits of CAD, CAD in today's fashion industry. Computer graphics software in apparel industry.

**Unit 2**

Design software - Introduction, features and its applications, resolution set up, saving files and file formats, vector graphics object vs raster graphics object.

Pattern design software (PDS), digitizing, grading and marker making systems.

**Unit 3**

3-D Modelling: Intelligent systems - 3D scanning technology.3Dbody scanners, imaging techniques for various designs. Automatic Pattern Generation Systems. 2D to 3D conversion technology. Draping 2D

**Unit 4**

Fashion trend forecasting websites - Introduction, leading online trend-analysis and research service on creative and business intelligence for the apparel. Applications of CAD in multimedia and 3D presentation.

**Suggested Text Books and References:**


1. Kathleen Colursy M, "Fashion Design on Computers", Prentice Hall, 2004.
2. Radhakrishnan R, Subramanyan S, Raju V, "CAD/CAM/CIM Computer Aided Design & Manufacturing", New Age International Publications, 2000.
3. Renee Weiss Chase, "CAD for Fashion Design", Prentice Hall Publications, 1997.




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4. Taylor P, “Computers in Fashion Industry”, Heinemann Publication, 1990.
5. Voisinet Donald D. “Computer Aided Drafting & Design-Concept & Application”, McGraw-Hill, 1987.
6. Winfred Aldrich, “CAD in Clothing & Textiles”, Blackwell Science, 1994.



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| | | |
|---|---|---|
| **Programme Name** | **Bachelor of Technology in Textile Technology** | **Semester VIII** |
| **Course Title** | **APPAREL MARKETING & MERCHANDISING** | |
| **Course Code** | **PEC-TEX-416A** | |
| **Course Purpose** | To describe the apparel marketing and merchandising process | |
| **Course Outcomes** | After completing this course, students will be able to:<br>CO1- Describe the marketing and its mix<br>CO2- Explain the organization of the apparel industry<br>CO3- Understand the merchandising process<br>CO4- Describe various documents required for exports. | |
| **Prerequisite** | Knowledge of basic garment manufacturing process | |

**PEC-TEX-416A**

**APPAREL MARKETING & MERCHANDISING**

| L | T | P | |
|---|---|---|---|
| 4 | 1 | - | **Sessional: 25 Marks**<br>**Exam: 75 Marks**<br>**Total: 100 Marks**<br>**Time: 3 hrs** |

**Note**- *Nine questions will be set in the question paper i.e. two from each unit. The students will be required to attempt one question from each unit.* *Question no. 1 is compulsory. It is objective type 10 questions of multiple choices covering the entire four units.*

**Unit-I**

**Marketing:**

Definition, steps involved in marketing, marketing evolution, selling vs marketing, marketing environment, marketing research, marketing objectives and strategies, marketing mix, fashion marketing planning.

**Unit-II**

**Introduction to apparel industry** – Different types of organization structure.

**Various departments of garment unit:**
Marketing, designing, merchandising, patternmaking, sampling, fabric & trim store, testing, cutting, sewing, finishing, IE, maintenance, quality control, account, HR, EDP

**Unit III**

**Merchandising:**
Introduction to fashion merchandising and its process, roles and responsibilities of merchandiser in different organizations, categories of apparel merchandising, Buying cycles and tools of merchandising–buying cycle, time and action calender, range planning, critical path, Costing techniques and Spec Sheets. Visual Merchandising

**Unit IV**

**Export Documentation:**

Various types of export documents, Pre-shipment Post-shipment documentation, Terms of sale,

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payment, shipment etc. Export incentives: Duty drawback, DEPB, I/ E license - exchange control regulation – (FEMA) foreign exchange management acts - export management risk - export finance. Various INCO terms.

**Suggested Text Books and References:**


1. Marketing Management by Philip Kotler. 15th edition Pearson Education. ISBN: 978-9332557185
2. Cooklin's Garment Technology for Fashion Designers, 2nd Edition by Gerry Cooklin, Steven Hayes, John McLoughlin, Dorothy Fairclough, Blackwell Publications, ISBN: 978-1-4051-9974-2
3. Garment Manufacturing: Processes, Practices and Technology by Prasanta Sarkar, Online Clothing Study. ISBN: 978-9383701759
4. Fashion Buying by Elaine Stone. McGraw-Hill In publication ISBN: 978- 0070617469
5. Apparel Merchandising by Kumar. Abhishek Publications, ISBN: 978-8182473010
6. Fashion Marketing by Mike Easey. John Wiley & Sons publication. ISBN: 978- 0632034598




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| Programme Name | Bachelor of Technology in Textile Technology | Semester VIII |
|---|---|---|
| **Course Title** | **QUALITY ASSURANCE IN APPAREL INDUSTRY** | |
| **Course Code** | **PEC-TEX-418A** | |
| **Course Purpose** | - To aware the students on about importance of quality in apparel sector | |
| **Course Outcomes** | After completing this course, students will be able to:<br>CO1- Understanding the basic concept of quality<br>CO2- Describe quality control and its commercial aspects<br>CO3- Discuss various inspection process<br>CO4- Illustrate different quality management systems<br>CO5- List the various care labelling systems | |
| **Prerequisite** | Basic knowledge of textile testing and garment manufacturing process | |

## PEC-TEX-418A

## QUALITY ASSURANCE IN APPAREL INDUSTRY

| L | T | P | |
|---|---|---|---|
| 4 | 1 | - | Sessional: 25 Marks |
| | | | Exam: 75 Marks |
| | | | Total: 100 Marks |
| | | | Time: 3 hrs |

**Note-** *Nine questions will be set in the question paper i.e. two from each unit. The students will be required to attempt one question from each unit***.** *Question no. 1 is compulsory. It is objective type questions of multiple choices covering the entire four units.*

### Unit I

Definition & importance of Quality, Tools of quality control,

### Unit II

Quality Control – Principles of Quality Control, total quality control, statistical quality control, quality circle, quality and profitability.

### Unit III

Inspection – Definition, inspection, loop, raw material inspection, in-process inspection, final inspection, comparability checks.

### Unit IV

ISO-9000 series of standards. Quality assurance, TQM, Six Sigma. Care labeling of apparel and textiles – American care labeling system, British care labeling system, and Japanese care labeling system.

### Suggested Text Books and References:

1. An Introduction to Quality Control for the apparel Pradip V Mehta
2. Industry Managing Quality in the Apparel Industry
3. Satish Bhardwaj & V Mehta, The Technology of Clothing Manufacture Harold Care & Barbara Latham



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| **Programme Name** | **Bachelor of Technology in Textile Technology** | **Semester VIII** |
|---|---|---|
| **Course Title** | **TEXTILE COSTING** | |
| **Course Code** | **OEC-TEX-420A** | |
| **Course Purpose** | -To aware the students on costing of textile products in industry | |
| **Course Outcomes** | After completing this course, students will be able to:<br>CO1 – Understand the basic concept of costing<br>CO2 – Explain the financial terms used in costing department.<br>CO3 – Describe the cost structure in textile industry.<br>CO4 – Explain labour allocation and rationalization of labours in textile industries. | |
| **Prerequisite** | Knowledge of textile production and management. | |

**OEC-TEX-420A**

**TEXTILE COSTING**

| **L** | **T** | **P** | |
|---|---|---|---|
| **4** | **1** | **-** | **Sessional: 25 Marks** |
| | | | **Exam: 75 Marks** |
| | | | **Total: 100 Marks** |
| | | | **Time: 3 hrs** |

**Note-** *Nine questions will be set in the question paper i.e. two from each unit. The students will be required to attempt one question from each unit. Question no. 1 is compulsory. It is objective type 10 questions of multiple choices covering the entire four units.*

**Unit I: Fundamentals of Costing**

Cost concept. Classification of cost, elements of cost. Methods of costing. Unit and operating costing, preparation of cost sheet. Estimation of cost of production and component of total cost. Profit planning, job order, batch process, and conversion cost. Inventory costing.

**Unit II:**

Cost-Profit-Volume analysis, break-even point, contribution margin, margin of safety, angle of incidence. Capital budgeting.

**Unit III: Cost Structure in Textile Industry**

Cost structure, cost of raw material/labour /utilities. Cost control, standard costs, determination of cost per kg of yarn, per meter of fabric, cost of dyeing/printing per meter of fabric, yarn realization, measures of cost reduction, selling price decision for yarn/fabric. Concept of depreciation.

**Unit IV: Labour Allocation and Rationalization of Labour**

Labour allocation in different department of textile mill. Work-load standards for card tenters, speed frame and ring frame tenters, doffers and winders, weavers, etc. Costing of large package spinning and optimum package size. Costing of Open end spun and Air-jet spun yarns.

Waste and its control at spinning and weaving, Costing of shuttle-less looms like Sulzer, air-jet. Economics of shuttle loom,

**Suggested Text Books and References:**

1. Textile Costing by SITRA.

2. Khan and Jain, "Management Accounting", Tata McGraw-Hill Publication.
3. Owler, L. W. J., Brown, J. L., "Wheldon's Cost Accounting and Cost Methods", ELVS Publication.

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| | | |
|---|---|---|
| **Programme Name** | **Bachelor of Technology in Textile Technology** | **Semester VIII** |
| **Course Title** | **MANAGEMENT OF TEXTILE PRODUCTION** | |
| **Course Code** | **OEC-TEX-422A** | |
| **Course Purpose** | To make the students aware of textile production management | |
| **Course Outcomes** | After completing this course, students will be able to:<br>CO1 – Define different sectors of Indian textile industry<br>CO2 – Get idea about plant location and layout for textile industries.<br>CO3–Describe the concept of production planning control and ERP<br>CO4–Understand the concept of air conditioning, power consumption, maintenance and work management in textile industry<br>CO5- Explain different measures to be taken for maintaining good working environment in industry | |
| **Prerequisite** | Basic knowledge of textile production processes | |

**OEC-TEX-422A**

**MANAGEMENT OF TEXTILE PRODUCTION**

| L | T | P | |
|---|---|---|---|
| 4 | 1 | - | Sessional: 25 Marks<br>Exam: 75 Marks<br>Total: 100 Marks<br>Time: 3 hrs |

**Note**- Nine questions will be set in the question paper i.e. two from each unit. The students will be required to attempt one question from each unit**.** Question no. 1 is compulsory. It is objective type 10 questions of multiple choices covering the entire four units.

**Unit I: Indian Textile Industry**

WTO / GATT / MFA - Functions and objectives, successes and failures.

Structure of Indian Textile Industry, Organized and Decentralized Sector, Handloom sector, Production and export, Sickness in Textile Industry.

**Location and Layout :** Plant location and site selection , Factors affecting location , plant lay- out, Different type of layouts, Layout plan for spinning, weaving and process house.

**Unit-II: Production, Planning and Control**

Product mix decision, linear programming concept, Supply chain management, Concept of zero defects, Management information system.

**Inventory Management**: Inventory concepts, techniques to reduce inventory, ABC analysis, EOQ, P and Q systems.

**Enterprise Resource Planning**: ERP concept, Applications of ERP, Ways to use ERP.

**Unit-III:**

**Air Conditioning and humidification:** Humidification systems used in textile mills, Development in humidification systems.

**Power Consumption:** Energy consumption in textile machines, Measure to reduce power



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consumption.

**Maintenance Management:** Maintenance systems, Maintenance schedules.

**Work Management**: Basics of work load and work assignment, effect of end breaks on work assignment.

**Unit-IV**

**Working Environment:** Measures of good working environment, Measures to minimize noise, terms related to lighting, illumination level required for different departments, Material handling equipments, Accidents and safety engineering, Fire prevention and protection.

**Suggested Text Books and References:**

1. Dudeja V D , “Management of textile Industry” Textile Trade Press Ahmedabad (1981)
2. Ormerod A, “Textile Project Management” The Textile Institute , ManchesterUK(1992)
3. Talukdar M K ,Srirammulu P K and Ajgaokar D B , “Weaving – Machine , Mechanism and Management ,” Mahajan Publisher Private Ltd., Ahmedabad , India (1998)
4. Grade A R and Subramanian T A , “Process Control in Spinning,” 3rd Edition., ATIRA Ahmedabad, (1987)
5. Higgins, “Handbook of Maintenance Management,” Prentice Hall New York (1999).

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| | | |
|---|---|---|
| **Programme Name** | **Bachelor of Technology in Textile Technology** | **Semester VIII** |
| **Course Title** | **PRODUCT DESIGN AND DEVELOPMENT** | |
| **Course Code** | **OEC-TEX-424A** | |
| **Course Purpose** | To make the students aware about of product design and development process | |
| **Course Outcomes** | After completing this course, students will be able to:<br>CO1 -Basic concepts and critical factors for product design<br>CO2 -Basic elements and tools for conceptualization of product design<br>CO3 –Understanding of product life cycle and its conceptualization<br>CO4 – Understand the various stages of sample development | |
| **Prerequisite** | Basic knowledge of textile production processes | |

**OEC-TEX-424A**

**PRODUCT DESIGN AND DEVELOPMENT**

| L | T | P | |
|---|---|---|---|
| 4 | 1 | - | Sessional: 25 Marks<br>Exam: 75 Marks<br>Total: 100 Marks<br>Time: 3 hrs |

**Note**- *Nine questions will be set in the question paper i.e. two from each unit. The students will be required to attempt one question from each unit. Question no. 1 is compulsory. It is objective type questions of multiple choices covering the entire four units.*

**Unit 1**

Introduction, Characteristics of successful product design, Product development, process tools, Understanding customer needs, establishing product function and product specification.

**Unit 2**

Product life cycle, phase of product development viz. Concept generation, Concept selection, Concept testing, Product architecture. Design for manufacturing.

**Unit 3**

Types of products, study apparel product lines, brand management, idea generation, screening, commercialization, product positioning, major reasons for product failure, Product design economics.

**Unit 4**

Merchandiser's role in product development, Pre-production & TNA meetings, sampling-developing samples, sample types, sample approvals, lab dip, yarn dip, bit loom, strike offs, pre-costing and order follow-up.

**Suggested Text Books and References:**

1. Otto Kevin, and Wood Kristin, Product Design Techniques in Reverse Engineering and New product Development Pearson Education publication, Ist Ed, 2006.

2. Ulrich K T, Product Design and Development, TMG, 3rd Ed, 2004



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**Bachelor of Technology (Biotechnology)**
**Credit-Based**
SCHEME OF STUDIES/EXAMINATIONS (Modified)
**Semester – III (w.e.f. the session 2021-22)**

| S. No. | Course No. | Course Title | Teaching Schedule | | | | Credits | Allotment of Marks | | | | Duration of Exam (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Hours /Week | | Major Test | Minor Test | Practical | Total | |
| 1 | BTE-201A | Cell Biology & Genetics | 3 | 0 | 0 | 3 | 3.0 | 75 | 25 | 0 | 100 | 3 |
| 2 | BTE-203A | Microbiology | 3 | 0 | 0 | 3 | 3.0 | 75 | 25 | 0 | 100 | 3 |
| 3 | BTE-205A | Biochemistry | 3 | 0 | 0 | 3 | 3.0 | 75 | 25 | 0 | 100 | 3 |
| 4 | BTE-207A | Principles of Biostatistics | 3 | 0 | 0 | 3 | 3.0 | 75 | 25 | 0 | 100 | 3 |
| 5 | HTM-901A | Universal Human Values II : Understanding Harmony | 3 | 0 | 0 | 3 | 3.0 | 75 | 25 | 0 | 100 | 3 |
| 6 | BTE-209LA | Cell Biology & Genetics Lab | 0 | 0 | 3 | 3 | 1.5 | 0 | 40 | 60 | 100 | 3 |
| 7 | BTE-211LA | Microbiology Lab | 0 | 0 | 3 | 3 | 1.5 | 0 | 40 | 60 | 100 | 3 |
| 8 | BTE-213LA | Biochemistry Lab | 0 | 0 | 3 | 3 | 1.5 | 0 | 40 | 60 | 100 | 3 |
| | | **Total** | **15** | **0** | **9** | **24** | **19.5** | **375** | **245** | **180** | **800** | |
| 9 | BTE-215A | Industrial Training-I | 2 | 0 | 0 | 2 | - | - | 100 | - | 100 | - |
| 10 | *MC-902A | Constitution of India | 3 | 0 | 0 | 3 | | 75 | 25 | 0 | 100 | 3 |

**Note:** BTE-215A is a mandatory credit less course in which the students to be evaluated for the industrial training undergone after 2nd semester and students will be required to get passing marks to qualify.

***MC-902A** is a mandatory credit less course in which the student will be required to get passing marks in the major test

| HTM-901A | Universal Human Values II: Understanding Harmony | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3.0** | **75** | **25** | **100** | **3 Hours** |
| **Purpose** | Purpose and motivation for the course, recapitulation from Universal Human Values-I | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO 1** | Development of a holistic perspective based on self-exploration about themselves (human being),family, society and nature/existence. | | | | | | |
| **CO 2** | Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence. | | | | | | |
| **CO 3** | Strengthening of self-reflection. | | | | | | |
| **CO 4** | Development of commitment and courage to act. | | | | | | |

**Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for ValueEducation**

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment ofaspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at variouslevels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrarinessin choice based on liking-disliking

**Module 2: Understanding Harmony in the Human Being - Harmony in Myself!**

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

**Module 3: Understanding Harmony in the Family and Society- Harmony in Human-HumanRelationship**

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as thefoundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the othersalient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- fromfamily to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value inrelationships. Discuss with scenarios. Elicit examples from students' lives

**Module 4: Understanding Harmony in the Nature and Existence - Whole existence asCoexistence**

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" canbe used), pollution, depletion of resources and role of technology etc.

**Module 5: Implications of the above Holistic Understanding of Harmony on ProfessionalEthics**

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching

institutions and organizations

28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. todiscuss the conduct as an engineer or scientist etc.

**READINGS:**

**Text Book**

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010

**Reference Books**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J CKumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

**MODE OF CONDUCT**

Lecture hours are to be used for lecture/practice sessions.

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at handand motivating students to reflect, explore and verify them.

Practice hours are to be used for practice sessions.

While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions, the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration. Scenarios may be used to initiate discussion. The student is encouraged to take up" ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Practice experiments are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.

This course is to be taught by faculty from every teaching department, including HSS faculty. Teacherpreparation with a minimum exposure to at least one 8-day FDP on Universal Human Values is deemedessential.

**ASSESSMENT:**

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.

Example:

Assessment by

faculty mentor: 5 marks

Self-assessment: 5 marks

Assessment by peers: 5 marks

Socially relevant project/Group Activities/Assignments: 10 marks

Semester End Examination: 75 marks

The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

| BTE-401A | Bioinformatics (B. Tech. Biotechnology Semester VII) | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **1** | **-** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | **To familiarize the students with the basics of Bioinformatics** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **Students will learn basic principles of various types of databases** | | | | | | |
| **CO2** | **Students will come to know about various tools related to sequence alignment and statistical significance of alignment** | | | | | | |
| **CO3** | **This unit will enable the students to learn various software tools for sequence analysis and primer designing** | | | | | | |
| **CO4** | **Students will be able to learn predictive methods for nucleotides and protein sequence analysis** | | | | | | |

**UNIT I**

1. **Databases**

**a.** Sequence Databases: introduction of Databases, primary and secondary databases, nucleotide and protein sequence databases: Genbank, EMBL, DDBJ, Swissprot, pfam, Block, PRI

**b.** Structure Databases: Introduction to structures. PDB (Protein Data bank) Molecular Modeling database at NCBI. , visualizing structural information, database structure viewers.

**c.** Sequence and Structure File Formats

2. **The Entrez system**: Integrated information axis, Information retrieval from biological database, sequence database beyond NCBI. Medical databases.

**UNIT II**

3. **Sequence Alignment AND Database Searches**

Introduction, the evolutionary basis of sequence alignment, Type of Aligmnents, Pair-wise Alignment, Multiple Alignment, The modular nature of proteins, Optimal alignment methods, substitution scores and gap penalties, statistical significance of alignment. FASTA, BLAST, low-complexity regions, repetitive elements, Tool of multiple sequence alignment: CLUSTAL W/X, progressive alignment method.

4. **Phylogenetic Analysis:**

Elements of phylogenetic models, phylogenetic data analysis: alignment, substitution model building, tree building and tree evaluation, building the data model (alignment), determining the substitution model, tree- building methods, searching for trees, rooting trees, evaluation trees and data, phylogenic software (PHYLIP). Phylogenetic online tool.

## UNIT III

**Sequence Analysis Using Software Resources:**

**Introduction.** The Wisconsin package, the Seq Lab environment, analyzing sequences with operations and Wisconsin package programmes, viewing output, monitoring programme progress and troubleshooting problems, annotating sequences and graphically displaying annotations in the Seqlab Editor, saving sequences in the Seq Lab Editor, Example of analysis that can be undertaken in Seqlab, extending Seqlab by including programmes that are not part of the Wiscosin package.

**Plasmid Mapping and Primer Design**

Restriction mapping, Mac Vector and OMIGA. Gene construction kit. Vector NTI, primer design for PCR Sequencing, primer design programs and software.

## UNIT IV

**Predictive Methods using nucleotide sequences:** Predictive methods using nucleotide sequences: Introduction, Gene prediction methods, Computational gene prediction in eukaryotes. Gene prediction programs: GRAIL, GeneID, GENSCAN, GENMARK, detecting functional sites in the DNA: Promoters, Intron Splice Sites, and Translation Initition Site.

**Predictive methods using protein sequences**: protein identity based on composition, physical properties based on sequence, secondary structure and folding classes, specialized structures or features, tertiary structure. Prediction of protein secondary and tertiary structures. Related software.

**Reference/Text Books-**

Bioinformatics by Andreas D.Boxevanis. Wiley Interscience, 4th edition 2020.

Bioinformatics: Sequence and genome analysis by David W.Mount, Cold Spring Harbor, 2004.

Biocomputing Informatics And The Genome Projects by Smith D.W., Academic Press, 2014.

Bioinformatics: A Biologists Guide to Computing and the Internet. by Stuart M. Brown, NKU Medical Center, NY USA, 2000.

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| BTE-403A | Pharmaceutical Biotechnology (B.Tech. Biotechnology Semester VII) | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Major Test** | **Total** | **Time** |
| **3** | 0 | **-** | **3** | **25** | **75** | **100** | **3 Hrs** |
| **Purpose** | **To learn various aspects of pharmaceutical biotechnology** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **tudents will learn the procedure for discovery and development of drugs** | | | | | | |
| **CO2** | **Students will be able to understand the metabolism of drug in the body and effects of drug on the human body** | | | | | | |
| **CO3** | **Students will learn the basic concepts involved in the preparation of various drugs and their formulations** | | | | | | |
| **CO4** | **Students will understand the management of different Life Style Diseases and know the procedure of Quality control and assurance.** | | | | | | |

**UNIT-I**

1. **Introduction and Different Disciplines of Pharmacy**
2. Historical Background and New Drug Discovery and Development – Preclinical and Clinical trials of drugs. Pharmacogenomics, Types of Drug receptors.

**UNIT-II**

3. **Pharmacokinetics and Pharmacodynamics:** Drug Bioavailability, Consideration in dosage form design, route of administration (oral, parental, inhalations, topical) Basic Principle of Drug Absorption, Distribution, Metabolism and Excretion.

4. **Radiopharmaceuticals and Nanopharmaceuticals**- Therapeutic applications of radioisotopes, Applications of Nano technology in Pharmaceuticals.

**UNIT-III**

5. **Basic concepts involved in the preparations of different Drugs and their Dosage forms**.Solid Dosage Forms- Tablets , Capsules, Powders , Semisolid Dosage Forms - Creams, Ointments, Pastes, lotions, Liquid Dosage Forms like Mixtures, Solutions, Emulsion, Ophthalmic etc.

6. **Additives and Excipients used in drug formulations**- Colors , flavours, sweeteners, binders, Disintegrating agents and other additives used in prescriptions.

**UNIT- IV**

7. **Management of Life style diseases** like obesity, diabetes, B.P., cholesterol heart stroke and cancer, joint problems etc. Neutraceuticals: Sources, Types, Potential Benefits, Role in prevention and control.

8. **Pharmaceutical products and their Types**
Laxatives, Analgesics, Antiseptics, Antacids, Antibiotics.

9. **Quality control and assurance**- GMP, GLP, ISO- 9000, validation and Drug Regulatory affairs

**Reference/Text Books**:


1. Principles of Medicinal Chemistry Vol. 1 Dr. S.S.Kadam, Dr. K.R. Mahadik, Dr. K.G.Bothara

2. Principles of Medicinal Chemistry Vol. 1 Dr. S.S.Kadam, Dr. K.R. Mahadik, Dr. K.G.Bothara

3. Pharmaceutical Dispensing.(2010) Pratibha Anand and Roop K. Khar. CBS Publishers and Distributors Pvt. Ltd.

4. R. M. Mehta, "*Dispensing Pharmacy*", Vallabh Prakashan, New Delhi.
5. Brahmankar, CBS Publishers.
6. Lipin Cott's Illustrated Reviews Pharmacology. Richard Maria, Pamela, Mary, Sheldon .

7. Cooper and Guunn's,*"Dispensing for Pharmaceutical Students",* CBS Publishers, Delhi

8. A Owunwonne, *"Hand Book of Radiopharmaceuticals",* Narosa Publishing House, New Delhi.
9. H C Ansel, *" Introduction to Pharmaceutical Dosage Forms",* K M Varghese& Co., Mumbai.
10. S.N.Pandeya: A Textbook of Inorganic Medicinal Chemistry, S.G.Publishers, Varanasi.
11. Clarke, E. C. G., "*Isolation and Identification of Drugs*", The Pharmaceutical Press, London


**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| BTE-411A | Biosensor and Bioinstrumentation (B.Tech. Biotechnology Semester-VII) | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **1** | **-** | **3** | **75** | **25** | **100** | **3Hrs** |
| **Purpose** | **To familiarize the students with basic and applied aspects of Biosensors and Bioinstrumentation** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **To familiarize with basic concepts of general properties of transducers and other analytical instruments** | | | | | | |
| **CO2** | **Students will come to know about bioassay design and implementation and basic concepts of automation and robotics** | | | | | | |
| **CO3** | **This unit will enable the students to learn about data retrieval, handling and integration of databases and basics of human cardiac and vascular system** | | | | | | |
| **CO4** | **Students will be able to know the basic concepts and applications of various types of biosensors** | | | | | | |

**UNIT – I**

1. **Introduction:** Electrical quantities and units, functional elements of an instrumentation system, static and dynamic characteristics, principle of analog and digital meters, CRO, energy meters, time and frequency meters, multimeters.
2. **Transducers**: Classification, resistive strain gauges, RTD, LVDT, Piezoelectric transducers, Electromagnetic transducers, Optical transducers, Transducers for biomedical science and their applications.
3. **Analytical Instruments:** pH meters, radiometric devices, fluorescence spectrophotometers, chromatology (chromatographic techniques- GC and HPLC), electrophoresis, lab on a chip – related instrumentation, Validation, commissioning and maintenance of the above equipments.

**UNIT-II**

4. **Assay Technologies and Detection methods:** Introduction, bioassay design and implementation, radiometric assay, scintillation proximity assay, fluorescence methodology to cover all types of fluorescence measurements and instrumentation, Reporter gene assay applications. Bio-analytical applications.
5. **Automation and Robotics:** Introduction: management and services issues of a centralized robotics HTS (high throughput screening) core, flexible use of people and machines, Bar-code technology and a centralized database, factors for the successful integration of assays, equipment, robotics and software. Perspectives on scheduling.

## UNIT-III

6. **Data retrival, handling and integration:** Database systems, systems integration, data management and tracking

7. **Cardiac and Vascular system:** Overview of cardiovascular system, types of blood pressure sensors, Lumped parameters modeling of a catheter- sensor/system, heart sounds, cardiac catheterization, indirect measurement of blood pressure, measuring blood flow rate, measuring blood volume, pacemakers, defibrillators, cardiac-assist devices and heart valves- related instrumentation of equipments and involved sensors.

8. **Respiratory system**: Modeling the respiratory system, measuring gas flow rate and lung volume, tests of respiratory mechanics, measuring gas concentration, tests of gas transport, ventilators, anesthesia machines- related instrumentation of equipments and involved sensors.

## UNIT-IV

9. **Biosensors:** Introduction to biosensors: concepts and applications, biosensors for personal diabetes management, micro fabricated sensors and the commercial development of biosensors, electrochemical sensors, chemical fibrosensors, Ion-selective FETs, non-invasive blood-gas monitoring, blood-glucose sensors. Noninvasive biosensors in clinical analysis, Applications of biosensors based instruments to the bioprocess industry. Applications of biosensors to the environmental samples, Introduction to biochips and their application to genomics, BIA core- an optical biosensors

**Reference Books**


1. M. K.Sezgintürk. Commercial Biosensors and their applications: Clinical, Food and Beyond. Elsevier. 2020.
2. G. Dutta, A. Biswas and A. Chakrabarti. Modern Techniques in Biosensors: Detection Methods and Commercial Aspects. Springer. 2021.
3. Introduction to Bio-analytical Sensors by Alice J Cunningham New York, John Wiley, 1998.
4. Applied Biosensors by DolandL.Wise, 1989
5. Advances in Laboratory Automation – Robotics, Eds. J.R.Strimataitis and J.N. Little, Zymark Corporation, Hopkinton, MA 1991.
6. Instrument methods of analysis by H W Willard, L LMerrit, J A Dean and F ASttle. 6/e, East- West publishers. 1992.
7. Biosensors and their applications by C Yang Victor and TNgo That, Plenum Press NY, 2000


**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| BTE-413A | DEC-I * Biochips and Microarray Technology (B. Tech. Biotechnology Semester VII) | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **1** | **-** | **3.0** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | **The purpose of this course is to familiarize the students with different array techniques** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **To familiarize with basic concepts of biochips and microarray technology** | | | | | | |
| **CO2** | **Students will be able to understand about RNA and Protein Chips and electrical detection methods for microarrays** | | | | | | |
| **CO3** | **This unit will enable the students to learn about applications of biochip technology in various fields** | | | | | | |
| **CO4** | **Students will be able to know the commercial aspects of biochip technology and DNA computing** | | | | | | |

## UNIT -1

1. **Introduction**: Basics of biochips and microarray technology, historical development of biochip technology .Why are Microarray important.

2. **Biochip and Microarray construction**: DNA microarrays, oligonuleotide, cDNA and genomics microarrays, microchip production technologies, megaclone technology for fluid microarray labels, microarray scanners./headers, microarray robotics. Microfluidics systems, chips and mass spectrometry.

## UNIT- II

3. **Biochip and Microarray construction (Continued)**: Biochips, microarrays, Chromosome on a chip, tissue chip, RNA chip, Protein chip technology, glycochips, biochips assays, combination of microarray and biosensor technology, biochip versus gel-based methods, process flow for production and analysis of a chip, standardization of microarray analysis, bioinformatics and microarrays, integrated biochip system, evaluation of conventional microarray technology. Electrical detection methods for microarrays, SERS (Surface-Enhanced Raman spectroscopy)-based microarrays.

## UNIT- III

4. **Applications of Biochip Technology:** Molecular diagnostics and pharmacogenomics, Application of microarray technology in drug discovery and development, Gene expression studies, use of DNA chip technology for drug safety, use of microchips for drug delivery, biochips as neural prostheses, use of biochips in health care, use of microarrays in population genetics and epidemiology, use of microarray in forensics. DNA chip technology for water

quality management, Bioagent chip, Application of microarray in the agro-industry, use of microarray in genetic disease monitoring, point of care (POC) applications.

**UNIT -IV**

5. **Commercial aspects of Biochip technology:** Markets for biochip technologies, commercial support for the development of biochips, government support for biochip development, business strategies and patent issues

6. **DNA Computing:** Introduction, junctions, other shapes, biochips and large-scale structures. Discussion of Robinson and Kallenbach's methods for designing DNA shapes, DNA cube. Computing with DNA, Electrical analogies for biological circuits. Challenges and future trends. Gene ontology and pathway analysis

**Reference /Text Books-**


1. Arun Jogota, "Microarray Data Analysis and Visualization", The Bay Press, 2001.
2. Ernst Wit and John McClure, "Statistics for Microarrays Design", Analysis and Inference, John Wiley & Sons, 2004.
3. Steen Knudsen, "Guide to analysis of DNA Microarray data", John Wiley & Sons, 2004.
4. Biochips and Microarrays-technology & Commercial Potential, Published by RCK Publishing, 2012.

5 DNA Arrays: Technology and Experimental strategies, Grigorenko (ed), CRC Press, 2002.

6. Microarray Analysis Mark Schena; J. Wiley & Sons (ed., New York), 2002.
7. Microarray Bioinformatics, Dov Stekel, Cambridge University Press, 2003.
8. Microarray Technology and Its Applications, Uwe R. Müller, Dan V. Nicolau, Springer, 2005.
9. DNA Microarrays: Current applications: Emanuele de Rinaldis, Armin Lahm,, Horizon Scientific Press, 2007.


**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

**** The students should select two Departmental Elective Courses (DEC-I)***

| BTE-415A | Enzyme Technology (B. Tech Biotechnology semester VII) | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **1** | **-** | **3.0** | **75** | **25** | **100** | **3 Hrs** |
| **Purpose** | **To familiarise students about different aspects of enzyme technology** | | | | | | |
| **Course outcome: After completion of this course the students will be able** | | | | | | | |
| **CO1** | **To articulate advantages and disadvantages of enzyme based production processes.** | | | | | | |
| **CO2** | **To compare different strategies used for protein engineering** | | | | | | |
| **CO3** | **To explain the principles and parameters used for enzyme immobilization.** | | | | | | |
| **CO4** | **To differentiate between solid state fermentation and submerged fermentation.** | | | | | | |

## UNIT I

**Introduction to enzyme Technology**: What are Biocatalysts? Bio- and Chemo catalysts – Similarities and Differences, Goals and Potential of Biotechnological Production Processes, The Use of Isolated or Intracellular
Enzymes as Biocatalysts, Advantages and Disadvantages of Enzyme-Based Production Processes, Goals and Essential System Properties for New or Improved Enzyme Processes, Essential System Properties for Rational Design of an Enzyme Process , Current Use and Potential of Enzyme Technology

## UNIT-II

**Enzyme Discovery and Protein Engineering**: Enzyme Discovery, Strategies for Protein Engineering, Rational Protein Design, Directed (Molecular) Evolution
Methods to Create Mutant Libraries, Assay Systems, Focused Directed Evolution, Computational Design of Enzymes

## UNIT-III

**Immobilization of Enzymes**: Principles, Parameters of Immobilization, Carriers
Inorganic Carriers, Polysaccharides, Synthetic Polymers, Binding Methods
Adsorption, Covalent Binding, Application of Immobilized Enzymes
Hydrolysis and Biotransformation of Carbohydrates, Amino Acid, Peptide Synthesis, Application of Lipases

## UNIT-IV

**Enzyme production and Purification**: solid state fermentation, submerged fermentation, environmental factors affecting microbial enzyme production in SSF. Strategies to improve production of microbial cellulase.

**Reference/Text Books**


1. Klaus Buchholz, Volker Kasche, and Uwe T. Bornscheuer "Biocatalysts and Enzyme Technology" 2nd Edition, Wiley-Blackwell, 2012
2. M.Y Khan and Farah Khan " Principles of enzyme technology" PHI, 2015
3. Enzyme Technologies editors: Hsiu-Chiung Yang Wu-Kuang Yeh and James R. McCarthy, Wiley, 2014
4. "Biotechnology of Microbial Enzymes" Editor Goutam Brahmachari, Academic Press, 2017


**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **BTE-417A** | **Advanced Management Information system and Information Technology ( B. Tech Biotechnology semester VIII)** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hour** |
| **Purpose** | **To familiarize the students with Management Information System.** | | | | | | |
| **Course Outcomes After completion of this course the students will be able** | | | | | | | |
| **CO1** | **To Understand and articulate fundamental concepts of information technology management.** | | | | | | |
| **CO2** | **To Assess and apply IT to solve common business problems.** | | | | | | |
| **CO3** | **To Suggest and defend effective solutions to business problems, and design a database application to solve a business problem.** | | | | | | |
| **CO4** | **To Discuss the ethical aspects of information technology use in the organization and its governance issues.** | | | | | | |

## UNIT I

**Introduction:** Definition information system, role and impact of MIS, The challenges of Information system, Nature of
MIS, Characteristics of MIS, Myths regarding MIS, Requirements of MIS, Problems & Solutions in implementing MIS, Benefits of MIS, Limitations of MIS, Significance of MIS, Components of MIS. Role of MIS, Major Management challenge to building and using information system in Organization, functions of management.

## UNIT II

**Information system and Organizations:** The relationship between Organization and Information System, Information needs of different organization levels: Information concept as quality product, classification and value of information, methods of data and information collection. Strategic role of information system, Salient features of Organization, Information, management and decision making, How Organization affect Information Systems, How Information system affect Organization, Ethical and Social impact of information system.

## UNIT III

**Business application of Information System:** Foundation Concepts Information systems in Business: Information system and technology, Business Applications, Development and Management. The internetworked E-business Enterprise: Internet, and Extranet in business. Electronic Commerce System: Electronics commerce Fundamentals, Commerce Application and issues. E-business Decision Support: Decision support in E-Business, Artificial Intelligence Technologies in business.

## UNIT IV

**Strategic and Managerial Implications of Information Systems:** Strategic Information System: Introduction, Characteristics of Strategic Information Systems, Strategic Information Systems (SISP), Strategies for developing an SIS, Potential Barriers to developing a Strategic Information System (SIS), Decision Support System (DSS): Decision making concepts, methods, tools and procedures. Managing Information Resources: Introduction, IRM, Principal of Managing Information Resources, IRM functions, Computer Security: Introduction, Computer Security, Types of Computer Security, Disaster Recovery Plan.

**Reference/Text Books:**

1. W.S . Jawadakar, “Management Information System”, McGraw Hill ,
2. J. O. Brien, “ Management Information System”, TMH, New Delhi
3. Uma G . Gupta, “Management Information System” Fifth Edition TMH.
4. Kenneth C. Laudon, “Management Information System Organisation and Technology” TMH.

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| BTE-419A | Stem Cell Technology (B.Tech. Biotechnology) Semester- VII | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time |
| 2 | 1 | 0 | 3 | 75 | 25 | 100 | 3 |
| Purpose | The objective of this course is to enable students to understand the principles of stem cells, their isolation and maintenance and their application in different therapies | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Students will be able to differentiate among the different types of stem cells | | | | | | |
| CO2 | Students will be able to explain the concept of stem cell cloning | | | | | | |
| CO3 | Students will be able to compare the isolation and maintenance methods for different type of stem cells | | | | | | |
| CO4 | Students will be able to recognize the applications of stem cells in different diseases | | | | | | |

**UNIT I**

**Introduction:** Basic concepts and properties of Stem cells, Totipotency and Pluripotency, Types of stem cells: Embryonic stem cells, germinal stem cells, Adult stem cells, Tumor stem cells.

**UNIT II**

**Molecular Cell Biology and Cloning:**Molecular mechanisms, Cell cycle regulation in stem cells. Stem cell niches, Stem cell lineage tracing

Therapeutic and reproductive cloning, Nuclear Transfer method, Application of nuclear transfer derived embryonic stem cells.

**UNIT III**

**Stem Cells maintenance and transplant:**Sources of stem cells; Cell types for transplantation: Bone marrow, Peripheral stem cells, cord blood stem cells

General methods of Isolation, Identification, Characterization and maintenance of different stem cells: Embryonic stem (ES) cells, Hematopoietic Stem Cells (HSC), Hematopoietic Stem Cells (HSC), Differentiation studies of Mesenchymal stem cells, Neural stem cell and Neural crest stem cell.

**UNIT IV**

**Stem cells and Therapy** Cell based therapy, organ factories, drug discovery and development, Medical applications in Leukemia, Immune deficiencies, diabetes, liver diseases, cardiovascular diseases, Neurological disorders

**Reference/Text Books**


1. Anthony Atala, Robert Lanza. Essentials of Stem Cell Biology. Netherlands: Elsevier/Academic Press, 2014.

2. Atala A & Lanza R, Stem Cells Handbook. Netherlands: Springer New York, 2013.

3. Satish Totey and Kaushik D. Deb. Stem Cell Technologies: Basics and Applications (McGraw-Hill, 2010).

4. Robert A. Meyers Stem Cells: From Biology to Therapy (Current Topics from the Encyclopedia of Molecular Cell Biology and Molecular Medicine), 2013


**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **BTE-421A** | **Herbal Drug Technology (B. Tech. Biotechnology Semester VII)** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **-** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | **To familiarize the students with basic and applied aspects of Herbal Drug Technology** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **The contents of first unit will enhance the knowledge of students about traditional herbs and herbal medicine.** | | | | | | |
| **CO2** | **Students will come to know about the basic concepts of various systems of medicine and traditional therapies** | | | | | | |
| **CO3** | **This unit will learn the skills about technology for production of crude drugs.** | | | | | | |
| **CO4** | **To familiarize with basic knowledge of use of herbs in the management of health. Students will learn about the economic aspects of herbs and herbal drugs** | | | | | | |

## UNIT I

**Herbs as raw materials**: Definition of herb, herbal medicine, herbal medicinal product, Common herbals and herbal medicines of India. Sources of Herbs Selection, Identification and authentication of herbal materials. The need for the study of herbs and herbal medicine.

## UNIT II

**Systems of Medicine** : Evolution of systems of medicine, Traditional Therapies and Types of therapies– Ayurveda , Unani, eight chikitsas , eight chakras, Naturopathy, Homeopathy, Aromotherapy, Faith healing, Religious beliefs and Ethnotherapeutics . Concept of Holistic medicine. Ayurvedic Pharmacopoeia of India.

## UNIT III

**Technology for production of crude drugs**: Herbal drug preparation. Processing of herbal raw material, Principles of extraction and different methods of extraction. Formulation and Standardization of herbal extracts. Stabilization and stability of herbal formulations.

## UNIT IV

**Health Benefits**: Evolution of conscious use of plants in the management of health and disease General aspects, scope and types of products available in the market. Health benefits and role of herbs in ailments like Diabetes, CVS diseases, Cancer, and various Gastro intestinal diseases. Role of herbs in cosmetics.

**Economic Aspects of Herbal Drugs**: Economic value of herbs and herbal drugs, Databases on herbals and herbal drugs. Rescue and Preservation of traditional medicinal knowledge and herbals. Development of herbal medicine industry- Present Scope and future prospects.

**Reference Books-**


1. A lexicon of medicinal plants in India. D.N.Guhabakshi, P.Sensarma and D.C.Pal, 1999.Naya prakash - publications.
2. Glossary of Indian medicinal plants. R.N.Chopra, S.L.Nayar and I.C.Chopra,1956. C.S.I.R, New Delhi.
3. Ethnobotany The Renaissance of Traditional Herbal Medicine. Rajiv K. Sinha, 1996.Ina Shree publishers.
4. The indigenous drugs of India. Kanny, Lall, Dey and Raj Bahadur, 1984. International Book Distributors.
5. Herbal plants and Drugs Agnes Arber, 1999. Mangal Deep Publications.
6. New Natural products and Plant drugs with Pharmacological, Biological (or) Therapeutical activity. H.Wagner and P.Wolff , 1979. Springer, New Delhi.
7. Ayurvedic drugs and their plant source. V.V.Sivarajan and Balachandran Indra, 1994. Oxford IBH publishing Co.
8. Ayurveda and Aromatherapy. Miller, Light and Miller, Bryan, 1988. Banarsidass, Delhi.
9. Principles of Ayurveda. Anne Green, 2000. Thorsons, London.
10. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.
11. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy)


**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

**** The students should select two Departmental Elective Courses (DEC-I)***

| BTE-405LA | BIOINFORMATICS LAB (B.Tech. Biotechnology Semester VII) | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test (Practical)** | **Minor Test** | **Total** | **Time** |
| - | - | 3 | 1.5 | 60 | 40 | 100 | 3 Hrs. |
| **Purpose** | **To familiarize the students with applied aspects of Bioinformatics** | | | | | | |
| **Course Outcomes** | | | | | | | |
| CO1 | **To familiarize with computer basics and searching of biological databases** | | | | | | |
| CO2 | **Students will come to know about data mining techniques** | | | | | | |
| CO3 | **To learn the concepts of phylogenetic analysis using bioinformatics software** | | | | | | |
| CO4 | **Students will be able to know the basic concepts of protein structure prediction** | | | | | | |

**List of Experiments:**

1. Computer basics
2. Searching biological database for relevant information
3. Data mining techniques in Bioinformatics.
4. Searching, retrieval and similarity analysis of biological database.
5. Sequence retrieval from nucleic acid and protein database.
6. Restriction mapping
7. Sequence (FASTA & BLAST) searches.
8. Pair wise comparison of sequences.
9. Evolutionary studies/ Phylogenic analysis.
10. Identification of genes in genomes.
11. Protein databank retrieval and visualization.
12. Superposition of structures.
13. Secondary structure prediction of proteins.
14. Pattern searching in nucleic acids.
15. Validation of 3D structures.

**Reference/Text Books-**


Bioinformatics- A Practical Guide to the Analysis of Genes and Proteins by Andreas D. Baxevanis and B.F.Francis Ouellette, 4th Edition, A John Wiley and Sons, Inc. Publications, 2020.

Bioinformatics: Sequence and Genome Analysis by David W. Mount, Cold Spring Harbor, 2004.

Biocomputing Informatics and the Genome Projects by Smith D.W., Academic Press, 2014.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **BTE-402A** | **Biocatalysis & Biotransformation (B.Tech. Biotechnology Semester VIII)** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **-** | **3.0** | **75** | **25** | **100** | **3 Hrs** |
| **Purpose** | **To familiarize the students with Concepts of Biocatalysis and Biotransformation** | | | | | | |
| **Course outcome** | **After completion of this course the students will be able** | | | | | | |
| **CO1** | **To articulate the concept of Biocatalysis and Biotransformation.** | | | | | | |
| **CO2** | **To differentiate between different strategies for production of succinic acid.** | | | | | | |
| **CO3** | **To explain the mechanism of pesticide transformation.** | | | | | | |
| **CO4** | **To compare computational tools for enzyme function prediction.** | | | | | | |

**UNIT I**

1. **Introduction to biocatalysis**, Current market of biocatalysis, fermentation, concept of biotransformation and advantages and limitations of biotransformation.
2. Development of chemo enzymatic processes: synthetic route design and integration of biocatalysis, chemo-enzymatic process development

**UNIT II**

4. **Production of Dicarboxylic Acid Using Yeasts**: Current Uses and Production of Dicarboxylic Acids, Selection and Improvement of Yeast Strains, Selection and Improvement of Yeast Strains, Metabolic Engineering Strategies for Biotechnological Production of Succinic Acid
5. **Engineering Proteases for Industrial Applications**: Proteases in Industry, Serine Proteases and Subtilisins, Engineering Subtilisin Protease toward Increased Oxidative Resistance, Increasing Protease Tolerance against Chaotropic Agents.

**UNIT III**

6. **Transformation of pesticides**: Accumulation of pesticide, Mechanism of pesticide transformation, enzymatic reactions in pesticide metabolism
7. Transaminases: Transaminases as a Biosynthetic Route for Chiral Amines, Kinetic Resolution of Amines Employing ATAs, Recent Advances in Industrially Relevant Asymmetric Reductive Amination Reactions, ATA Screening Kit

**UNIT IV**

8. **Structural Bioinformatics and Biocatalysis Research**: Computational Tools for Function Prediction and Analysis of Enzymes.
9. **Recent development in biotransformation**: current challenges and future scopes of biotransformation process, practical consideration for enhancing efficiency of biotransformation

**Reference/text books**

1. Green Biocatalysis edited by Ramesh N. Patel, John Wiley and Sons, 2016.
2. Biotransformation of Agricultural Waste and By-Products edited by Palmiro Poltronieri and Oscar Fernando D'Urso, Elsevier Inc, 2016
3. Applied Biocatalysis edited by Lutz Hilterhaus, Andreas Liese, Ulrich Kettling, and Garabed Antranikian, Wiley-VCH, 2016.
4. Journal of Biocatalysis and Biotransformation.

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| BTE-404A | Metagenomics (B.Tech. Biotechnology Semester- VIII) | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **1** | **-** | **3.0** | **75** | **25** | **100** | **3Hr** |
| **Purpose** | **The purpose of this course is to provide focus on next generation DNA sequencing technology and p how the metabolic functions, taxonomic distribution, diversity, evenness and species richness of microbial communities varies across environment** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **Students will become familiar with Metagenomics** | | | | | | |
| **CO2** | **Students will be able to perform the phylogenetic tree** | | | | | | |
| **CO3** | **Students will develop the knowledge and able to perform Metagenomic analysis of soil microbial communities** | | | | | | |
| **CO4** | **Students will develop focus on the application of metagenomics** | | | | | | |

**UNIT -1**

**What is metagenomics**; Types of metagenomes: Amplicon, Shotgun, Functional; Amplicon metagenomics: History, phylogenetic marker, examples; Shotgun metagenomics: History and examples. Techniques subtractive hybridization (SSH); Differential expression analysis (DEA); Microarrays & Metagenome sequencing

**UNIT- II**

**Direct linking of microbial populations** to specific biodegradation and biotransformation processes by stable isotope probing of biomarkers- PhyloChip & GeoChip-Detection of xenobiotic-degrading bacteria by using oligonucleotide microarrays

Phylogenetic analysis and Comparative genomics Software's & Tools and Construction of a metagenomic library; Analysis of Metagenomic Libraries; Sequence-based Metagenomics Analysis; Function-based Metagenomics Analysis

**UNIT -III**

**Metagenomic analysis of soil microbial communities**; Metagenomic analysis of marine microbial communities; Metagenome of the Microbial Community in Acid Mine Drainage; Metagenomic Analysis of Bacteriophage; Metagenomics and Its Applications to the Study of the Human Microbiome; Archaeal Metagenomics: Bioprospecting Novel Genes and Exploring New Concepts.

**UNIT -V**

**Application of Metagenomics to Bioremediation**; Applications of Metagenomics for Industrial Bioproducts; Escherichia coli host engineering for efficient metagenomic enzyme discovery; Next-generation sequencing approaches to metagenomics; Stable isotope probing: uses in metagenomics; DNA sequencing of uncultured microbes from single cells.

**Reference/Text Books**


1. Diana Marco Universidad Nacional de Cordoba, Argentina, "*Metagenomics: Theory, Methods and Applications"*, Caister Academic Press,2010.
2. Diana Marco Universidad Nacional de Cordoba, Argentina "*Metagenomics: Current Innovations and Future Trends"*,Caister Academic Press,2011.
3. Joanna R. Freeland, Heather Kirk, Stephen Petersen, "*Molecular Ecology*", Mc Graw Hill, 2nd Edition "2012.
4. Beebee T.J.C., D G. Rowe," *An Introduction to Molecular Ecology*", Mc Graw Hill, 2004.


**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| BTE-406A | Molecular Modelling and Drug Design (B.Tech. Biotechnology Semester VIII) | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **1** | **-** | **3** | **75** | **25** | **100** | **3Hrs** |
| **Purpose** | **The course will focus on the Molecular Modelling in context of drug designing** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **To understand the critical relationship among biomolecular structure, function and force field models.** | | | | | | |
| **CO2** | **To be able to utilize basic modelling techniques to explore biological phenomena at the molecular level.** | | | | | | |
| **CO3** | **To emphasize Modelling drug/receptor interactions in detail by molecular mechanics, molecular dynamics simulations and homology modelling.** | | | | | | |
| **CO4** | **An awareness of rational drug design, based on understanding the three-dimensional structures and physicochemical properties of drugs and receptors will be created.** | | | | | | |

## UNIT I

1. **Introduction to Molecular Modelling**: Introduction - Useful Concepts in Molecular Modelling: Coordinate Systems. Potential Energy Surfaces. Molecular Graphics. Surfaces. Computer Hardware and Software. The Molecular Modelling Literature.

## UNIT II

2. **Force Fields: Fields. Bond Stretching**. Angle Bending. Introduction to Non-bonded Interactions. Electrostatic Interactions. Van der Waals Interactions. Hydrogen Bonding in Molecular Mechanics. Force Field Models for the Simulation of Liquid Water.

## UNIT III

3. **Energy Minimisation and Computer Simulation**: Minimisation and Related Methods for Exploring the Energy Surface. Non-Derivative method, 1st and 2nd order minimisation methods. Computer Simulation Methods. Simple Thermodynamic Properties and Phase Space. Boundaries. Analyzing the Results of a Simulation and Estimating Errors. GROMACS and CNS.

## UNIT IV

4. **Molecular Dynamics & Monte Carlo Simulation**: Molecular Dynamics Simulation Methods. Molecular Dynamics Using Simple Models. Molecular Dynamics with Continuous Potentials. Molecular Dynamics at Constant Temperature and Pressure. Metropolis Method. Monte Carlo Simulation of Molecules. Models Used in Monte Carlo Simulations of Polymers. Molecular Modeling software: BIOSUITE
5. **Structure Prediction and Drug Design**: Structure Prediction - Introduction to Comparative Modeling. Sequence Alignment. Constructing and Evaluating a Comparative Model. Predicting Protein Structures by 'Threading', Molecular Docking, AUTODOCK and HEX. Structure based De Novo Ligand design, Drug Discovery – Chemoinformatics – QSAR.

**Reference/Text Books**

1. S. Ramasamy. Molecular Modeling. Lambert Academic Publishing, USA. 2015
2. V. Magnasco. Methods of Molecular Quantum Mechanics- An Introduction to Electronic Molecular Structure. Wiley. 2009
3. A.R.Leach, Molecular Modelling Principles and Application, Longman, 2001.
4. J.M.Haile, Molecular Dynamics Simulation Elementary Methods, John Wiley and Sons, 1997.
5. S. P. Gupta. QSAR and Molecular Modeling, Springer - Anamaya Publishers, 2008.

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus**.

| BTE-408A | Cancer Biology (B.Tech. Biotechnology) Semester- VIII | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **1** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | **To give complete overview of cancer as a disease detailed analysis of biological changes of the tumor cells. Analyze the impact of the cell cycle (proliferation), gene mutations and apoptosis in cancer. Discuss the impact of applied/translational research in cancer diagnosis as well as the design of novel targeted therapeutic agents in the treatment of cancer.** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **Students will be able to categorize the different forms of cancer** | | | | | | |
| **CO2** | **Students will be able to explain the genetic basis of cancer** | | | | | | |
| **CO3** | **Students will be able to recognize the role of different proteins in cancer and their clinical significance** | | | | | | |
| **CO4** | **Students will be able to assess/compare different diagnostic and therapy methods** | | | | | | |

## UNIT I

**Fundamentals of Cancer Biology and Principles of Carcinogenesis**

Overview of the hallmarks of cancer, Different forms of cancers, Diet and cancer, Natural history of Carcinogenesis, Chemical Carcinogenesis, Metabolism of Carcinogenesis, Principles of Physical Carcinogenesis, X - Ray radiation - mechanism of radiation Carcinogenesis.

## UNIT II

**Molecular Cell Biology of Cancer:** Tumor viruses and Oncogenes, Identification of Oncogenes, Mechanism of oncogene activation, Role of growth factors and receptors in carcinogenesis, RAS signaling in cancer

Regulation of Cell cycle, modulation of cell cycle in cancer, Tumor suppressor genes, pRb tumor suppressor, Apoptosis and p53 tumor suppressor

## UNIT III

**Principles of Cancer Metastasis:** Three-step theory of Invasion, Proteinases and tumour cell, Basement Membrane disruption, The biology of angiogenesis, Metastatic cascade

## UNIT IV

**Detection of Cancer and Cancer Therapy:** Fundamental principles behind cancer diagnosis, Advances in Cancer detection, Different forms of therapy: Chemotherapy, radiation Therapy, and Immuno therapy, Applications of omics technologies in diagnostics and treatment.

**Reference/Text Books**


1. Pecorino, Lauren. Molecular Biology of Cancer: Mechanisms, Targets, and Therapeutics. United Kingdom: Oxford University Press, 2016.

2. Weinberg, Robert Allan. The Biology of Cancer. United Kingdom: Garland Science, 2014.

3. Vincent T. DeVita Jr. MD, Theodore S. Lawrence, Steven A. Rosenberg Cancer: Principles and Practice of Oncology Primer of Molecular Biology in Cancer(3rd edition)

4 Oxford Textbook of Cancer Biology, edited by Pezzella, Francesco, Mahvash Tavassoli, and David J. Kerr. Oxford, UK: Oxford University Press, 2019-05. https://oxfordmedicine.com/view/10.1093/med/9780198779452.001.0001/med-9780198779452.

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| BTE-410A | Developmental Biology (B. Tech. Biotechnology) Semester- VIII | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **1** | **-** | **3.0** | **75** | **25** | **100** | **3h** |
| **Purpose** | **This course will help the students to understand the basic knowledge of morphogenesis and organogenesis in plants and animals.** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **Students will be able to illustrate the basic concept of development.** | | | | | | |
| **CO2** | **Students will be able to classify Gametogenesis between plant and animal.** | | | | | | |
| **CO3** | **Students will be able to develop the knowledge of morphogenesis in animals.** | | | | | | |
| **CO4** | **Students will be able to develop the knowledge of morphogenesis in plants.** | | | | | | |

## UNIT -1

**Basic concepts of development :** Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development.

## UNIT- II

**Gametogenesis, fertilization and early development:** Production of gametes, cell surface molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination.

## Unit –III

**Morphogenesis and organogenesis in animals :** Cell aggregation and differentiation in *Dictyostelium*; axes and pattern formation in Drosophila, amphibia and chick, organogenesis – vulva formation in *Caenorhabditis elegans*, eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development- larval formation, metamorphosis; environmental regulation of normal development; sex determination.

## UNIT –IV

**Morphogenesis and organogenesis in plants:** Organization of shoot and root apical meristem; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems and floral development in Arabidopsis and Antirrhinum. Programmed cell death, aging and senescence.

**Reference/Text Books**


1. Developmental Biology by Gilbert SF and Sunderland MA. 6th Edition, 2000.
2. Abu-Shaar M, Mann R S. Generation of multiple antagonistic domains along the proximodistal axis during *Drosophila* leg development. Development. 1998.
3. The Biology of Aging by Sinauer Associates, Sunderland, MA *2nd Ed 1998.*


**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| BTE-412A | Protein Engineering* (B.Tech. Biotechnology Semester VIII) | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **1** | **-** | **3.0** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | **To create awareness with concepts of protein engineering** | | | | | | |
| **Course Outcomes: After completion of this course the students will be able** | | | | | | | |
| **CO1** | **To differentiate between secondary and tertiary structures of protein** | | | | | | |
| **CO2** | **To demonstrate structure function relationship of membrane proteins** | | | | | | |
| **CO3** | **To explain the concept of designed protein** | | | | | | |
| **CO4** | **To identify protein- protein interactions.** | | | | | | |

**UNIT I**

1. **Structure Function Dynamics Correlation**. Basic structural concepts – Primary, secondary, tertiary and quaternary structures. Ramachandran plot, super secondary structures – motif and domain. Protein folding and mechanisms.

**UNIT II**

2. **Structure Function Engineering**. The correlation of structure and function in – transcription factors, serine proteinases, membrane proteins, signal transduction proteins and recognition in immune system.

**UNIT III**

3. **Library Construction for Protein Engineering**: Established methods for library construction, critical methods in evaluation of library construction methods. Designed proteins, examples of designed proteins (enzymes) with enhanced stability and efficiency, playing a significant role in industries.

**UNIT IV**

4. **Engineering of Therapeutic Proteins**: Sources of Protein Therapeutics, Strategies for Designing Effective Protein Therapeutics, Examples of Protein Therapeutics
5. **Proteomics Application**. Mining proteomes, protein expression profiling, identifying protein – protein Interactions and protein complexes, mapping- protein identification, new directions in proteomics.

**References/Text Books**

1. Amit Kessel and Nir Ben-Tal, "Introduction to Protein" 2nd Edition, Chapman and Hall, 2018

2. Anton Torres Editor "Protein Engineering and Design," Syrawood Publishing House, 2017

3. Daniel C. Liebler, "Introduction to Proteomics – Tools for the New Biology," Humana Press, 2001

4. Protein Engineering and Design edited by Sheldon J. Park Jennifer R. Cochran, CRC Press, 2010

5 M.Romya and P. Ponmurugan, Protein Engineering, Narosa Publications, New Delhi, 2015

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| BTE-414A | Bioethics, IPR and Biosafety (B. Tech. Biotechnology) Semester- VIII | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **1** | **0** | **3** | **75** | **25** | **100** | **3hrs** |
| **Program Objective (PO)** | Students will able to acquire knowledge of regulatory bodies ,acts and organization indulge in creating a balancing force between advent in technology with monitoring their impacts on human and ecology alongwith biosafety measures with ethical conduct to society. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Students will be able to describe the basic terms and procedure for IPR, patent filing and implications on society of commercialized products. | | | | | | |
| **CO2** | Students will be able to learn and describe various act, policies, different organizations and guidelines for biosafety. | | | | | | |
| **CO3** | Students will develop knowledge of outbreak and risk assessment and management at laboratory level along with health impacts. | | | | | | |
| **CO4** | Students will develop awareness of ecological impact of release of genetically modified organisms and monitoring methods. | | | | | | |

**UNIT -1**

**Introduction**- Intellectual Property Rights, Copyrights, Trademarks, Trade secrets, Geographical indications, Patents, Patent Filing, Indian Patent act and amendments, Implications of intellectual property rights on the commercialization of Biotechnology products, Patented products in Market and Success story.

**UNIT- II**

**Policies, Agreements and Organization -**National biosafety policies and law, The Cartagena protocol on biosafety, Convention on biological diversity, Cross border movement of germplasm and agreements, World Trade Organization and agreements, Updated Regulatory frameworks.

**UNIT-III**

**Biological Containment-** Risk assessment, Risk management, General principal for biological containment at laboratory level, Health impact of containment issues-Allergenicity, Antibiotic resistance and Toxicology. Case studies.

**UNIT –IV**

**Ecological Impacts-**Genetically Modified organism and impact on biodiversity, gene flow, gene escape and creation of superweeds/ superviruses, Monitoring strategies and method of detecting transgenics(Radioactive /Non radioactive methods).Case studies.

**Reference/Text Books**

1. Padma Nambisan, An introduction to ethical safety and intellectual property rights issues in biotechnology, Academic Press,ISBN-978-0-12-809231-6, 2017.
2. Deepa Goel and Shomini Parashar, IPR, Biosafety and Bioethics, Pearson Education,India,ISBN-978933251429,2013.
3. V. Sree Krishna, Bioethics and Biosafety in Biotechnology, New age international private ltd., 2007.
4. Gerald A. Urban, BioMEMS, Springer, 2010.

| OEC-BT-418A | Biomedical Electronics (B. Tech Biotechnology semester VIII) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Practical | Total | Time |
| 3 | - | - | 3 | 75 | 25 | - | 100 | 3 |

**Course Outcomes**
**At the end of this course students will demonstrate the ability to**

| | |
|---|---|
| CO1 | Understand and explain the concept of biomedical signals, electrodes and instrumentation |
| CO2 | Understand and explain the physiological transducers and recording systems |
| CO3 | Understand and explain biomedical recorders and patient monitoring systems |
| CO4 | Understand and explain cardiac pacemakers, defibrillator and patient safety |

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

**UNIT-I**

**Introduction:** Role of technology in medicine, physiological systems of the body, sources of biomedical signals, basic medical instrumentation and their performance requirements, intelligent medical instrumentation systems, consumer and portable medical equipment, implantable medical devices, role of engineers in healthcare facilities.

**Bioelectric Signals and Electrodes:** Origin of bioelectric signals, recording electrodes, silver- silver chloride electrodes, electrodes for ECG, electrodes for EMG, electrical conductivity of electrode jellies and creams, microelectrodes.

**UNIT-II**

**Physiological Transducers:** Definition, classification and performance characteristics of transducers, displacement, position and motion transducers, pressure transducers, transducers for body temperature measurement, photoelectric transducers, optical fiber sensors, biosensors, smart sensors.

**Recording System:** Basic recording system, general considerations for signal conditioners, preamplifiers, sources of noise in low level measurements, biomedical signal analysis and processing techniques, the main amplifier and driver stage, writing systems.

**UNIT-III**

**Biomedical Recorders:** Electrocardiograph, vectorcardiograph (Vcg), phonocardiograph (Pcg), digital stethoscope, electroencephalograph (Eeg), electromyograph.

**Patient Monitoring Systems:** System concepts, cardiac monitor, bedside patient monitoring systems, central monitors, measurement of heart rate, measurement of temperature, measurement of respiration rate, catheterization laboratory instrumentation, ambulatory monitoring instruments.

**UNIT-IV**

**Cardiac Pacemakers and Defibrillators:** Need for cardiac pacemaker and defibrillator, external pacemakers, implantable pacemakers, pacing system analyzer, DC defibrillator, implantable defibrillators, types of defibrillators, defibrillator analyzer.

**Patient Safety:** Electric shock hazards, leakage currents, safety codes for electromedical equipment, electrical safety analyzer.

**Text/Reference Books:**

1. R S Khandpur: Handbook of biomedical instrumentation, 3rd ed., McGraw Hill Education.
2. Joseph D. Bronzino: The biomedical engineering handbook, 2nd ed., CRC Press.

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| OEC-BT-420A | Matlab&Simulation (B.Tech Biotechnology Semester VIII) | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **-** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Course Outcomes (CO) At the end of the course students will be able to** | | | | | | | |
| **CO1** | **Write basic commands and script files in MATLAB** | | | | | | |
| **CO2** | **Solve mathematical equations** | | | | | | |
| **CO3** | **Create 2D and 3D analysis plots** | | | | | | |
| **CO4** | **Design Simulink models** | | | | | | |

## UNIT I

**Introduction to MATLAB:** Introduction to MATLAB software, Key features, MATLAB window, Command window, Workspace, Command history, Setting directory, Working with the MATLAB user interface, Basic commands, Assigning variables, Operations with variables. Working with script tools, Writing Script file, Executing script files, The MATLAB Editor, Saving m files. Introduction to Graphical User Interface (GUI).

## UNIT II

**Matrix and Data files:** Character and string, Arrays and vectors, Column vectors, Row vectors, Basic Mathematics, BODMAS Rules, Arithmetic operations, Operators and special characters, Mathematical and logical operators, Solving arithmetic equations, Operations on matrix, Crating rows and columns Matrix, Matrix operations, Finding transpose, determinant and inverse, Solving matrix, Trigonometric functions, Complex functions. Writing user defined functions.

## UNIT III

**2D and 3D Plots:** Plots: Plotting vector and matrix data, Plot labelling, curve labelling and editing, 2D Plots: Basic Plotting Functions, Creating a Plot, Plotting Multiple Data Sets in One Graph, Specifying Line Styles and Colors, Graphing Imaginary and Complex Data, Figure Windows, Displaying Multiple Plots in One Figure, Controlling the Axes, 3D Plots: Creating Mesh and Surface, About Mesh and Surface Visualizing, Subplots.

## UNIT IV

**MATLAB Programming and Simulink:** Automating commands with scripts, Writing programs with logic and flow control, Writing functions, Control statement Programming, Conditional Statement Programming, Control Flow Conditional Control — if, else, switch, Loop Control — for, while, continue, break, Program Termination — return. Introduction to Simulink, Simulink Environment & Interface, Study of Library, Circuit Oriented Design, Equation Oriented Design, Model, Subsystem Design, Connect Call back to subsystem, Application.

**Text and Reference Books/Material:**


1. Marvin Marcus, Matrices and MATLAB: A Tutorial, Prentice Hall , 2010
2. MATLAB Primer by MATHWORKS: http://www.mathworks.com/help/releases/R2014b/pdf_doc/matlab/getstart.pdf


**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| OEC-BT-422A | History of Science (B.Tech Biotechnology semester VIII) | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **-** | **3.0** | **75** | **25** | **100** | **3 Hr** |
| **Purpose** | **The purpose of this course is to aware the students about development of science in India** | | | | | | |
| **Course outcome : After completion of this course the students will be able** | | | | | | | |
| **CO 1** | **To articulate the scope and importance of science and technology in development of society.** | | | | | | |
| **CO2** | **To appreciate the development of science and technology in Ancient India.** | | | | | | |
| **CO3** | **To explain the development of science and technology in Medieval India.** | | | | | | |
| **CO4** | **To appreciate the Policy development in the field of science and Technology.** | | | | | | |

## UNIT-I

**Concepts and Perspectives**: Meaning of History Objectivity, Determinism, Relativism, Causation, Generalization in History; Extent of subjectivity, contrast with physical sciences, interpretation and speculation, concept of historical inevitability, Historical Positivism.

Science and Technology-Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India.

## UNIT-II

**Science and Technology in Ancient India:** Technology in pre-historic period, beginning of agriculture and its impact on technology, Science and Technology during Vedic and Later Vedic times.

## UNIT-III

**Science and Technology in medieval India**: Legacy of technology in Medieval India, Interactions with Arabs, Astronomy and Mathematics: interaction with Arabic Sciences, Science and Technology on the eve of British conquest

## UNIT-IV

**Science and Technology in a post-independent India**: Science, Technology and Development discourse Shaping of the Science and Technology, Policy Developments in the field of Science and Technology, Social implications of new technologies like the Information Technology and Biotechnology

**Reference/Text Books**

1. M. Bhardwaj "History of science and Technology in Ancient India" Publisher Bookwin, 2010
2. Bal Ram Singh, Nath Girish and Umesh Kumar Singh " Science and Technology in ancient Indian Text, D.K.Print world, 2012
3. Kamlesh Mohan "Science and Technology in Colonial India, Aakar Publisher, 2014

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| OEC-BT-424A | Internet of Things (B.Tech. Biotechnology Semester VIII) | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **-** | **3.0** | **75** | **25** | **100** | **3 Hrs** |
| **Purpose** | **To familiarize students about basics of Internet of Things** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | **Understand what IoT technologies are used for today, and what is required in certain scenarios.** | | | | | | |
| **CO2** | **Understand the types of technologies that are available and in use today and can be utilized to implement IoT solutions.** | | | | | | |
| **CO3** | **Understand the type of protocols and challenges for designing IoT systems.** | | | | | | |
| **CO4** | **Apply these technologies to tackle scenarios in teams of using an experimental platform for implementing prototypes and testing them as running applications. Understand operating system requirements of IOT.** | | | | | | |

**UNIT 1**

**Introduction to IoT:** Defining IoT, Characteristics of IoT, Functional blocks of IoT, Physical and logical design of IoT, Smart cities and IoT revolution, ,Difference between IoT and M2M, M2M and peer networking concepts Ipv4 and IPV6, Software Defined Networks SDN,

**UNIT 2**

**Developing IoTs**: IoT design methodology, case study on IoT system for weather monitoring. IoT system Management,

Developing IoT applications through embedded system platform: Introduction to sensors, IoT physical devices and endpoints, Raspberry pi, Raspberry pi interfaces, Arduino, arduino interfaces.

**UNIT 3**

**Protocols for IoT**- messaging protocols, transport protocols, Ipv4, Ipv6, URI, Cloud for IoT: IoT with cloud, challenges, introduction to fog computing, cloud computing,

Challenges in IoT: Design challenges, development challenges, security and legal considerations.

**UNIT 4**

**Logic design using Python**: Introduction to python, data types, data structures, control flow, functions, modules, file handling and classes., implementing IotT concepts with python, Applications of IoT, Connected cars IoT Transportation, Smart Grid and Healthcare sectors using IoT,

**References/Text Books:**


1) A Bahaga, V. Madisetti, "Internet of Things- Hands on approach", University press, 2014.
2) S.K.Vasudevan, A.S.Nagarajan, "Internet of Things", Wiley, 2019.
3) CunoPfister, "Getting started with Internet of Things", Maker Media, 1st edition, 2011. Samuel Greenguard, "Internet of things", MIT Press, 2015.


**Web resources:**

1) http://www.datamation.com/open-source/35-open-source-tools-for-the-internet-of-things-1.html
2) https://developer.mbed.org/handbook/AnalogIn
3) http://www.libelium.com/50_sensor_applications
4) M2MLabs Mainspring http://www.m2mlabs.com/framework Node-RED http://nodered.org/

## BACHELOR OF TECHNOLOGY (MECHANICAL ENGINEERING) CREDIT BASED
## KURUKSHETRA UNIVERSITY KURUKSHETRA
## SCHEME OF STUDIES/EXAMINATION
## SEMESTER V (w.e.f. session 2021-2022 )

| S. No. | Course No. | Course Name | L:T:P | Hours/ Week | Credits | Examination Schedule (Marks) | | | | Duration of Exam (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Major Test | Minor Test | Practical | Total | |
| 1 | HTM-901A | Universal Human Values II : Understanding Harmony | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | MEC-301A | Heat Transfer | 3:1:0 | 4 | 4 | 75 | 25 | 0 | 100 | 3 |
| 3 | MEC-303A | Production Technology | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 4 | MEC-305A | Mechanical Vibrations and Tribology | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 5 | MEC-307LA | Heat Transfer lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 6 | MEC-309LA | Production Technology Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 7 | MEC-311LA | Mechanical Vibrations and Tribology Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 8 | MEC-313LA | Project-I | 0:0:2 | 2 | 1 | - | 0 | 100 | 100 | 3 |
| 9 | *MEC-315A | Industrial Training-II | 2:0:0 | 2 | - | - | 100 | - | 100 | - |
| 10 | **MC-903A | Essence of Indian Traditional Knowledge | 3:0:0 | 3 | - | 100 | - | - | 100 | 3 |
| | | | **Total** | **26** | **17** | **300** | **220** | **280** | **800** | |

*MEC-315A is a mandatory non-credit course in which the students will be evaluated for the industrial training undergone after 4th semester and students will be required to get passing marks to qualify.

**MC-903A is a mandatory credit-less course in which the students will be required to get passing marks in the major test.

| HTM-901A | Universal Human Values II: Understanding Harmony | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3.0** | **75** | **25** | **100** | **3 Hours** |
| **Purpose** | Purpose and motivation for the course, recapitulation from Universal Human Values-I | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO 1** | Development of a holistic perspective based on self-exploration about themselves (human being),family, society and nature/existence. | | | | | | |
| **CO 2** | Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence. | | | | | | |
| **CO 3** | Strengthening of self-reflection. | | | | | | |
| **CO 4** | Development of commitment and courage to act. | | | | | | |

**Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for ValueEducation**

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' andExperiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment ofaspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at variouslevels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrarinessin choice based on liking-disliking

**Module 2: Understanding Harmony in the Human Being - Harmony in Myself!**

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

**Module 3: Understanding Harmony in the Family and Society- Harmony in**

**Human-HumanRelationship**

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the othersalient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- fromfamily to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

**Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" canbe used), pollution, depletion of resources and role of technology etc.

**Module 5: Implications of the above Holistic Understanding of Harmony on ProfessionalEthics**

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and

organizations

28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.

**READINGS:**

**Text Book**

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

**Reference Books**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J CKumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

**MODE OF CONDUCT**

Lecture hours are to be used for lecture/practice sessions.

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Practice hours are to be used for practice sessions.

While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elementsto help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions, the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration. Scenariosmay be used to initiate discussion. The student is encouraged to take up" ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Practice experiments are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based onbasic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.
This course is to be taught by faculty from every teaching department, including HSS faculty. Teacher preparation with a minimum exposure to at least one 8-day FDP on Universal Human Values is deemed essential.

## ASSESSMENT:

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.
Example:
Assessment by
faculty mentor: 5 marks
Self-assessment: 5 marks
Assessment by peers: 5 marks
Socially relevant project/Group Activities/Assignments: 10 marks
Semester End Examination: 75 marks
The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

# Seventh Semester

| B. Tech. (7th Semester) Mechanical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|
| MEO-401A | SMART MATERIALS | | | | | | |
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time (Hrs.) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Purpose | The purpose of this course is to develop the understanding of various aspects of smart materials, smart structures and their applications. | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Students will be able to recognize the key concepts behind classification and fabrication of smart materials and various functions of intelligent materials. | | | | | | |
| CO2 | Students will be able to categorize the various types of smart structure systems, actuators and sensors. | | | | | | |
| CO3 | Students will be able to describe the various types of SMA based hybrid composites and smart battery materials. | | | | | | |
| CO4 | Students will be able to perceive the structure and properties of various types of nanotubes. | | | | | | |

**UNIT-I**

**Smart materials: key concepts:** Introduction to smart materials, definition of smart materials, define smart materials, basic principles behind smart properties, classification of smart materials according to their production technologies and applications in various industries, approaches to fabrication of smart materials, properties of smart materials, nanoscale and microscale structure property relationship, Intelligent materials, primitive functions of intelligent materials, intelligence inherent in materials, intelligent materials in harmony with humanity,intelligent biological materials, biomimetics.

**UNIT-II**

**Smart materials and structural systems:** Introduction, actuator materials, sensing technologies, sensing technologies, microsensors, intelligent systems, hybrid smart materials, passive sensory smart structures, reactive actuator based smart structures, active sensing and reactive smart structures, smart skins.

**UNIT–III**

**Shape memory alloys:** Phase transition, shape-memory effect, shape memory alloy fiber/metal matrix composites, shape memory alloy fiber/polymer matrix composites, SMA particulate / aluminum matrix composites.

**Smart battery materials:** Introduction, electrochemical concepts involved in a battery, types of batteries, lithium ion batteries, layered oxide cathodes, spinel oxide cathodes, olivine oxide cathodes, carbon anodes.

**UNIT–IV**

**Nanoscale intelligent materials and structures:** Introduction, nanotube geometric structures, structures of carbon nanotubes, structures of non-carbon nanotubes, designations of nanotubes and nanostructured materials, mechanical and physical properties of nanotubes; elastic properties, electrical conductivity, magnetoresistance, piezo-resistance, electrokinetics of nanotube, piezoelectric properties, electrochemical effects, nanotube power generation, nanotube contact phenomena.

**Text books:**

1. Smart Materials and Structures - M.V. Gandhi and B.S. Thompson, Chapman and Hall pub.
2. Encyclopedia of Smart Materials - Mel Shwartz Vol.1 and 2, John Wiley & Sons, Inc.
3. Nano engineering of Structural, Functional, and Smart Materials - Mark J. Schulz, Ajit D. Kelkar, and Mannur J. Sundaresan , Taylor and Francis Pub.

**Reference books:**

1. Micro and smart systems - Ananthasuresh, Wiley India Ltd.
2. Coursera course Smart Materials: Microscale and Macroscale Approaches - Peter the great St. Petersburg Polytechnic University.

**Note: The paper setter will set the paper as per the question paper template provided.**

| B. Tech. (7th Semester) Mechanical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MEO-405A** | **NON-DESTRUCTIVE TESTING** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time (Hrs.)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | The purpose of this course is to make the students understand about different inspection and testing methods of components safely and without damage. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Students will be able to learn the fundamental concepts of NDT. | | | | | | |
| **CO2** | Students will be able to describe the different methods of NDE. | | | | | | |
| **CO3** | Students will be able to describe the concept of thermography and eddy current testing. | | | | | | |
| **CO4** | Students will be able to explain the ultrasonic testing and acoustic emissions. | | | | | | |

**UNIT-I**

**Introduction to NDT:** NDT vs destructive testing, overview of the don-destructive, Testing methods for the detection of manufacturing defects as well as material characterization, relative merits and limitations, various physical characteristics of materials and their applications in NDT, visual inspection – unaided and aided

**UNIT-II**

**Surface NDE methods:** Liquid penetrant testing – principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, testing procedure, interpretation of results, magnetic particle testing-theory of magnetism, inspection materials magnetization methods, interpretation and evaluation of test indications, principles and methods of demagnetization, residual magnetism.

**UNIT–III**

**Thermography and eddy current testing (ET):** Thermography- principles, contact and non-contact inspection methods, techniques for applying liquid crystals, advantages and limitations – infrared radiation and infrared detectors, instrumentations and methods, applications, eddy current testing-generation of eddy currents, properties of eddy currents, eddy current sensing elements, probes, instrumentation, types of arrangement, applications, advantages, limitations, interpretation/evaluation

**UNIT–IV**

**Ultrasonic testing (UT) and acoustic emission (AE):** Ultrasonic testing-principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A/Scan, B-scan, C-scan, phased array ultrasound, time of flight diffraction, acoustic emission technique–principle, AE parameters, applications.

**Text books:**

1. Non-Destructive Testing - Baldev Raj, T.Jayakumar, M.Thavasimuthu Narosa Publishing House.

2. Non-Destructive Testing Techniques - Ravi Prakash, 1st revised edition, New Age International Publishers.

**Reference books:**


1. ASM Metals Handbook,Non-Destructive Evaluation and Quality Control, American Society of Metals, Metals Park, Ohio.
2. ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NDT Handbook,Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing, Vol. 5, Electromagnetic Testing, Vol. 6, Acoustic Emission Testing, Vol. 7, Ultrasonic Testing.
3. Handbook of Nondestructive evaluation by Charles, J. Hellier, McGraw Hill, New York 2001.
4. Introduction to Non-destructive testing: a training guide by Paul E Mix, Wiley, 2nd Edition New Jersey, 2005.


**Note: The paper setter will set the paper as per the question paper template provided.**

| B. Tech. (7th Semester) Mechanical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MEO-407A** | **MANUFACTURING COST ESTIMATION** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time (Hrs.)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | The purpose of this course is to impart the students with the knowledge of cost estimating function and controls, organizing and staffing for cost estimation and cost estimation of machining, joining and finishing processes. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Students will be able to describe cost reduction techniques, cost estimating functions, and establish staff and organization for cost estimation. | | | | | | |
| **CO2** | Students will be able to discuss cost estimating controls and various estimating procedures. | | | | | | |
| **CO3** | Students will be able to estimate the costs for different machining and casting processes. | | | | | | |
| **CO4** | Students will be able to estimate the costs for different joining and surface finishing processes. | | | | | | |

## UNIT-I

**The estimating function and costing studies**: Explanation of terms, importance of the life of the product, target cost, product costs, purpose of estimating, types of estimates, a systematic approach to cost reduction, cost reduction examples, team efforts.

**Organizing and staffing for estimating:** Coordinated product cost estimating, cost estimating department, type of organization and cost estimating, qualifications of a cost estimator, development of a cost estimator.

## UNIT-II

**Cost estimating controls:** Administrative controls, initiating cost requests, estimating methods, controlling the cost estimate, controlling estimate deviations, estimating in a changing cost environment, do's and don'ts of cost estimating.

**Estimating procedures:** Cost estimating analysis, part analysis, preliminary manufacturing plan, facilities, direct material cost, tooling costs, manufacturing time, direct labour costs, factory burden,total manufacturing cost.

## UNIT–III

**Cost estimation for machining:** Traditional machining operations defined, gathering information, economical machining, cost modeling and calculations, grinding application, milling application, non-traditional machining applications.

**Estimating casting costs:** Casting materials, casting processes, determining material costs, foundry tooling defined, molding costs, core costs, machining and cleaning costs, heat treatment, inspection and shipping costs, foundry burden.

## UNIT–IV

**Estimation of cost:** Joining Costs: Welding, Braze Welding, Brazing, Soldering, Electron Beam Welding, Laser Beam Welding, Plasma Arc Welding, Adhesive Bonding, Fastening, Ultrasonic Welding.
**Estimating surface finishing costs:**Deburring, ultrasonic cleaning, polishing, honing, hybrid finishing processes, painting, electroplating, cost modelling and calculations.

**Text books:**

1. Realistic cost estimating for manufacturing. Third Edition - Lembersky, Michael Society of Manufacturing Engineers, 2016.
2. Process Planning and Cost Estimation, Second Edition - R. Kesavan, C. Elanchezhian, B. Vijaya Ramanath, New age international publishers.

**Reference books:**

1. Process Planning And The Cost Estimation - M. Adithan, New age international publishers.
2. Estimating and Costing for the Metal Manufacturing Industries - Robert Creese (Author), M. Adithan (Author), CRC Press

**Note: The paper setter will set the paper as per the question paper template provided.**

| B. Tech. (7th Semester) Mechanical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MEO-409A** | **ERGONOMICS** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time (Hrs.)** |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| **Purpose** | The purpose of this course is to make the students aware of the human factor engineering principles and its application to different disciplines. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Students will be able to explain the ergonomics fundamentals and anthropometry. | | | | | | |
| **CO 2** | Students will be able to analyse the human posture, relative movements and human behavior and perception. | | | | | | |
| **CO 3** | Students will be able to apply the ergonomics principles in visuals display and product designing. | | | | | | |
| **CO 4** | Students will be able to describe the workstation design and occupational safety. | | | | | | |

**UNIT-I**

**Discipline approach: ergonomics/ human factors:** Introduction to ergonomics, Fitting task to man their contractual structure, domain, philosophy and objective, mutual task comfort: two way dialogue, communication model, ergonomics/ human factors fundamentals, physiology (work physiology) and stress.

**Human physical dimension concern:** Human body- structure and function, anthropometrics, Anthropometry: body growth and somatotypes, static and dynamic anthropometry, stand posture-erect, Anthropometry landmark: sitting postures, Anthropometry: squatting and cross-legged postures, anthropometric measuring techniques, statistical treatment of data and percentile calculations.

**UNIT-II**

**Posture and movement:** Human body- structure and function, posture and job relation, posture and body supportive devices, chair characteristics, vertical work surface, horizontal work surface, movement, work counter

**Behaviour and perception:** Communication and cognitive issues, psycho-social behaviour aspects, behaviour and stereotype, information processing and perception, cognitive aspects and mental workload, human error and risk perception

**UNIT-III**

**Visual Issues:** Visual performance, visual displays, environments factors, environmental factors influencing human performance

**Ergonomic design process:** Ergonomics design methodology, Ergonomics criteria/check while designing, Design process involving ergonomics check, some checklists for task easiness.

**UNIT-IV**

**Performance support and design intervention:** Occupational safety and stress at workplace in view to reduce the potential fatigue, errors, discomforts and unsafe acts workstation design, furniture support, vertical arm reach and design application possibility

**Humanising design:** Design and human compatibility, comfort and adaptability aspects, Design Ergonomics in India: scope for exploration.

**Text Books:**

1. Introduction to Ergonomics - R. Bridger-CRC Press, Taylor & Francis Group.
2. Human Factors in Engineering and Design-M. Sanders, E. McCormick, McGraw-Hill International Editions: Psychology Series.
3. An Introduction to Human Factors Engineering-C. Wicknes, S. Gordon, Y. Liu and S. Gordon-Becker, New York.
4. Indian Anthropometric Dimensions for Ergonomic Design Practice-D. Chakrabarti, National Institute of Design, Ahmedabad.

**Reference Books:**

1. Handbook of Human Factors and Ergonomics-G. Salvendy, John Wiley & Sons, Inc.
2. Ergonomics for Beginners, A Quick Reference Guide, J. Dul and B. Weerdmeester, CRC Press, Taylor & Francis Group.

**Note: The paper setter will set the paper as per the question paper templates provided.**

| B. Tech. (7th Semester) Mechanical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MEO-411A** | **AIR AND NOISE POLLUTION** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time (Hrs.)** |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| **Purpose** | The objective of this course is to analyze the emissions from automobiles, industries and to describe various techniques of reducing these emissions. Also to understand the concept to control noise pollution. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Students will be able to analyze the emissions from industries and various vehicles. | | | | | | |
| **CO2** | Students will be able to understand standards, alternative control strategies and AAQ guidelines. | | | | | | |
| **CO3** | Students will be able to describe various processes for desulfurization, flue control methods for various exhaust gases. | | | | | | |
| **CO4** | Students will be able to explain the characterization of noise, physical sound and various noise barriers. | | | | | | |

**UNIT-I**

**Introduction**: Concept of unpolluted air, gaseous and vapour pollutants in atmosphere, scales of air pollution, primary and secondary pollutants, ambient air quality, monitoring of pollutants ($SO_2$, $NO_2$, $O_3$, PAN, particulates, hydrocarbons, PAH's) and their health effects,stack monitoring for $SO_x$, $NO_x$, CO, $CO_2$, Hydrocarbons, Fluorides, Ammonia, VOCs, effects of air pollution on vegetation, materials and structures,stack monitoring for thermal power plant, oil refinery industry, fertilizer industry, non-ferrous metal industry. recent techniques of online stack monitoring, emission inventory,trends of AAQ in urban, rural and Industrial areas.

**UNIT-II**

**Air quality:** National and International air emission standards and AAQ guidelines, indoor air quality, averaging time, air pollution system, alternative control strategies, GLC estimates for multiple sources using standard software (e.g., EPA's ISC model), determination of effective stack height.

**UNIT–III**

**Emission Standards and Particulate matter**: Distribution and sources of particulate matter, Hood duct design, particulate collection mechanisms, control systems and their design,flue-gas desulfurization processes, flue gas control methods for $NO_x$,emission standards for automobiles, origin of exhaust 3 emissions from gasoline, diesel, CNG and LPG engines,crankcase and evaporative emissions, emission reduction by fuel changes, emission reduction by engine design changes, catalytic converters, diesel engine emissions.

**UNIT–IV**

**Noise**: Characteristics, sources, types of noise, impact of noise.

**Physics of sound-** Speed of sound, sound pressure, frequency, wavelength, RMS sound pressure, sound pressure level, loudness, sound power level and sound energy density, sound propagation, wind and temperature gradient.

**Enclosures and Barriers**: Lead as a noise barrier, plenum barriers, barrier around pipe, wires and rectangular ductwork, high transmission loss ceilings, acoustical foams, nylon in noise reduction, damping compounds.

**Noise measuring equipments**: Sound level meter, octave band analyzer, statistical analyzer and noise average meter.

**Text books:**

1. Rao M.N. and Rao H.V.N., "Air Pollution", Tata McGraw Hill Publishing Company Ltd., New Delhi.
2. Wang L.K., Pereira N.C., Hung Y.T., "Advanced Air and noise pollution control", Volume I andII, Humana Press, New Jersey.

**Reference books:**

1. Ghassemi A., "Pollution Control and Waste Minimization", Marcel Dekker, Inc., New York.
2. Rao C.S., "Environmental Pollution Control Engineering", New Age International (P) Ltd., New Delhi.
3. Singal S.P., "Noise Pollution and Control Strategy", Alpha Science International, New Delhi.
4. Ray T.K., "Air Pollution Control in Industries", Volume I, Tbi, New Delhi.
5. Stern A.C., Bauble R.W., Fox D.L., Turner B., "Fundamentals of Air Pollution, Hardcover", Elsevier Science and Technology Books.
6. Narayanan P., "Environmental Pollution Principles, Analysis and Control", CBS Publishers

**Note: The paper setter will set the paper as per the question paper template provided.**

| MEC-401A | AUTOMATION IN MANUFACTURING | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time (Hrs.) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Purpose | The purpose of this course is to impart knowledge of production automation, robotics, flexible manufacturing, CNC programming, material handling and automated storage systems. | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Students will be able to explain the role automation in manufacturing and robotics in industry. | | | | | | |
| CO2 | Students will be able to describe the group technology and flexible manufacturing techniques in the automated production line and manufacturing system. | | | | | | |
| CO3 | Students will be able to explain computer aided process planning and shop floor manufacturing activities. | | | | | | |
| CO4 | Students will be able to develop CNC programs and understand the concept automated guided vehicle and automated storage system in material handling. | | | | | | |

**UNIT-I**

**Introduction**: Production system, automation in production system, manual labour in production system, automation principle and strategies, manufacturing industries and products, manufacturing operations, product facilities, product/ production relationship, basic elements of an automation system, advance automation function, level of automation.

**Industrial robotics:** Robot anatomy and related attributes, joint and links, common robot configuration, joint drive system, sensors in robotics, robot control system, end effectors, grippers and tools, applications of industrial robots, material handling, processing operation, assembly and inspection, robot programming.

**UNIT-II**

**Group technology and cellular manufacturing:** Part families, parts classifications and coding, production flow analysis, cellular Manufacturing- composite part concept, machine cell design, applications of group technology, grouping parts and machines by rank order clustering technique, arranging machines in a G.T. cell.

**Flexible manufacturing:** Introduction, FMS components, flexibility in manufacturing – machine, product, routing, operation, types of FMS, FMS layouts, FMS planning and control issues, deadlock in FMS, FMS benefits and applications.

**UNIT- III**

**Process planning:** Introduction, manual process planning, computer aided process planning – variant, generative, decision logic decision tables, decision trees, Introduction to artificial intelligence.

**Shop floor control:** Introduction, shop floor control features, major displays, major reports, phases of SFC, order release, order scheduling, order progress, manufacturing control, methodology, applications,shop floor data collections, Types of data collection system, data input techniques, automatic data, collection system.

**UNIT- IV**

**CNC basics and part programming:** Introduction, historical, background, basic components of an NC, steps in NC, verifications of numerical control machine tool programs, classification of NC Machine tool, basics of motion control and feedback for NC M/C, NC part programming, part programming methods, modern machining system, automatically programmed tools, DNC, adaptive control.

**Automated guided vehicle and storage system:** Functions of AGV, types of AGV, safety consideration for AGV, design of AGV; Introduction to storage system, storage system performance, storage location strategies, conventional storage method and equipment, automated storage system, fixed aisle automated storage/ retrieval system, carousel storage systems, analysis of storage system, fixed aisle automated storage/ retrieval systems, carousel storage systems.

**Text Books:**

1. CAD/CAM/CIM-P. Radhakrishnan, S. Subramanayan and V.Raju, New Age International (P) Ltd., New Delhi.
2. Computer Integrated Manufacturing- Alavudeen and Venkateshwaran, Prentice- Hall of India Pvt. Ltd., New Delhi.

**Reference Books:**

1. Automation, Production System and Computer Integrated Manufacturing- Mikell P. Groover, Pearson fourth edition.
2. CAD/CAM: Computer Aided Design and Manufacturing-Groover-M.P. and Zimmers E. W.,Prentice Hall International, New Delhi, 1992.

**Note: The paper setter will set the paper as per the question paper template provided.**

| B. Tech. (7th Semester) Mechanical Engineering | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **MEC-403L A** | **MECHANICAL ENGINEERING LAB-III** | | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credits** | **Major Test** | **Minor Test** | **Practical** | **Total Time** | **Time (Hrs.)** |
| **0** | **0** | **2** | **1** | **0** | **40** | **60** | **100** | **3** |
| **Purpose:** | To provide practical knowledge in the concerned subject that a student opt from the program electives offered in the curriculum. | | | | | | | |

**COMPUTER AIDED DESIGN PRACTICALS**

**Course Outcomes**

**CO1** Students will be able to draw and design 2D models.

**CO 2** Students will be able to draw and design 3D modelling.

**CO 3** Students will be able to assemble the parts.

**List of experiments:**

1To study the 2 dimensional drawing, orthographic views, front view, top view and side view.
2Introduction to Solid Works and working with sketch mode.
3To study the wireframe, surface and solid modelling.
4Working with the tools like Pattern, Copy, Rotate, Move and Mirror etc.
5Working with creating 3D features (Extrude & Revolve).
6Working with the tools like Hole, Round, and Chamfer etc.
7 Createthe part drawing of product 1 using any 3D software.
8Draw the part drawing of product 2 using any 3D software.
9Draw the part drawing of product 3 using any 3D software.
10Make assembly by using any 3D software.

**Note:** Product 1, 2 and 3 must be based on MEP-401.

**FINITE ELEMENT ANALYSIS LAB:**

**Course Outcomes**

**CO1** Students will be able to apply the basic theory of elasticity to continuum problems

**CO2** Students will be able to formulate Finite Element problems like bar, truss and beam elements for linear static structural analysis

**CO3** Students will be able to formulate 2D and axisymmetric finite elements

**CO4** Students will be able to formulate and solve finite element equations for 1D heat transfer elements

**List of Experiments:**

1.To solve problems related to solid mechanics, heat transfer and free vibration by using NASTRAN/SIMULIA/ANSYS/ABAQUS.
2.Introduction of GUI of the software in the above mentioned areas realistic problems.
3.To analyze beams and frames (bending and torsion problems).
4.To analyze plane stress and plane strain problems.
5.Problems leading to analysis of axisymmetric solids.
6.Problems leading to analysis of three dimensional solids: (a) Heat Transfer problems (b) Modal analysis problem:

**By writing own code for finite element analysis using MATLAB for:**

7.Plane stress and Plane strain problems.
8.Modal analysis problems.

**Reference Books:**

1. Finite Element Method using MATLAB-Young W Kwon and Hyochoong Bang, CRC Press Washington, USA.
2. Finite Element Method: A Practical Course-G. R. LIU and S. S. Quek, Elsevier Science, Butterworth – Heinemann publication.

**POWER PLANT ENGINEERING LAB:**

**Course Outcomes**

**CO1** Students will be able to explain the constructional features and working of different boilers, accessories, mountings, heat balance sheet preparation and to analyze the quality of steam.

**CO2** Students will be able to describe the functions of different cooling towers and condensers and calculate their efficiencies.

**CO3** Student will be able to calculate the calorific value of fuels using a bomb calorimeter.

**CO4** Student will be able to explain the functioning and use of solar photovoltaic systems and calculatethe efficiency of a solar cell.

**List of Experiments:**

1. To study high pressure boilers.
2. To study low pressure boilers.
2. To study about the mountings & accessories of high and low-pressure boilers.
3. To prepare the heat balance sheet for the given boiler.
5. To find the calorific value of a given sample of solid/liquid fuel(s) using a bomb calorimeter.
6. To find power output and efficiency of impulse and reaction steam turbine.
7. To study cooling tower and calculate its efficiency.
8. To study various types of condenser and calculate efficiency.
9. To find the dryness fraction of steam using separating and throttling calorimeters.
10. To study solar photovoltaic systems and calculation of efficiency of a solar cell.

**MECHATRONIC SYSTEMS PRACTICALS**

**Course Outcomes**

**CO1** Students will be able to control the speed of DC motor and servo motor using 8051 microcontrollers.

**CO2** Students will be able to control the motion of single and double acting cylinder using Pneumatic and Hydraulic training kit.

**CO3** Students will be able to control traffic light signals using PLC and 8051 microcontrollers.

**CO4** Students will be able to perform operations of addition, subtraction, multiplication and division using 8086 Microprocessor.

**List of Experiments**

1 To run a stepper motor at different speeds and directions using 8051 assembly language.

2 To control traffic light by interfacing with PLC kit.

3 To perform speed control of DC motor with 8051 microcontroller.

4 To perform experiment on hydraulic trainer kit.

5 To perform experiment on pneumatic trainer kit.

6 To study various types of sensors and transducers.

7 To control a traffic light system using 8051 Microcontroller

8 To perform the 8-bit addition and subtraction using 8086 Microprocessor.

9 To perform the 8-bit multiplication and division using 8086 Microprocessor.

**INDUSTRIAL ROBOTICS PRACTICALS**

**Course Outcomes**

**CO1**Students will be able to analyze the movement of various positions of robotics arm.
**CO 2**Students will be able to design the robotics systems.
**CO 3**Students will be able to analyze the pneumatic and hydraulic systems.
**CO 4**Students will be able to demonstrate sensors, grippers etc.

**List of Experiments**

1. Recoding Robot positions (Absolute positions, Delete Positions, Save and load positions and Move theRobot to recorded positions).
2. Demonstration of Cartesian/ cylindrical/ spherical robot.
3. Study of different types of grippers.
4. Study of sensor integration.
5. Study of robotic system design.
6. Setting robot for any one industrial application after industrial visit.
7. Study the major equipment/Software/Components in Robotics Lab, e.g. Robotic Arm components, Arena etc.
8. Study of pneumatic and hydraulic system in Robotics.

**SOLAR ENERGY ANALYSIS PRACTICALS**

**Course Outcomes**

**CO 1** Students will be able to analyze the solar based heating concepts and flow of working fluid in collector.

**CO 2** Students will be able to analyze the solar parabolic trough and evacuated tube collector.

**CO 3** Students will be able to know about the solar energy storage by different means and understand the sun-earth relationships for sun tracking.

**CO 4**Students will able to describe the functioning of solar PV collector power plant.

**List of Experiments:**

1. To evaluate the system efficiency and heat transfer of evacuated tube collector indifferent parts of system at different ambient conditions.
2. Evaluation of system thermal efficiency solar collector during charging storing and discharging the PCM.
3. To determine the thermal Performance of the Parabolic Trough collector with different inlet temperature of water and oil.
4. To evaluate the thermal performance of flat plate collector in thermosiphon and forced mode of flow at different radiation level.
5. To find the drying rate and drying time of different fruits and vegetables in flat plate based solar dryer.
6. To determine the efficiency of solar photo voltaic collector with and without sun tracking.

| B. Tech. (7th Semester) Mechanical Engineering | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **MEC-405LA** | **PROJECT-III** | | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total Time** | **Time (Hrs.)** |
| **0** | **0** | **10** | **5** | **0** | **100** | **100** | **200** | **3** |
| **Purpose:** | To implement the engineering principles and theories into innovative practical projects for solving real world problems. | | | | | | | |
| **Course Outcomes** | | | | | | | | |
| **CO1** | Students will be able to apply the theoretical knowledge into practical/software projects. | | | | | | | |
| **CO2** | Students will be able to design new products using latest technologies. | | | | | | | |

The project work could be done for the problem statement of an industry or practical project in the institute. The students may also opt for the analysis based software projects with proper validation. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.

**Note:** The maximum number of students in a group should not exceed four.

| B. Tech. (7th Semester) Mechanical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MEP-401A** | **COMPUTER AIDED DESIGN** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time (Hrs)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | To apply the computer's technology in designing. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | To understand the fundamentals of CAD and analyze the CAD hardware. | | | | | | |
| **CO2** | Students will be able to evaluate the CAD software and various transformation operations. | | | | | | |
| **CO3** | Students will be able to analyze the geometric modeling. | | | | | | |
| **CO4** | Students will be able to create surface modeling and understand the data exchange. | | | | | | |

**UNIT-I**

**Fundamentals of CAD**: Introduction, Traditional product cycle, CAD/CAM product cycle, rapid prototypic, design for everything, computer aided design, computer aided engineering, customer relationship management, product lifecycle management,

**CAD hardware:** Introduction, basic structure of computer, input, storage, processing, output, control, microcomputer, minicomputer, mainframes, supercomputer**,** input out device, LAN, MAN, WAN.

**UNIT-II**

**CAD Software:** Introduction, system software, application software, General CAD process, selection of CAD system, database management system, data structure, database types, function of database management system, advantages of DBMS, database coordinate system.

**Geometric transformations:** Introduction, 2D transformation, translation, rotation, scaling, homogeneous coordinate relationship, reflection transformation, shear transformation, inverse transformation for translation, rotation, scaling, reflection, shear, composite transformation, examples of composite transformation, geometric transformations in engineering design, solved examples.

**UNIT-III**

**Geometric modeling:** Need of geometric modeling, requirements of geometric modeling, wire frame modeling, surface modeling, solid modeling, difference between wireframe, surface and solid modeling, introduction to solid modeling, set theory, representation schemes for solid models, boundary representation, cellular decomposition, feature based modeling, Euler theory, mass property calculation.

**Mathematical representation of 2D entity:** Introduction, parametric representation, of analytic curves, lines, circle, conic selection, ellipse, parabola, hyperbola, parametric representation of synthetic curve, Hermite cubic spline curve, Bezier curves, B- spline curve, non-uniform rational, B splines, manipulation of curves.

**UNIT-IV**

**Mathematical representation of surface entity:** Introduction, surface entities, analytic surface, plane surface, tabulated surface, ruled surface, surface of revolution, sweep surface, synthetic surface, Hermite Bicubic surface, Bazier surface, bilinear surface, coons surface

**Data exchange formats:** Introduction, CAD/CAM data exchange, neutral file formats, data exchange format, initial graphics exchange specification, standard triangular language, standard for exchange of product data.

**Text Books:**

1. CAD/CAM – Principle Practice and Manufacturing Management - Chris McMahon and Jimmie Browne, Addison Wesley England, Second Edition, 2000.
2. CAD/CAM Theory and Practice, Mastering CAD/CAM - Ibrahim Zeid, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

**Reference Books:**

1. Mathematical Elements for Computer Graphics - NC-Rogers, D.F. and Adams, McGraw Hill, NY, 1989
2. CAD/CAM/CIM - P. Radhakrishnan, S. Subramanayan and V.Raju, New Age International (P) Ltd., New Delhi.
3. CAD/CAM: Computer Aided Design and Manufacturing - Groover M.P. and Zimmers E. W., Prentice Hall International, New Delhi, 1992.
4. CAD/CAM/CAE - Chougule N. K, Scitech publications (INDIA) PVT. LTD.

**Note: The paper setter will set the paper as per the question paper template provided.**

| B. Tech. (7th Semester) Mechanical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MEP-403A** | **FINITE ELEMENT ANALYSIS** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time (Hrs.)** |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| **Purpose** | The purpose of this course is to understand the formulation of FEA problems and to describe various methods of FEM. Also to understand the FEM with CI continuity and FDM. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Students will be able to understand the basic steps in FEM formulation. Also to study various concepts associated and assembly along with the boundary conditions in FEM formulation. | | | | | | |
| **CO2** | Students will be able to analyze how FEM problems are formulated in 1-D elements. Also to discuss shape functions, h and p approximations; and various solvers associated in FEM. | | | | | | |
| **CO3** | Students will be able to study FEM formulation of 2-D elements using various methods like Galerkin approach, Weighted Residual etc. Also to understand the natural coordinates, numerical integration and various other concepts related to 2-D FEM formulation. | | | | | | |
| **CO4** | Students will be able to describe the axi-symmetric problems along with plane stress and plane strain problems with regards to solid mechanics. Also to discuss various elements of FEM, FEM with CI continuity and FDM problems. | | | | | | |

**UNIT-1**

**Introduction**: Basic steps in FEM formulation, general applicability of the method,variational functional,Ritz Method.

**Variational FEM**: Derivation of elemental equations, assembly, imposition of boundary conditions, solution of the equations.

**UNIT-II**

**1-D Elements**: Basis functions and shape functions, convergence criteria, h and p approximations, natural coordinates, numerical integration, Gauss elimination based solvers, computer implementation: pre-processor, processor, post-processor.

**UNIT-III**

**Methods of FEA**: Alternate formulation: Weighted Residual Method, Galerkin Method;

**Problems with C1 Continuity**: beam bending, connectivity and assembly of C1 continuity elements.

**2-D Elements (Triangles and Quadrilaterals)and Shape Functions:** Natural Coordinates, Numerical Integration, Elemental Equations, .Connectivity and Assembly, Imposition of Boundary Conditions.

Axisymmetric (Heat Conduction) problem, plane strain and plane stress solid mechanics problems, sub-parametric, iso-parametric and super-parametric elements; elements with C1 continuity.

**UNIT-IV**

**Free vibration problems and FDM**: Formulation of eigenvalue problems, FEM formulation, time-dependent problems, combination of Galerkin FEM and FDM (Finite Difference Method), convergence and stability of FD Scheme.

**Text Books:**

1.Finite element analysis-C. S. Krishnamoorthy, Tata McGraw Hill
2.An introduction to Finite element method-J. N Reddy, Tata Mc. Graw Hill
3.Finite Element Method with applications in Engineering-Y. M. Desai, Pearson Education India.

**Reference Books:**

1.Nonlinear Finite Elements for Continua and Structures (Paperback)-Belytschko(shelved 1 time as *finite-elements*)
2.The Finite Element Method for Three-Dimensional Thermomechanical Applications (Hardcover)-Guido Dhondt(shelved 1 time as *finite-elements*)
3.Numerical Solution of Partial Differential Equations by the Finite Element Method (Paperback)-Claes Johnson(shelved 1 time as *finite-elements*)

**Note: The paper setter will set the paper as per the question paper template provided.**

| | B. Tech. (7th semester) Mechanical Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| MEP-405A | POWER PLANT ENGINEERING | | | | | | |
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time (Hrs.) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Purpose | To understand modern aspects of power generation, different power plants, their combinations, operation and components, energy demand and supply and power plant economics. | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Students will be able to analyze the economics of power generation and describe the variety of power plants. | | | | | | |
| CO2 | Students will be able to analyze steam power cycles and understand the coal handling process in detail. | | | | | | |
| CO3 | Students will be able to understand about the operation & advancements of Solar, Diesel and Gas turbine power plants. | | | | | | |
| CO4 | Students will be able to describe the role of nuclear energy in power generation and various combinations of power plants and their operation. | | | | | | |

## UNIT-I

**Economics of power generation:** Introduction to economics of power generation, different terms and definitions, hydrology, rainfall, runoff, hydrographs, flow duration curves, cost analysis, power plant locations, selection of power plant equipment, factors affecting economics of generation and distribution of power, performance and operating characteristics of power plants, economic load sharing, tariff for electrical energy.

**Different types of power plants:** Recent developments in power plants, geothermal power plants, tidal power plants, windmills, solar power plants, hydroelectric power plant: site selection, classification, estimation of power availability, selection of water turbines, advantages and disadvantages of hydro power plants.

## UNIT-II

**Analysis of steam cycle:** The ideal Rankine cycle, externally irreversible Rankine cycle, superheat, reheat, regeneration, internally irreversible Rankine cycle, open feed water heaters, closed type feed water heaters with drains cascaded backward and pumped forward, typical layout of steam power plant, efficiency and heat rate.

**Coal handling plant:** Coal Handling: unloading, feeding, crushing, feeding system, conveyor system, stacking system, magnetic separator/ metal detector, bin/chute vibratory system, coal weighment, coal sampling, fire-fighting system, dust suppression system, dust extraction system, mechanical stokers, pulverized fuels and burners, ash handling and disposal.

## UNIT-III

**Solar Power Plants:** Introduction; solar collectors: flat plate and concentrating; absorber coating; solar pond electric power plant; solar thermal electric conversion systems: low temperature, medium temperature and high temperature; solar electric power generation: solar photovoltaics, solar cell working and principle; combination of solar and hydropower plants; solar chimney power plant system.

**Diesel engine & gas turbine power plants: Introduction,** Types, layout of diesel engine power plant, different components of diesel power plant, performance characteristics, supercharging, layout and components of gas turbine power plants, gas turbine fuels, material selection for gas turbines.

**UNIT-IV**

**Nuclear power plants:** Basic theory and terminology, nuclear fission and fusion processes, fission chain reaction, moderation, fertile materials, nuclear fuels, general components of nuclear reactor, different types of reactors: PWR, BWR, GCR, LMFBR, CANDU-PHW, disposal of nuclear waste and related issues.

**Power plant combinations:** Combination of hydro power plants with steam plants, GT-ST Combined Cycle plant, combined cycles with heat recovery boiler, PFBC combined cycle, STIG (steam injected gas turbine) cycle, combined cycles with multi-pressure steam, combined cycle for nuclear power plants.

**Text Books:**

1. Power Plant Engineering-Morse, D. Van Nostrand.
2. Power Plant Engineering-PK Nag, McGraw Hill.
3. Power Plant Technology-El-Wakil, McGraw Hill.

**Reference Books:**

1. Power Plant Engineering-P.C. Sharma, SK Kataria & Sons.
2. Power Plant Engineering-Domkundwar, Dhanpat Rai & Co.
3. Power Plant Technology-G.D.Rai, Khanna Publishers.
4. Power Plant Engineering-R.K. Rajput, Laxmi Publications.

**Note: The paper setter will set the paper as per the question paper templates provided.**

| B. Tech (7th Semester) Mechanical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MEP-407A** | **MECHATRONIC SYSTEMS** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time (Hrs.)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | The purpose of this course is to provide students with an in-depth knowledge of mechatronics systems. The subject will give knowledge of electronics components to students and assist them to acquire inter disciplinary skills. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Students will be able to understand Mechatronics systems and their applications. The students will be able to understand different sensors and transducers as well as able to select the transducers as per applications. | | | | | | |
| **CO2** | Students will be able to describe different types of number systems andBoolean algebra and able toconvert number systems from one system to another. The students will be able to explain pin configuration and architecture of microprocessor. | | | | | | |
| **CO3** | Students will be able to understand the architecture of microcontroller and structure of PLC. The students will also be able to draw the ladder diagram. | | | | | | |
| **CO4** | Students will be able to understand various types of actuator. The students will also be able to explain the working of DC and servo motor. | | | | | | |

## UNIT-I

**Introduction:** Definition of mechatronics, multi-disciplinary scenario, evaluation of mechatronics, objectives, advantages & disadvantages of mechatronics, an overview of mechatronics, microprocessor based controllers, principle of working of automatic camera, automatic washing machine & engine management system.

**Review of sensors and transducers:** Definition and classification of transducers, definition & classification of sensors, performance terminology, working principle and application of displacement, position & proximity, velocity and motion, force, fluid pressure, liquid flow, liquid level, temperature, light sensors, selection of transducers.

## UNIT-II

**Digital principles:** Introduction, digital number system, range and weight of binary number system, octal and hexadecimal number systems, conversion, BCD number systems, gray code, Boolean algebra, logic states, logic functions, more logic gates, universal gates, exclusive-OR gate, minimization of Boolean expression usingKarnaugh map.

**Microprocessor:** 8086 CPU architecture: 8086 Block diagram, description of data registers, addressregisters; pointer and index registers, PSW, Queue, BIU and EU, 8086 Pin diagram descriptions, 8086 minimum mode and maximum mode CPU module.

## UNIT–III

**Micro controller:** Introduction of 8051 microcontroller &its block diagram, comparison of microprocessor and microcontroller

**PLC:** Programmable logic controllers, basic structure, input/output processing, ladder diagram timers, internal relays and counters, shift registers, master and jump controls, data handling, analogue input/output, selection of a PLC.

**UNIT–IV**

**Actuators:** Definition, classification of actuators, mechanical actuation systems, types of motion, kinematics chains, cams, gear trains, ratchet and pawl, belt and chain drives, bearings, brief survey of electromechanical actuators, drive requirements for cutting movements, requirements of feed drives, calculation of drive requirements on feed motor shaft.

**Motors:** DC motors & Control of DC motors, DC &AC servomotors, stepper motors-types, characteristics, advantages, limitations and applications, mechanical aspects of motor selection.

**Text books:**

1.A Textbook of Mechatronics-R. K Rajput, S. Chand & Company, Edition 2010
2.Mechatronics, W. Bolton – Pearson Education Asia - 2nd Edition, 2011.

**Reference books:**

1.Mechatronics, HMT Ltd., McGraw Hill Education, 2017
2.Mechatronics Principles, Concepts and Application-Nitaigour and Premchand, Mahilik – Tata McGraw Hill – 2003
3.Mechatronics: An Introduction-Robert H. Bishop, CRC Press, 2015
4.Mechatronics: Integrated Mechanical Electronic System- Ramachandran, Vijayaraghavan, Balasundaran- Wiley Publication, 2008

**Note: The paper setter will set the paper as per the question paper template provided.**

| B. Tech. 7th Semester Mechanical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|
| MEP-409A | INDUSTRIAL ROBOTICS | | | | | | |
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time (Hrs.) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Purpose | The purpose of this course is to make the students understand about the fundamental of robotics technology, its components and robotics cell design and control. | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Students will be able to understand the fundamentals of robotics and find its applications. | | | | | | |
| CO2 | Students will be able to explain the use of different sensors and end effectors in robotics. | | | | | | |
| CO3 | Students will be able to describe the application of robotics in manufacturing. | | | | | | |
| CO4 | Students will be able to design and analyze the work cell and robotic motion. | | | | | | |

## UNIT-I

**Introduction:** Automation and robotics, robotics in science fiction, a brief history of robotics, the robotics market and the future prospectus,

**Fundamental of robotics:**Robot anatomy, work volume, robot drives systems, control systems, precession of movement, end effectors, robot application.

## UNIT-II

**Sensors in robotics:** Type of sensors in robotics, exteroceptors or external sensors, force and torque sensors, proximity sensors (position sensors), range sensors, machine vision sensors, velocity sensors. tactile sensor, proximately and range sensors, use of sensor in robotics.

**Robot end effectors:**Types of end effectors, characteristics of end-of-arm tooling, elements of end-of-arm tooling.

## UNIT-III

**Material transfer and equipments:**General consideration in robot material handling, material transfer applications, machine loading and unloading,

**Grippers:**Tool selection of gripper, gripping mechanism, types of gripper, mechanical gripper, vacuum and magnetic grippers.

## UNIT-IV

**Robot cell design and control:** Robot cell layouts, multiple robots and machine interface, other considerations in work cell design, work cell control, interlocks, the work cell controller, robot motion analysis and control: introduction to manipulator kinematics, manipulator path control, robot dynamics, configuration of robot control.

**Text books:**

1. Robot Analysis and Control-Asada, H., and J. J. Slotine, Wiley.

2.CAD/CAM: Computer Aided Design and Manufacturing- Groover M.P. and Zimmers E. W., Prentice Hall International, New Delhi.

**Reference Books:**

1. Robotics and Control-R. K. Mittal, I. J. Nagrath, McGraw Hill.
2. Fundamental of Robotics Analysis and Control-Robert J Schilling, Pearson
3. Industrial Automation and Robotics-J K Arora, Laxmi Publications

**Note: The paper setter will set the paper as per the question paper templates provided.**

| B. Tech. (7th Semester) Mechanical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MEP-411A** | **SOLAR ENERGY ANALYSIS** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time (Hrs.)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | The purpose of this course is to make the students aware about the importance, availability, use and applications of solar energy. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Students will be able to describe the sun-earth relationships and various solar activities based on sun and earth rotation. | | | | | | |
| **CO 2** | Students will be able to analyze the concentrating collector in solar energy applications and solar energy storage by different means. | | | | | | |
| **CO 3** | Students will be able to apply the solar based heating-cooling concepts in building structures and explain the water heating flow systems. | | | | | | |
| **CO 4** | Students will be able to analyze solar power generation, refrigeration and air-conditioning systems. | | | | | | |

**Unit-I**

**Introduction:**Basic Heat transfer principles, availability of solar energy, nature of solar energy, solar energy and environment, sun as the source of radiation, solar radiation: measurement of solar radiation, irradiance, solar constant, insolation, radiosity, emissive power, earth's equator, meridian longitude, sun earth angles, sunrise, sun set and day length, solar time, equation of time, various methods of using solar energy, photo thermal, photovoltaic, photosynthesis, present & future scope of solar energy.

**Unit-II**

**Solar thermal energy:** Stationary collectors, FPC, CPC, ETC, sun tracking, concentrating collectors, PTC, PDR, HFC, Fresnel collectors, solar thermal power plants, solar chimney power plant, solar pond, solar water heater, solar cooker, types- solar disinfection, limitations of solar thermal energy.

**Heat Storage:** Sensible and latent heat storage, chemical energy system, performance calculations.

**Unit-III**

**Flow systems:** Natural and forced flow systems, water heating systems for domestic, industrial and space heating requirements, solar distillation.

**Solar heating and cooling:** Direct, indirect and isolated heating concepts, cooling concepts, load calculation methods, performance evaluation methods.

**Unit-IV**

**Solar thermal power generation:** Introduction, paraboloid concentrating systems, cylindrical concentrating systems, central receiver system.

**Solar refrigeration and air conditioning systems:** Introduction, solar refrigeration and air conditioning systems, solar desiccant cooling.

**Text Books:**

1.Solar Thermal Engineering Process - Duffie and Beckman.
2.Advanced Solar Energy Technology - H.P. Garg, Kluver.
3.Solar Energy- S.P. Sukhatme, TMH.

**Reference Books:**

1.Solar Energy- J.S. Hsieh, Pearson College DIV.
2.Solar Thermal Engineering- P.J. Lunde, John Wiley & Sons.

**Note: The paper setter will set the paper as per the question paper templates provided.**

| B. Tech. (7th Semester) Mechanical Engineering | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **MEC-407A** | **INDUSTRIAL TRAINING-III** | | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time (Hrs.)** |
| **2** | **0** | **0** | **--** | **--** | **100** | **--** | **100** | **--** |
| **Purpose** | To provide an industrial exposure to the students and enhance their skills and creative capability for conversion of their innovative ideas into physical reality. | | | | | | | |
| **Course Outcomes** | | | | | | | | |
| **CO 1** | Students will be able to self-improve through continuous professional development and life-long learning. | | | | | | | |
| **CO 2** | Students will be able to develop social, cultural, global and environmental responsibility as an engineer. | | | | | | | |
| **CO 3** | Students will be able to weigh all the latest changes in technological world. | | | | | | | |

**Note:** MEC-407 is a mandatory non-credit course in which the students will be evaluated for the industrial training undergone for minimum 4 weeks after 6th semester and students will be required to get passing marks to qualify.

The candidate has to submit a training report of his/her work/project/assignment completed in the industry during the training period. The evaluation will be made on the basis of training report submitted and viva-voce/presentation.

# Eighth Semester

| B. Tech. (8th Semester) Mechanical Engineering | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **MEC-402L A** | **Project-IV** | | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time (Hrs.)** |
| **0** | **0** | **10** | **5** | **0** | **100** | **100** | **200** | **3** |
| **Purpose** | To implement the engineering principles and theories into innovative practical projects for solving real world problems. | | | | | | | |
| **Course Outcomes** | | | | | | | | |
| **CO1** | Students will be able to apply the theoretical knowledge into practical/software projects. | | | | | | | |
| **CO2** | Students will be able to design new products using latest technologies. | | | | | | | |

The project work could be done for the problem statement of an industry or practical project in the institute. The students may also opt for the analysis based software projects with proper validation. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.

**Note:** The maximum number of students in a group should not exceed four.

| B. Tech. (8th Semester) Mechanical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MEO-402A** | **SUPPLY CHAIN MANAGEMENT** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time (Hrs.)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | The main objective of the course is to impart students with the knowledge of the performance, driver and metrics, network design, economies and uncertainties in Supply chain management. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Students will be able to explain the basics of Supply chain management and its performance. | | | | | | |
| **CO2** | Students will be able to discuss supply chain metrics and the process of designing the supply chain networks. | | | | | | |
| **CO3** | Students will be able to explain various aspects and functions of the supply chain network. Also, they will be able to explain the design process of the Global supply chain network. | | | | | | |
| **CO4** | Students will be able to describe how to manage economies and uncertainties in the supply chain. | | | | | | |

**UNIT-I**

**Understanding the supply chain:** Introduction, definition, the objective of a supply chain, the importance of supply chain decisions, decision phases in a supply chain, process views of a supply chain, examples of supply chains.

**Supply chain performance:** Achieving strategic fit and scope: Competitive and supply chain strategies, achieving strategic fit, expanding strategic scope, challenges to achieving and maintaining strategic fit.

**UNIT-II**

**Supply chain drivers and metrics:** Financial measures of performance, drivers of supply chain performance, framework for structuring drivers, facilities, inventory, transportation, information, sourcing, pricing.

**Designing the supply chain network:** Designing distribution networks and applications to online sales: the role of distribution in the supply chain, factors influencing distribution network design, design options for a distribution network, online sales and the distribution network, distribution networks in practice.

**UNIT-III**

**Network design in the supply chain:** The role of network design in the supply chain, factors influencing network design decisions, framework for network design decisions, models for facility location and capacity allocation, making network design decisions in practice.

**Designing global supply chain networks:** The impact of globalization on supply chain networks, the offshoring decision: total cost, risk management in global supply chains, discounted cash flows, evaluating network design decisions using decision trees, to onshore or offshore: evaluation of global supply chain design decisions under uncertainty, making global supply chain design decisions under uncertainty in practice.

## UNIT-IV

**Managing economies of scale in a supply chain:** Cycle inventory, the role of cycle inventory in a supply chain, estimating cycle inventory–related costs in practice, economies of scale to exploit fixed costs, economies of scale to exploit quantity discounts, short-term discounting: trade promotions, managing multi-echelon cycle inventory.

**Managing uncertainty in a supply chain:** Safety inventory, the role of safety inventory in a supply chain, determining the appropriate level of safety inventory, impact of supply uncertainty on safety inventory, impact of aggregation on safety inventory, impact of replenishment policies on safety inventory, managing safety inventory in a multie-chelon supply chain, the role of IT in inventory management, estimating and managing safety inventory in practice.

**Text books:**


1. Supply chain Management: Strategy, Planning and Operations - Chopra, S., and Meindl, P., Fifth Edition, Pearson Education (Singapore) Pte. Ltd, 2004.
2. Designing & Managing the Supply Chain: Concepts, Strategies & Case studies - Simchi-Levi, P., Kaminsky, Ravi Shankar, E., Third Edition, Tata McGraw-Hill Edition, 2003.


**Reference books:**


1. Purchasing and Supply Chain Management: Text and Cases - Doebler, D.W. and Burt, D.N., McGraw-Hill Publishing Company Limited, New Delhi, 1996.
2. Supply Chain Management for Competitive Advantage - Rangaraj, TMH.


**Note: The paper setter will set the paper as per the question paper template provided.**

| B. Tech. (8th Semester) Mechanical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MEO-404A** | **COMPETITIVE MANUFACTURING SYSTEMS** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time (Hrs.)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | The objective of this course is to make the students understand about the concepts of competitive manufacturing management systems. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Students will be able to interpret the tactics, strategies and tools of continuous improvements of products and services. | | | | | | |
| **CO2** | Students will be able to implement the just in time and total quality management philosophy for continuous improvement and identify the elements of lean and wasteless production. | | | | | | |
| **CO3** | Students will be able to describe how to reduce the setup time and how to maintain and improve the equipment efficiency. | | | | | | |
| **CO4** | Students will be able to explain the pull-push production system and will be able to know the systems for eliminating defects. | | | | | | |

**UNIT-I**

**Fundamentals of continuous improvement:** Continuous improvement as tactics and strategy-Incremental improvement: Kaizen, improvement threshold, innovation improvement making the leap, improvement as strategy, finding and implementing improvements-PDCA cycle, value analysis/value engineering, process engineering.

**Basic problem solving and improvement tools:** Check list, histogram, Pareto analysis, scatter diagram, process flow chart, cause and effect analysis, run diagram.

**UNIT-II**

**JIT: value added and waste elimination:** Value added focus- necessary and unnecessary activities, support organization, sources of waste-Toyota's seven wastes, Canon's none wastes, JIT principles-simplification, cleanliness and organization, visibility, cycling time, agility, variation reduction, ,measurement, Meaning of JIT-philosophy, method, JIT limitations and implementation barriers, social impact of JIT.

**Total quality management (TQM):** Quality, Framework for managing total quality, employee involvement, benchmarking, quality certification, implementing TQM.

**Elements of lean production:** Lot size basics-lot size and setup reduction, kinds of lots, Lot sizing-process and purchase batches, EOQ based methods, transfer batches, Lot size reduction- Effect of lot size reduction on competitive criteria, cases for larger process batches, minimum lot size, small buffer stock, EOQ models for lot sizing.

**UNIT-III**

**Setup time reduction:** Setup reduction methodology-Shingo and SMED, SMED methodology for setup reduction, techniques for setup reduction-separate internal and external activities, improve internal setups, improve external setups.

**Maintaining and improving equipment:** Equipment maintenance-breakdown repair, equipment problems and competitiveness, preventive maintenance, total predictive maintenance, Equipment effectiveness-equipment losses, maintainability, reliability, availability, efficiency, quality rate, preventive maintenance programs, Total productive maintenance-perform TPM preventive maintenance, develop in house quality to restore and redesign equipment, eliminate human error in operation and maintenance, Implementing TPM-program feasibility, master plan, target areas, management support.

**UNIT-IV**

**Pull production systems:** Production control systems, Pull systems and Push systems- pull production process, push production process, rules for pull production, process improvement, necessary conditions for pull production systems, pull system as a fixed quantity/reorder point system, conveyance Kanbans, production Kanbans, Signal Kanbans, CONWIP method of pull production.

**Systems for eliminating defects:** Inspection (screening), self-checks and successive checks, requirements for self-checking, successive checkings, automation, cycle time, limits of inspection, source inspection and POKAYOKE: POKAYOKE functions, ideas, continuous improvements, JIDOKA-autonomation, andons.

**Text Books:**

1. Competitive Manufacturing Management – John M. Nicholas, TMH.
2. Manufacturing Management – Principles and Concepts, Gibson, Greenhalgh and Kerr, Champan and Hall.

**Reference Books:**

1. Production and Operation Management – K.C. Jain, Dreamtech Press.
2. Operations management-William J. Stevenson, McGraw Hill Education.

**Note: The paper setter will set the paper as per the question paper templates provided.**

| B. Tech. 8TH Semester Mechanical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MEO-406A** | **CONCURRENT ENGINEERING** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time (Hrs.)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | The objective of this course is to familiarize students with the concepts, approaches and implementation techniques related to concurrent engineering. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Students will be able to describe the basic concepts of concurrent engineering and implement concurrent engineering techniques. | | | | | | |
| **CO2** | Students will be able to identify the concept of life cycle management. | | | | | | |
| **CO3** | Students will be able to analyze reengineering and system engineering approaches and processes. | | | | | | |
| **CO4** | Students will be able to appraise different information modeling systems and product realization taxonomy. | | | | | | |

## UNIT – I

**Concurrent engineering concept:** Concurrent engineering definitions, basic principles of CE, components of CE, concurrency and simultaneity, modes of concurrency, modes of cooperation, CE design methodologies, benefits of concurrent engineering,

**Review of CE technique:** Design for manufacture (DFM), design for assembly (DFA), quality function deployment (QFD), rapid prototyping (RP), total design (TD), organizing for CE, CE tool box.

## UNIT – II

**Life-cycle management:** Introduction, shrinking life-cycle, product development cycle, product-life cycle, life-cycle management, new product introduction, strategic technology insertions, managing continuity, managing revision changes, life-cycle cost drivers, life-cycle management tools, sequential versus concurrent engineering.

## UNIT – III

**Process-reengineering:** Introduction, understanding and managing change, reengineering approaches work-flow mapping, information flow-charting, process improvement methodology, change management methodology, concurrent process reengineering.

**System engineering:** System engineering process, systems thinking, approaches to system complexity, sharing and collaboration in CE, system integration, management and reporting structure.

## UNIT – IV

**Information modeling systems:** Information modeling, modeling methodology, foundation of information modeling, concurrent engineering process invariant, enterprise model-class, specification model-class, product model-class, process model-class, cognitive models, merits and demerits.

**Product realization taxonomy:** Development methodology for CPRT, concurrent product realization taxonomy, pull system of product realization, description of parallel tracks, description of 2-T loops, description of 3-T loop.

**Text Books:-**

1. Concurrent Engineering Fundamental, (Vol 1) integrated Product and Process Organization - Biren Prasad.
2. Concurrent Engineering - G.S. SAWHNEYUNIVERSITY SCIENCE PRESS (An Imprint of Laxmi Publications Pvt. Ltd.) An ISO 9001:2008 Company.
3. Concurrent Engineering Fundamentals: Integrated Product Development - Prasad, Prentice hall India

**Reference Books:**

1. Design for Concurrent Engineering - J. Cleetus, CE Research Centre, Morgantown
2. Concurrent Engineering in Product Design and Development - I. Moustapha, New Age International
3. Concurrent Engineering: Automation Tools and Technology - Andrew Kusiak - , Wiley Eastern

**Note: The paper setter will set the paper as per the question paper templates provided.**

| B. Tech. (8th Semester) Mechanical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|
| MEO-408A | LUBRICANTS AND LUBRICATION | | | | | | |
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time (Hrs.) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Purpose | The purpose of the course is to make the students aware of the different properties and composition of lubricants and understand the fundamental concepts of hydrodynamic, hydrostatic and extreme pressure lubrication. | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Students will be able to describe properties and composition of lubricants. | | | | | | |
| CO2 | Students will be able to understand the basics of hydrodynamic lubrication and analyse the thermal and non-Newtonian effects in hydrodynamic lubrication. | | | | | | |
| CO3 | Students will be able to explain and analyze the hydrostatic lubrication, and extreme pressure lubrication at different temperature-load combinations. | | | | | | |
| CO4 | Students will be able to understand and analyze the elastohydrodynamic lubrication. | | | | | | |

## UNIT-I

**Physical properties of lubricants:** Introduction, relationship of viscosity with temperature, pressure and shear rate, viscosity index, viscosity measurement, viscosity of mixtures; Viscosity classification, thermal properties of lubricants, temperature characteristics of lubricants, neutralization number, carbon residue, optical properties, additive compatibility and solubility, lubricant impurities and contaminants.

**Lubricants and their composition**: Mineral oil based liquid lubricants – sources, types, synthetic oils – manufacturing of synthetic oils, hydrocarbon synthetic lubricants, silicon analogues of hydrocarbons, organohalogens; new developments in synthetic lubricants, emulsions and aqueous lubricants, greases, grease characteristics, lubricant additives.

## UNIT-II

**Hydrodynamic lubrication:** Introduction, Reynolds equation, pressure distribution, load capacity, coefficient of friction, lubricant flow; converging diverging wedges, journal bearings, thermal effects in bearings, isoviscous and non-isoviscous thermal analysis, hydrodynamic lubrication with non-Newtonian fluids, squeeze films.

## UNIT–III

**Hydrostatic lubrication:** Introduction, hydrostatic bearing analysis, general approach, optimization of bearing design, aerostatic bearings, stability.

**Extreme pressure lubrication:** Lubrication mechanisms for low temperature-low load, low temperature - high load, high temperature – medium load and high temperature – high load, boundary and EP lubrication of non-metallic surfaces.

## UNIT–IV

**Elastohydrodynamic lubrication:** Introduction, contact stresses, geometry of contacting bodies, contact area, pressure, maximum deflection and position of maximum shear stress, EHL of lubricating films, pressure distribution, film thickness formulae, effect of non-dimensional parameters, lubrication regimes, partial EHL, surface temperature at conjunction.

**Text books:**

1. Engineering Tribology - Gwidon W. Stachowiak, Andrew W. Batchelor, Butter worth, Heinemann.
2. Introduction to Tribology of Bearings - B.C. Majumdar, S. Chand Co.

**Reference books:**

1. Friction and Lubrication - E.P. Bowden and Tabor. D., Heinemann Educational Books Ltd.
2. Engineering Tribology - Ross Beckett, Larsen and Keller Education
3. Fundamentals of Fluid Film Lubrication - Bernard Hamrock, Bo Jacobson, and Steven R. Schmid, Taylor and Francis.

**Note: The paper setter will set the paper as per the question paper template provided.**

| B. Tech. 8th Semester) Mechanical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MEO-410A** | **TOTAL QUALITY MANAGEMENT** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time (Hrs.)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | The purpose of this course is to develop an understanding of quality management framework, philosophies, in-depth knowledge of various tools and techniques with their application in the manufacturing and service industry. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Students will be able to understand quality management philosophies and frameworks. | | | | | | |
| **CO2** | Students will be able to describe various tools and techniques of quality management. | | | | | | |
| **CO3** | Students will be able to explain the applications of quality tools and techniques in both manufacturing and service industry | | | | | | |
| **CO4** | Students will be able to describe various quality systems like ISO and its standards. | | | | | | |

**UNIT-I**

**Introduction and philosophies of quality management:**introduction, need for quality ,evolution of quality, definitions of quality, dimensions of product and service quality, basic concepts of TQM, TQM framework, benefits, awareness and obstacles, quality, vision, mission and policy statements, contributions of Deming, Juran and Crosby , barriers to TQM, quality statements, customer focus,customer orientation, customer satisfaction, customer complaints, and customer retention,costs of quality.

**UNIT-II**

**Principles of quality management:**Leadership,strategic quality planning, quality councils, employee involvement, motivation, empowerment, team and teamwork, quality circles recognition and reward, performance appraisal, continuous process improvement , PDCA cycle, 5S, Kaizen ,supplier partnership, partnering, supplier selection, supplier rating.

**Process capability:** Meaning, significance and measurement,six sigma concepts of process capability.

**UNIT–III**

**Tools and techniques for quality management**: Quality functions development (QFD), benefits, voice of customer, information organization, house of quality (HOQ), building a HOQ, QFD process.

**Failure mode effect analysis (FMEA):** Requirements of reliability, failure rate, FMEA stages, design, process and documentation,seven old (statistical) tools,seven new management tools,bench marking and POKAYOKE.

**UNIT–IV**

**Quality systems organizing and implementation:**Need for ISO: 9000, ISO: 9001-2008 quality system,elements, documentation, quality auditing, QS:9000, ISO: 14000,concepts, requirements and benefits, TQM implementation in manufacturing and service sectors, quality audits, TQM culture.

**Text Books:**

1.Total Quality Management-Dale H.Besterfield, Pearson Education (First Indian Reprints 2004).
2. Total Quality Management-Shridhara Bhat K, Himalaya Publishing House, First Edition 2002.

**Reference Books:**

1. Competitive Manufacturing Management – John M. Nicholas, TMH.
2. Total Quality Management- R Kesavan, C Elanchezhian, B Vijaya Ramnath, IK International.
3. Total Quality Management: Principles, Methods, and Applications-Sunil Luthra, Dixit Garg, Ashish Agarwal, Sachin K. Mangla, CRC Press.
4. Total Quality Management-Poornima M. Charantimath, Pearson Pub.

**Note: The paper setter will set the paper as per the question paper template provided.**

| B. Tech. 8th Semester) Mechanical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|
| MEO-412A | ENERGY CONSERVATION AND MANAGEMENT | | | | | | |
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time (Hrs.) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Objective | To impart students, the knowledge of various energy management and conservation techniques, building audit and survey procedures for energy management. | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Students will be able to describe various renewable sources of energy and the technicalities, operating principles and classification of HVAC Systems. | | | | | | |
| CO2 | Students will be able to describe the methodology of Site and Building Surveys. | | | | | | |
| CO3 | Students will be able to explain various energy analysis techniques and the principle and classification of Process Energy. | | | | | | |
| CO4 | Students will be able to discuss the implementation of various energy management techniques in building designs. | | | | | | |

## UNIT-I

**Renewable energy:** Introduction; solar energy; wind energy; energy from water; energy from earth; energy from biomass.

**Heating, venting and air conditioning systems:** General principles; the requirements for human comfort; description of typical systems-dual duct HVAC system; multi zone HVAC systems: variable and volume systems, terminal repeat system, evaporative systems, package system; basic principle governing HVAC system, package system; energy management opportunities in HVAC systems; modeling of heating and cooling loads in buildings; problems.

## UNIT-II

**Site and building surveys:** Phases involved in surveys: initiation phase, audit and analysis phase, implementation phase; general methodology for building and site energy audit; site survey: methodology, site survey-electrical system, steam and water systems; building survey: methodology, basic energy audit instrumentation, measurement for building surveys.

## UNIT-III

**Energy analysis techniques:** Introduction; annual energy consumption; normalized performance indicators; time-dependent energy analysis; linear regression; single independent; correlation coefficients; multivariable analysis; CUSUM.

**Process energy:** General principles; process heat; energy saving in: condensate return, steam generation and distribution, automotive fuel control, hot water and water pumping; direct and indirect fired furnaces over process electricity; other process energy forms-compressed air and manufacturing processes; problems.

## UNIT-IV

**Waste heat recovery:** Introduction, recuperative heat exchangers, heat exchanger theory; number of transfer units (NTU) concept, run-around coils, regenerative heat exchangers, heat pumps, energy efficient heating: thermal comfort, building heat loss; U values, heat loss calculations, heating energy calculations; intermittent heating; radiant heat; radiant heating; low-emissivity glazing.

**Passive solar and low energy building design:** Introduction, passive solar heating, direct gain techniques, indirect gain techniques, isolated gain techniques, thermosiphon systems, passive solar cooling, shading techniques, solar control glazing, advanced fenestration, natural ventilation, thermal mass, night venting, termodeck, building form, building operation.

**Text Book:**

1. Energy Management and Conservation Handbook, Second Edition - Frank Kreith, D. Yogi Goswami.
2. Energy Management, Supply and Conservation, Second Edition - Clive Beggs
3. Energy Management Principles - Criag B. Smith, Published by Pergamon Press.
4. Energy Systems and Developments – Jyoti Parikh, Oxford University Press.

**Reference Books:**

1. Energy,Resources, Demand and Conservation with reference to India – Chaman Kashkari, Tata Mc Graw Hill Co. Ltd.
2. Integrated Renewable Energy for Rural Development–Proceedings of Natural Solar Energy Convention, Calcutta.

**Note: The paper setter will set the paper as per the question paper templates provided.**

| B. Tech. 8th Semester) Mechanical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MEP-402A** | **Non-Conventional Machining** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time (Hrs.)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | This course provides comprehensive knowledge about the advanced technologies and different Non-conventional machining processes. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | Students will be able to compare conventional and non-conventional machining processes and recognize the need for Non-conventional machining processes. | | | | | | |
| **CO 2** | Students will be able to know about the constructional features, performance parameters, process characteristics, applications, advantages and limitations of USM. | | | | | | |
| **CO 3** | Students will be able to know about the constructional features, performance parameters, process characteristics, applications, advantages and limitations of AJM, WJM and AWJM. | | | | | | |
| **CO 4** | Students will be able to identify the need of chemical and electro-chemical machining processes along with the constructional features, process parameters, process characteristics, applications, advantages and limitations. | | | | | | |
| **CO 5** | Students will be able to explain the constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM, LBM and EBM. | | | | | | |

## UNIT-I

**Introduction to non-conventional machining:** Introduction to non-conventional machining(NCM) processes, characteristics of conventional machining processes, characteristics of non-conventional machining processes, need for development of non-conventional machining processes, comparison of conventional and non-conventional machining processes, , classification of non-conventional machining processes, history of non-conventional processes, advantages of non-conventional machining processes, disadvantages of non-conventional machining processes, applications of non-conventional machining processes.

**Ultrasonic machining (USM):** process principle, equipment, design consideration for tool, tool feed mechanism, abrasive slurry, Liquid media, operation of USM, process parameters, process capabilities, mechanics of cutting in USM applications of USM, advantages of USM, disadvantages of USM, Mechanics of cutting in USM, ultrasonic welding

## UNIT-II

**Abrasive jet machining (AJM)**: process principle, equipment, process parameters, process capabilities, applications of AJM, advantages of AJM, disadvantages of AJM, Mechanics of cutting in AJM.

**Water jet machining (WJM):** process principle, equipment, process parameters, process capabilities, Metal removal rate, applications of WJM, advantages of WJM, disadvantages of WJM.
**Abrasive water jet machining (AWJM)**: process principle, equipment, process parameters, process capabilities, Metal removal rate, applications of AWJM, advantages of AWJM, disadvantages of AWJM.

**UNIT-III**

**Chemical machining:** Introduction, process principle, five steps of chemical machining,elements of process, Influence of etchant medium, selection of maskant and etchants, chemical blanking, accuracy of chemical blanking, applications of chemical machining, advantages of chemical machining, disadvantages of chemical machining, chemical milling, photochemical machining.
**Electrochemical machining (ECM):** classification of ECM processes, fundamental principles of ECM, elements of ECM process, electro-chemistry of ECM process, process parameters, process characteristics, tool design, accuracy, determination of metal removal rate, evaluation of metal removal rate of an alloy, surface finish and work material characteristics, economic consideration, advantage, limitation and application, basics of electrochemical grinding, deburring and honing.

**UNIT-IV**

**Electric discharge machining (EDM)**: Principal and metal removal mechanism, generators, electrode feed control, electrode material, tool electrode tool design, EDM wire cutting, surface finish, accuracy and application.
**Laser beam machining(LBM):** Introduction, generation of LASER, Equipment and mechanism of metal removal, LBM parameters and characteristics, Applications, Advantages & limitations.
**Electron beam machining (EBM):** Introduction, Principle, equipment and mechanism of metal removal, applications, advantages and limitations.

**Text Books:**

1. Unconventional Machining processes- T. Jagdeesha, I.K. International Publishing house
2. Advanced Machining processes- V.K. Jain, Allied Publishers private Ltd.
3. Unconventional Manufacturing process- M.K. Singh, New Age International
4. Modern machining processes – P.C. Pandey and M.S. Shan, TMH

**Reference Books:**

1. Non-traditional Manufacturing Processes –G.F. Benedict, Marcel Dekker,Inc.
2. Advanced Method of Machining –J.A. McGeough, Chapman and Hall.
3. Electrochemical Machining of Metals –Ruryantsev & Davydov, Mir Pub.

**Note: The paper setter will set the paper as per the question paper template provided.**

| B. Tech. (8th Semester) Mechanical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MEP-404A** | **AUTOMOBILE ENGINEERING** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time (Hrs.)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | The objective of this course is to enable the students to understand various automobiles and their components. Also to describe the steering geometry, components and the mechanism involved in the automobile. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Students will be able to understand the basics of the engine cylinder and functions of the clutch. | | | | | | |
| **CO2** | Students will be able to explain the working of the gearbox, transmission, and new safety features etc. | | | | | | |
| **CO3** | Students will be able to describe how the rear axle, brake systems and wheel operate. | | | | | | |
| **CO4** | Students will be able to understand the steering geometry and suspension system. | | | | | | |

## UNIT-I

**Introduction:** Classification of automobile engines, use of engines, merits and demerits of vertical and horizontal engines, reasons for using single-cylinder two-stroke air-cooled petrol engine on two-wheelers, reasons for using multi-cylinder diesel engine for commercial vehicles, merits and demerits of two-stroke and four-stroke cycle engines, advantages of a multi-cylinder engine for the same power.

**Clutch:** Introduction, function of a clutch, main parts of a clutch, clutch types, clutch actuating mechanism, clutch construction, driven member-(friction or clutch disc), automatic transmission devices, troubleshooting/service procedures.

## UNIT-II

**Gear box:** Introduction, type of gear boxes, three speed gearbox, merits and demerits of gear boxes, gear shifting mechanisms, epicyclic gearbox, gear reduction, overdrive, Maruti 800 gear box, five-speed gearbox, six speed gearbox.

**Propeller shaft, universal joint and other features:** Introduction, drive mechanism from gearbox to final drive in cars, propeller shaft (constructional features), shaft, universal joints, centre bearing in propeller shaft drive, propeller shaft, problems, ABS, GPS vehicle tracking, autonomous emergency braking (AEB), automatic transmission, electronic stability control (ESC), forward collision warning.

## UNIT-III

**Rear axle assembly:** Introduction, purpose of the final drive, final drive requirements, the final drive, the differential, axle housing, maintenance of rear axle, troubleshooting in differentials.

**Brake system:** Introduction, functions of a brake, requirements of a brake system, brake actuating mechanism, leading and trailing shoes, classification of brakes, tandem master cylinder, drum brakes, self-energized brakes, disc brakes, floating-caliper brakes, power brakes, air-hydraulic brakes, air brake system, emergency and parking brakes.

**Wheel and tyre:** Introduction, types of automobile wheels, tyres, types of tyres, tyre tread, tyre selection, tyre service parameters, tyre maintenance.

**UNIT-IV**

**Suspension system:** Introduction, brief history, need for a good suspension system, stages in suspension system, elements of a suspension system, suspension systems, suspension system maintenance and troubleshooting, inspection and service of suspension system (general), troubleshooting of suspension systems.

**Steering and front axle:** Function of the steering system, steering gears, steering mechanisms used in some Indian vehicles, steering linkage, steering wheel and column, front axle, steering heads, steering geometry, wheel alignment, adjusting steering angles, Ackerman linkage, power Steering, under steering and over steering, steering lock, turning radius.

**Text Books:**

1. Automobile Engineering -By K.M. Gupta, Umesh Publications.
2. Automobile Engineering- Sudheer kumar, University Science Press.
3. Automobile Engineering- K.K Jain, Tata McGraw-Hill Publishing Company Limited.

**Reference Books:**

1. The Motor Vehicle - By Newton, Steeds and Garrett Basic.
2. Automobile Engineering - By Kirpal Singh, Standard Publication.

**Note: The paper setter will set the paper as per the question paper template provided.**

| B. Tech. (8th Semester) Mechanical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MEP-406A** | **PRODUCT DESIGN AND MANUFACTURING** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time (Hrs.)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | The objective of the course is to understand the importance of design factors, manufacturing, assembly and environmental guidelines, prototyping and patenting requirements in product design, manufacturing, development and economics. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Students will be able to describe the concept of product design, design considerations, design practiced by the industry, production and marketing, and aesthetics. | | | | | | |
| **CO2** | Students will be able to explain and apply manufacturing, assembly and environmental guidelines in product design, manufacturing and development. | | | | | | |
| **CO3** | Students will be able to apply the value engineering concepts in product designing and will be able to understand the application of prototyping in product design. | | | | | | |
| **CO4** | Students will be able to explain the patenting, and intellectual property. They will also be able to understand the manufacturing and economic aspects related to a product. | | | | | | |

## UNIT-I

**Introduction:** Introduction to product design, design by evolution and innovation, essential factors of product design, production consumption cycle, flow and value addition in production consumption cycle, morphology of design (the seven phases)

**Product design practice and industry:** Product strategies, time to market, analysis of the product, the three s's, designer and his role, myth and reality, basic design considerations, problems faced by industrial designer, role of aesthetics in product design.

## UNIT-II

**Design for manufacture and assembly:**Overview and motivation, basic method: design guidelines: design for assembly, design for piece part production, advanced method: manufacturing cost analysis, cost driver modeling, critique for design for assembly method.

**Design for the environment:** Environmental objectives, basic DFE methods, design guidelines, life cycle assessment, techniques to reduce environmental impact.

## UNIT-III

**Value engineering:** Value, nature and measurement of value, maximum value, normal degree of value, importance of value, value analysis job plan, creativity, steps to problem solving and value analysis, value analysis tests, value engineering idea generation checklist, cost reduction through value engineering-case study, materials and process selection in value engineering.

**Prototyping:**Prototyping essentials, types of prototypes, uses of prototypes, reverse engineering, rapid prototyping techniques, scale, dimensional analysis, and similitude, basic method: physical prototype design and planning- guidelines for prototype design, sample prototype application, 3-D printing.

**UNIT-IV**

**Patents and intellectual property:** What is intellectual property? Overview of patents, utility patents, invention disclosure.

**Product development economics:** Elements of economic analysis, base case financial model, sensitive analysis, project trade-offs, influence of qualitative factors on project success, qualitative analysis.

**Text Books:**

1. Product Design and Development-Karl T. Ulrich and Steven D Eppinger, TMH.
2. Product Design and Engineering-A. K. Chitale and Gupta, PHI.

**Reference Books:**

1. Product Design and Process Engineering-Niebel and Draper, McGraw-Hill.
2. Product Design-Techniques in Reverse Engineering and New Product Development- Kevin Otto and Kristin Wood, Pearsons.

**Note: The paper setter will set the paper as per the question paper templates provided.**

| B. Tech. (8th Semester) Mechanical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MEP-408A** | **WELDING TECHNOLOGY** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time (Hrs.)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | To expand the student's knowledge base and practical aspects in various areas of welding processes. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | Students will be able to explain the applications of welding and allied processes in various industries. | | | | | | |
| **CO 2** | Students will be able to select arc welding power source and process parameters based on particular applications. | | | | | | |
| **CO 3** | Students will be able to describe working of various gas welding equipment and will be able to suggest weld positions based on the application. | | | | | | |
| **CO 4** | Students will be able to test weld for different defects and learn about the performance of TIG welding of aluminium and MIG welding of steels. | | | | | | |

## UNIT-I

**Introduction to welding technology:** History of metal-working, early developments in welding, development of modern welding, functions of welding in industries, application of welding in different industries

**Welding and allied processes:** Fusion welding, electric resistance welding, solid phase welding, braze welding, thermal cutting, thermal spraying, welding compared to riveting and casting.

## UNIT-II

**Arc welding process and equipment:** Working principle of arc welding processes, static characteristics curves, open circuit voltage, current rating and duty cycles, classes of insulation, power factor.

Different types of AC and DC power sources, arc welding transformers; methods to control welding current in welding transformers, arc welding generators, arc welding rectifiers comparison of power source,factors for selection of power sources.

Special power sources; universal type, multi-operator type, solid state power source, inverter based multi-process power source units.

## UNIT–III

**Gas welding process and equipment:** Working principle of gas welding process, gases used, welding flames, setup and equipment, gas cylinders, handling fuel and oxygen cylinders, pressure regulators, hoses, welding torch; selection of welding torch tip size, torch lighters, lighting equal pressure type torch, lighting injector type welding torch, torch adjustments, shutting off torch, torch position and movements, puddling, types of oxy-acetylene welds made without the use of welding rod and with the use of welding rod, selection of welding rod size, welding positions, trolleys, filler rod and fluxes, protective equipment and clothing.

## UNIT–IV

**Inspection and testing welds**: Non-destructive tests, destructive tests, visual inspection, magnetic particle inspection, liquid particle inspection, ultrasonic inspection, X-ray inspection, eddy current inspection, inspecting welds using pneumatic and hydraulic pressure, bend tests, impact tests, laboratory methods of testing welds

**TIG welding of aluminum and magnesium**: TIG equipment for aluminium, clean the parts using caustic cleaners and scouring pads, heat transfer in aluminium, aluminium arcing, balling tungsten, welding machine settings, striking the arc, aluminium weld procedure, square wave welders, TIG welding magnesium, TIG welding aluminium cylinder heads, weld fixture.

**MIG welding of steel and stainless steel**: Metal transfer modes, wire size, starting to MIG weld, aircraft seat welding, stress relieving, MIG welding tips, MIG welding stainless steel, backside protection, MIG welding titanium

**Text books:**

1.Welding Principle and Practices- Edward R. Bohnart, McGraw-Hill Publications.
2. Modern Arc Welding Technology -S.V. Nadkarni, Oxford and IBH Publishing Pvt. Ltd.
3. Modern Welding - Althouse, Goodheart Willcox co. Inc.
4. Performance Welding Handbook - Robert Finch, MBI publishing company.
5. Welding Processes and Technology - O.P. Khanna, Dhanpat rai publications
6. Welding Science and Technology- Ibrahim Khan, New Age International Publishers.
7. Welding Processes and Technology - R.S. Parmar, Khanna Publishers

**Reference books:**

1.Welding - A.C. Davies, Cambridge UniversityPress.

**Note: The paper setter will set the paper as per the question paper template provided.**

| | B. Tech. (8th Semester) Mechanical Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| **MEP-410A** | **DESIGN OF PRESSURE VESSELS AND PIPING** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time (Hrs.)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | The course aims to impart basic knowledge of design of pressure vessels and piping system. It is also aimed to introduce various standards used for the pressure vessel design. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Students will be able to analyze thin plates and shells for various types of stresses. | | | | | | |
| **CO 2** | Students will be able to design shells, end closures and tall cylinder columns of pressure vessels. | | | | | | |
| **CO 3** | Students will be able to explain the buckling and fracture in the pressure vessel. | | | | | | |
| **CO 4** | Students will be able to design piping systems and explain the piping code, behavior and support. | | | | | | |

**Unit-I**

**Stresses in pressure vessels:** General theory of membrane stresses in vessel under internal pressure and its application to shells (cylindrical, conical and spherical) and end closures,bending of circular plates and determination of stresses in simply supported and clamped circular plate, thermal stresses, stress concentration in plate having circular hole due to bi-axial loading, excessive elastic deformation, plastic instability, brittle rupture and creep,theory of reinforced opening and reinforcement limits.

**Unit-II**

**Design of vessels:** Design of tall cylindrical self-supporting process columns, supports for short vertical vessels, stress concentration: at a variable thickness transition section in a cylindrical vessel, about a circular hole, elliptical openings, theory of reinforcement, pressure vessel design.

**Unit-III**

**Buckling and fracture analysis in vessels:** Buckling phenomenon, elastic buckling of circular ring and cylinders under external pressure, collapse of thick walled cylinders or tubes under external pressure, effect of supports on elastic buckling of cylinders, buckling under combined external pressure and axial loading, control and significance of fracture mechanics in vessels, FEM application

**UNIT-IV**

**piping design:** Flow diagram, Piping layout and piping stress analysis; Flexibility factor and stress intensification factor; Design of piping system as per B 31.1 piping code. Piping components - bends, tees, bellows and valves. Types of piping supports and their behaviour; Introduction to piping Codes and Standards.

**Text Book:**

1.Theory and Design of Pressure Vessels-John F. Harvey, CBS Publishers and Distributors, 1987.
2.American Standard Code for Pressure Piping, B 31.1”, ASME.

3.Pressure Vessel Design Handbook-Henry H Bednar, CBS publishers and distributors
4.Chemical Process Equipment, Selection and Design-Stanley M Wales, Butterworths, Series in Chemical Engineering, 1988. Elsevier.
5.Pressure Vessels: ASME Code Simplified-J. Phillip Ellenberger, ASME.
6.Fundamentals of Piping Design-Smith P, Elsevier.

**Reference Books:**

1.Pressure Vessels, Design Hand Book-Henry H. Bedner, CBS Publishers and Distributors, 1987.
2.Chemical Process Equipment, Selection and Design-Butterworths series in Chemical Engineering", Stanley, M. Wales, 1988
3.Pressure Vessel Design-Harvey J F, CBS Publication.
4.Process Equipment Design-Brownell L. E and Young. E. D, Wiley Eastern Ltd., India
5.ASME Pressure Vessel and Boiler Code-Section VIII Div. 1, 2, and 3", ASME.

**Note: The paper setter will set the paper as per the question paper template provided.**

| B. Tech (8th Semester) Mechanical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MEP-412A** | **QUALITY AND RELIABILITY ENGINEERING** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time (Hrs.)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | The purpose of this course is to provide students with an in-depth knowledge of quality and reliability. The course addresses the principles and techniques of Statistical Quality Control and their practical uses as well as give insight to modern reliability engineering tools. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Students will be able to understand the concept of quality value and engineering and application of statistical methods for quality control. The student will also be able to solve the problems related with dispersion of data. | | | | | | |
| **CO2** | Students will be able to understand different control charts and will solve the problems on control charts. They will also understand various sampling plans and design sampling plans. | | | | | | |
| **CO3** | Students will be able to explain the loss function and tolerance design for online quality control. They will come to know the concept of reliability and will be able to understand the mathematical derivations of different failure rates. | | | | | | |
| **CO4** | Students will be able to describe various hazard models and solve problems for finding reliability of complex systems. | | | | | | |

## UNIT-I

**Quality value and engineering**: Quality systems, quality engineering in product design and production process, system design, parameter design, tolerance design, statistical methods for quality control and improvement, mean, median, mode, standard deviation, calculating area, Normal distribution tables, finding the Z score, Central limit theorem.

## UNIT-II

**Variation in process:** Control charts for variables: X-bar and R charts, Control charts for attributes P, C and U-Chart, Establishing and interpreting control charts process capability, Quality rating, Short run SPC.

Acceptance sampling by variables and attributes, single, double, sequential and continuous sampling plans, design of various sampling plan.

## UNIT–III

**Loss function, tolerance design:** N type, L type, S type; determination of tolerance for these types, online quality control – variable characteristics, attribute characteristics, parameter design.

**Concept and definition of reliability**: Reliability Parameters: Reliability as a function of time, failure rate as a function of time, Bath-tub curve, constant failure rate, increasing failure rate, mean time to failure (MTTF), MTTF as a function of failure rate, mean time between failure (MTBF), mean down time (MDT), maintainability & availability

## UNIT–IV

**Brief discussion on hazard models:**Constant hazard model, linearly increasing hazard model, nonlinear hazard model and Weilbull distribution, Advantages of weibull distribution, System reliability models: series system, parallel system, series-parallel system

**Complex system:**Reliability of series, parallel & standby systems & complex systems & reliability prediction and system effectiveness, reliability testing

**Text books:**

1. Reliability Engineering, (3rdEdition) - LS Srinath, Affiliated East West Pvt Ltd, 1991..
2. Reliability Engineering- E.Bala Guruswamy, Tata McGraw Hill, 1994.
3. Statistical Quality Control- M. Mahajan, Dhanpat Rai & Co., 2018.
4. Statistical Process Control- Eugene Grant, Richard Leavenworth, McGraw Hill.

**Reference books:**

1. Introduction to Reliability Engineering- Lewis E. E., John Wiley & Sons - 1987
2. Reliability Based Design-Rao S. S., McGraw Hill - 1992
3. Practical Reliability Engineering- O'cconer P. D. T., John Wiley & Sons Ltd. - 2003
4. Statistical Quality Control-Eugene G. L., McGraw-Hill - 1996

**Note: The paper setter will set the paper as per the question paper template provided.**

**BACHELOR OF TECHNOLOGY (AERONAUTICAL ENGINEERING) CREDIT BASED**
**KURUKSHETRA UNIVERSITY KURUKSHETRA**
**SCHEME OF STUDIES/EXAMINATION**
**SEMESTER-V w.e.f 2021-22 ONWARDS**

| S. No. | Course Code | Course Title | Teaching Schedule | | | | Credit | Examination Schedule (Marks) | | | | Duration of Exam (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Hours/ Week | | Major Test | Minor Test | Practical | Total | |
| 1 | HTM-901A | Universal Human Values II : Understanding Harmony | 3 | 0 | 0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | AER-301A | Aircraft Structure-II | 3 | 1 | 0 | 4 | 4 | 75 | 25 | 0 | 100 | 3 |
| 3 | AER-303A | Aerodynamics-II | 3 | 1 | 0 | 4 | 4 | 75 | 25 | 0 | 100 | 3 |
| 4 | AER-305A | Propulsion-II | 3 | 0 | 0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 5 | AER-307A | Aircraft Materials and Manufacturing Processes | 3 | 0 | 0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 6 | AER-309A | Aircraft Structure Lab | 0 | 0 | 2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 7 | AER-311A | Aerodynamics Lab | 0 | 0 | 2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 8 | AER-313A | Project-I | 0 | 0 | 2 | 2 | 1 | 0 | 0 | 100 | 100 | 3 |
| 9 | *AER-315A | Industrial Training-II | 2 | 0 | 0 | 2 | - | 0 | 100 | 0 | 100 | |
| 10 | **MC-903A | Essence of Indian Traditional Knowledge | 3 | 0 | 0 | 3 | - | 100 | - | - | 100 | 3 |
| | | **Total** | **20** | **2** | **6** | **28** | **20** | **375** | **205** | **220** | **800** | |

**Note:**

1. *AER-315A is a mandatory non-credit course in which the students will be evaluated for the industrial training undergone after 4$^{th}$ semester and students will be required to get passing marks to qualify.
2. **MC-903A is mandatory credit-less course in which the students will be required to get passing marks in the major test.*

| HTM-901A | Universal Human Values II: Understanding Harmony | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | 0 | 3.0 | 75 | 25 | 100 | 3 Hours |
| Purpose | Purpose and motivation for the course, recapitulation from Universal Human Values-I | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| CO 1 | Development of a holistic perspective based on self-exploration about themselves (human being),family, society and nature/existence. | | | | | | |
| CO 2 | Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence. | | | | | | |
| CO 3 | Strengthening of self-reflection. | | | | | | |
| CO 4 | Development of commitment and courage to act. | | | | | | |

**Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' andExperiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment ofaspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at variouslevels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrarinessin choice based on liking-disliking

**Module 2: Understanding Harmony in the Human Being - Harmony in Myself!**

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

**Module 3: Understanding Harmony in the Family and Society- Harmony in**

**Human-HumanRelationship**

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as thefoundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the othersalient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- fromfamily to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value inrelationships. Discuss with scenarios. Elicit examples from students' lives

**Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" canbe used), pollution, depletion of resources and role of technology etc.

**Module 5: Implications of the above Holistic Understanding of Harmony on ProfessionalEthics**

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and

organizations

28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. todiscuss the conduct as an engineer or scientist etc.

**READINGS:**

**Text Book**

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010

**Reference Books**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J CKumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

**MODE OF CONDUCT**

Lecture hours are to be used for lecture/practice sessions.

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at handand motivating students to reflect, explore and verify them.

Practice hours are to be used for practice sessions.

While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions, the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration. Scenarios may be used to initiate discussion. The student is encouraged to take up" ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Practice experiments are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based onbasic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.

This course is to be taught by faculty from every teaching department, including HSS faculty. Teacher preparation with a minimum exposure to at least one 8-day FDP on Universal Human Values is deemedessential.

**ASSESSMENT:**

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.

Example:

Assessment by

faculty mentor: 5 marks

Self-assessment: 5 marks

Assessment by peers: 5 marks

Socially relevant project/Group Activities/Assignments: 10 marks

Semester End Examination: 75 marks

The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

**BACHELOR OF TECHNOLOGY (AERONAUTICAL ENGINEERING) CREDIT BASED**
**KURUKSHETRA UNIVERSITY KURUKSHETRA**
**SCHEME OF STUDIES/EXAMINATION**
**SEMESTER-VII *w.e.f.*2021-22 ONWARDS**

| S. No. | Course Code | Course Title | Teaching Schedule | | | | | Examination Schedule (Marks) | | | | Duration of Exam (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Hours/Week | Credit | Major Test | Minor Test | Practical | Total | |
| 1 | AEO* | Open Elective-I | 3 | 0 | 0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | AER-401A | Avionics | 3 | 0 | 0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 3 | AER-403A | Avionics Lab | 0 | 0 | 2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 4 | AER-405A | Project-III | 0 | 0 | 10 | 10 | 5 | 0 | 100 | 100 | 200 | 3 |
| 5 | AEP* | Program Elective – III | 3 | 0 | 0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 6 | AEP* | Program Elective-IV | 3 | 0 | 0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 7 | **AER-407A | Industrial Training-III | 2 | 0 | 0 | 2 | - | 0 | 100 | 0 | 100 | |
| | | **Total** | **14** | **0** | **12** | **26** | **18** | **300** | **240** | **160** | **700** | |

| Program Elective-III | | Program Elective-IV | | Open Elective-I | |
|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Course Code** | **Course Title** | **Course Code** | **Course Title** |
| AEP-401A | Principles of Helicopter Engineering | AEP-409A | Computational Fluid Dynamics | AEO-401A | Flight Dynamics |
| AEP-403A | Boundary Layer Theory | AEP-411A | Finite Element Methods | AEO-403A | Aircraft Communication and Navigation Systems |
| AEP-405A | Aircraft Maintenance of Power Plant and Systems | AEP-413A | Aircraft Maintenance of Airframe and Systems | AEO-405A | Experimental Aerodynamics |
| AEP-407A | Fuels and Propellant Technology | AEP-415A | Ergonomics in Aerospace | AEO-407A | Microprocessor and Interfacing |

***Note:***

1. **The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.*
2. **AER-407A is a mandatory non-credit course in which the students will be evaluated for the industrial training undergone after 6th semester and students will be required to get passing marks to qualify.

**BACHELOR OF TECHNOLOGY (AERONAUTICAL ENGINEERING) CREDIT BASED**
**KURUKSHETRA UNIVERSITY KURUKSHETRA**
**SCHEME OF STUDIES/EXAMINATION**
**SEMESTER-VIII *w.e.f.*2021-22 ONWARDS**

| S. No. | Course Code | Course Title | Teaching Schedule | | | | | Examination Schedule (Marks) | | | | Duration of Exam(Hrs.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Hours/Week | Credit | Major Test | Minor Test | Practical | Total | |
| 1 | AER-402A | Project-IV | 0 | 0 | 10 | 10 | 5 | 0 | 100 | 100 | 200 | 3 |
| 2 | AEO* | Open Elective-II | 3 | 0 | 0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 3 | AEO* | Open Elective-III | 3 | 0 | 0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 4 | AEP* | Program Elective-V | 3 | 0 | 0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 5 | AEP* | Program Elective-VI | 3 | 0 | 0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| | | **Total** | **12** | **0** | **10** | **22** | **17** | **300** | **200** | **100** | **600** | |

| Open Elective-II | | Open Elective-III | |
|---|---|---|---|
| **Course Code** | **Course Title** | **Course Code** | **Course Title** |
| AEO-402A | Wind Tunnel Techniques | AEO-410A | Rockets and Missiles |
| AEO-404A | Robotics and Automation | AEO-412A | Introduction to Automatic Flight Control |
| AEO-406A | Computer Aided Design | AEO-414A | Aerospace Power Electronics |
| AEO-408A | Product Design and Manufacturing | AEO-416A | Non-Destructive Testing |

| Program Elective-V | | Program Elective-VI | |
|---|---|---|---|
| **Course Code** | **Course Title** | **Course Code** | **Course Title** |
| AEP-402A | Space Dynamics | AEP-410A | Air Transportation and Aircraft Maintenance Management |
| AEP-404A | Aircraft Quality Control, Quality Assurance and Certification | AEP-412A | Aircraft Modeling and Simulation |
| AEP-406A | Aircraft Systems and Instrumentation | AEP-414A | Control Theory and Practices |
| AEP-408A | Theory of Vibrations | AEP-416A | Mechatronics |

***Note:****1.*The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section*

| | B. Tech (7th Semester) Aeronautical Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| **AER-401A** | **AVIONICS** | | | | | | |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To familiarize the students with the applications of electronics in Aeronautical Engineering** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **Introduction to Avionics** | | | | | | |
| **CO2** | **Introduction to the principles of digital systems and its avionics architecture** | | | | | | |
| **CO3** | **Understanding the concept of electronic equipment in flight deck and cockpits** | | | | | | |
| **CO4** | **Introduction to the types of Avionics Systems** | | | | | | |

**Unit-I**

Need for Avionics in civil and military aircraft and space systems – Integrated Avionics and Weapon system – Typical avionics sub systems – Design and Technologies.

**Unit-II**

Digital Computers – Microprocessors – Memories

Avionics system architecture–Data buses MIL–STD 1553 B–ARINC 429–ARINC 629.

**Unit-III**

Control and display technologies CRT, LED, LCD, EL and plasma panel - Touch screen - Direct voice input (DVI) - Civil cockpit and military cockpit: MFDS, HUD, MFK, HOTAS

**Unit-IV**

Communication Systems - Navigation systems - Flight control systems - Radar electronic warfare
- Utility systems Reliability and maintainability - Certification.

**Text Books:**

1. Malcrno A.P. and Leach, D.P., “Digital Principles and Application”, Tata McGraw-Hill, 1990.

2. Gaonkar, R.S., “Microprocessors Architecture – Programming and Application”, Wiley and Sons Ltd., New Delhi

**Reference Books:**

1. Middleton, D.H., Ed., “Avionics Systems, Longman Scientific and Technical”, Longman Group UK Ltd., England,

2. Spitzer, C.R., “Digital Avionic Systems”, Prentice Hall, Englewood Cliffs, N.J., USA. 1987. Brain Kendal, “Manual of Avionics”, The English Book House, 3rd Edition, New Delhi,

| | B. Tech (7th Semester) Aeronautical Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| AER-403A | AVIONICS LAB | | | | | | |
| L | T | P | Credit | Practical | Minor Test | Total | Time |
| - | - | 2 | 1 | 60 | 40 | 100 | 3h |
| Purpose | To give the practical knowledge of handling the avionics related instruments. | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Tomakethestudentsfamiliarwiththeexperimentsrelatedwith Avionics | | | | | | |
| CO2 | To make students apply hands on approach on Avionics instruments | | | | | | |

**DIGITAL ELECTRONICS**

1. Addition/Subtraction of binary numbers.
2. Multiplexer/Demultiplexer Circuits.
3. Encoder/Decoder Circuits.
4. Timer Circuits, Shift Registers, Binary Comparator Circuits.

**MICROPROCESSORS**

5. Addition and Subtraction of 8-bit and 16-bit numbers.
6. Sorting of Data in Ascending & Descending order.
7. Sum of a given series with and without carry.
8. Greatest in a given series & Multi-byte addition in BCD mode.
9. Interface programming with 4 digit 7 segment Display & Switches & LED's.
10. 16 Channel Analog to Digital Converter & Generation of Ramp, Square, Triangular wave by Digital to Analog Converter.

**AVIONICS DATA BUSES**

11. Study of Different Avionics Data Buses.
12. MIL-Std – 1553 Data Buses Configuration with Message transfer.
13. MIL-Std – 1553 Remote Terminal Configuration.

**Note: At least Eight Experiments should be performed. Out of that Two Experiments may be performed or designed and set by the concerned institute as per the scope of the syllabus.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **B. Tech (7$^{th}$Semester) Aeronautical Engineering** | | | | | | | |
| **AER-405A** | **PROJECT – III** | | | | | | | |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **10** | **5** | **0** | **100** | **100** | **200** | **3h** |
| **Purpose** | **To familiarize the students with the applications of engineering problems as a minor project.** | | | | | | | |
| **Course Outcomes** | | | | | | | | |
| **CO1** | **Enhancement of analytical capability of students for real time engineering problems.** | | | | | | | |
| **CO2** | **Understand Methodologies and professional way of Documentation and Communication** | | | | | | | |
| **CO3** | **Extend or use the idea on major project** | | | | | | | |
| **CO4** | **To implement presentation techniques in their work style** | | | | | | | |

The students expected to take up a project under the guidance of teacher from the college. The project must be based on (Aeronautical Engineering / Mechanical Engineering) problems, which can be extended up to the full academic session. The students may be asked to work individually or in a group not more than four students.

Students need to submit a model which can be a physical working model or simulation based virtual model with a full preliminary report in a proper format as instructed by Project Guide. Viva- Voce must be based on the preliminary report submitted by students related to the project.

| | B.Tech. (7th Semester) Aeronautical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **AER-407A** | **INDUSTRIAL TRAINING – III** | | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credits** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time (Hrs.)** |
| **2** | **0** | **0** | **--** | **--** | **100** | **--** | **100** | |
| | | | | | | | | |

| | |
|---|---|
| **Purpose** | To provide comprehensive learning platform to students where they can enhance their employability skills and exposure to the industrial environment. |
| **Course Outcomes** | |
| **CO1** | Capability to acquire and apply fundamental principles of engineering. |
| **CO 2** | Become updated with all the latest changes in technological world. |
| **CO 3** | Capability and enthusiasm for self-improvement through continuous professional development and life-long learning |
| **CO 4** | Awareness of the social, cultural, global and environmental responsibility as an engineer. |

**Note:** AER-407A is a mandatory non-credit course in which the students will be evaluated for the industrial training undergone after 6th semester and students will be required to get passing marks to qualify.

The candidate has to submit a training report of his/her work/project/assignment completed in the industry during the training period. The evaluation will be made on the basis of submitted training report and viva-voce/presentation.

## Elective Subjects for 7th Semester Aeronautical Engineering Students

In **7th Semester**, there will be three electives, **OPEN ELECTIVE – I**, **PROGRAM ELECTIVE – III**, **PROGRAM ELECTIVE – IV**.

| OPEN ELECTIVE – I | |
|---|---|
| **Course Code** | **Course Title** |
| AEO-401A | Flight Dynamics |
| AEO-403A | Aircraft Communication and Navigation Systems |
| AEO-405A | Experimental Aerodynamics |
| AEO-407A | Microprocessor and Interfacing |

| PROGRAM ELECTIVE – III | |
|---|---|
| **Course Code** | **Course Title** |
| AEP-401A | Principles of Helicopter Engineering |
| AEP-403A | Boundary Layer Theory |
| AEP-405A | Aircraft Maintenance of Power Plant and Systems |
| AEP-407A | Fuels and Propellant Technology |

| PROGRAM ELECTIVE – IV | |
|---|---|
| **Course Code** | **Course Title** |
| AEP-409A | Computational Fluid Dynamics |
| AEP-411A | Finite Element Methods |
| AEP-413A | Aircraft Maintenance of Airframe and Systems |
| AEP-415A | Ergonomics in Aerospace |

**The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.*

# OPEN ELECTIVE – I

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **B. Tech (7th Semester) Aeronautical Engineering** | | | | | | |
| **AEO-401A** | **FLIGHT DYNAMICS** | | | | | | |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To introduce students with the advanced concepts of flight dynamics and stability** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **Understanding the performance analysis of aircraft** | | | | | | |
| **CO2** | **Introduction to the principles of load factor and turn criteria** | | | | | | |
| **CO3** | **Understanding the concept of longitudinal stability** | | | | | | |
| **CO4** | **Introduction to the advanced lateral and directional stability** | | | | | | |

### Unit-I

Range and Endurance of Propeller and Jet aircrafts, Rate of climb, Climb hodograph, Maximum Climb angle and Maximum Rate of climb- Effect of design parameters for propeller and jet aircrafts, Absolute and service ceiling, Cruise climb, Gliding flight

### Unit-II

Take-off and landing performance, Turning performance, bank angle and load factor, Constraints on load factor, Pull up and pull down maneuvers, maximum turn rate, V-n diagram.

### Unit-III

Criteria for longitudinal static stability, contribution to stability by wing, tail, fuselage, wing fuselage combination, Total longitudinal stability, Neutral point-Stick fixed and Stick free aspects, Free elevator factor, static margin, Hinge moment, longitudinal control, Movement of centre of gravity, elevator control power, elevator angle to trim, elevator angle per g, maneuver point, Stick force gradient and stick force per g, Aerodynamic balancing Aircraft Equations of motion, small disturbance theory, Phugoid motion, Factors affecting the period and damping

### Unit-IV

Directional stability-yaw and sideslip, contribution to static directional stability by wing, fuselage, vertical tail, Power effects on directional stability-propeller and jet aircrafts, Rudder lock and Dorsal fin, Directional control, rudder control power, rudder requirements, adverse yaw, asymmetric power condition, spin recovery, Lateral stability-Dihedral effect, contribution of various components, lateral control, aileron control power, strip theory, roll control by spoilers, aileron reversal, aileron reversal speed

**Text Books:**

1. Anderson, Jr., J.D. Aircraft Performance and Design, McGraw-Hill International Edition, 2012.
2. Houghton,E.L. and Carruthers, N.B. Aerodynamics for engineering students, Edward Amold Publishers, 2000

**Reference Books:**
1. Nelson, R.C." Flight Stability & Automatic Control", McGraw Hill, 2005
2. Perkins C.D. &Hage R.E. "Airplane performance, stability and control", John Wiley & Sons 1976

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **B. Tech (7th Semester) Aeronautical Engineering** | | | | | | |
| **AEO-403A** | **AIRCRAFT COMMUNICATION AND NAVIGATION SYSTEMS** | | | | | | |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To introduce students with the techniques of communication and navigation** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **Understanding the basics of communication features** | | | | | | |
| **CO2** | **Introduction to the principles of pulse modulation and its transmission** | | | | | | |
| **CO3** | **Understanding the concept of propagation of signals** | | | | | | |
| **CO4** | **Introduction to the advanced frequency systems** | | | | | | |

## Unit-I

Information: Communication systems: signals, analogue, digital and coded forms, time and frequency representation, signal spectra, types of distortion
Information: Nature and measure, influence of bandwidth and signal/noise ratio on channel capacity, elements of Shannon's theorem and its implications. Problems of communicating in presence of noise.

Modulation: Amplitude, angle and phase modulations, single and vestigial sideband forms, demodulation, Super heterodyne principle, automatic gain and frequency control, typical circuit arrangements
.

## Unit-II

Pulse modulation: Sampling principles, sampling criterion, quantisation and quantisation noise,selection of number and distribution of quantisation levels, bandwidth requirements, examples ofcoding and decoding circuits.

Transmission: Transmission lines and their circuit representation, characteristic impedance, complex propagation constant, standing wave radio, matching and impedance charts.
ChannelPerformance: Amplitude and phase distortion, phase and group delay distortion caused bymultiple effects. Noise, origin, measurements, noise figure and noise temperature effecton channel performance. Frequency and time division multiplexing.

## Unit-III

Radiation: Principles: application of basic formulae for unipole and dipole, aerials,effective height, directional, properties, gain, impedance, linear arrays, traveling waveaerials, rhombicas, parasitic elements. Propagation: Principles: influence of ionosphere andtroposphere reflection from earth's surface, field strength calculations, fading diversity reception.

## Unit-IV

Special Systems (Principles) : VHF, UHF, Fibre optics and Laser Technology, Satellitecommunication and related equipment, electronic counter measures, low-level TV andHead-down displays, CR T displays, Direction finding. Air borne telemetry systems. Laserand infrared systems, Air data and flight recording systems.Satellite communication, spread spectrum technology: satellite transponders, earthterminals.

**Text Books:**

1. F E Terman, Radio Engineering, McGraw Hill
2. E C Jordon, Electromagnetic Waves and Radiating System, Prentice Hall
3. B P Lathi, Communications Systems, John Wiley and Sons

**Reference Books:**

1. Prasad, Antenna and Propagation
2. Schwattz Bennet MWR and Stein S, Communication Systems and Techniques, McGraw Hill, NY
3. Carlson A. N., Communication Systems - An Introduction to Signals and Noise

| | B. Tech (7th Semester) Aeronautical Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| AEO-405A | EXPERIMENTAL AERODYNAMICS | | | | | | |
| L | T | P | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | - | 3 | 75 | 25 | 100 | 3h |
| Purpose | To familiarize students with the experimental techniques of aerodynamic testing | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Understanding the low speed wind tunnel testing | | | | | | |
| CO2 | Understanding the high speed wind tunnel testing | | | | | | |
| CO3 | Understanding the pressure, velocity and temperature measurement in wind tunnel | | | | | | |
| CO4 | Introduction to the computation techniques | | | | | | |

## Unit-I

Low speed wind tunnels-Power losses in wind tunnel, energy ratio, Calibration, Flow angularity,Yaw Sphere, Yaw meter, Turbulence sphere, Pressure sphere, Wind tunnel balances, boundary correction, calculation of $C_L$ and $C_D$forairfoils.

## Unit-II

High Speed wind tunnels- Blow down, Induction Type Tunnels, Losses in supersonic tunnels, Second throat, running time estimation, Hypersonic, transonic tunnels, Shock tunnels, Gun tunnels

## Unit-III

Pressure measurement, Hot wire anemometer, laser Doppler anemometer for turbulence and velocity measurements-Temperature measurement, Measurement of wall shear stress, Rotameters and Ultrasonic flow meters.

## Unit-IV

Smoke tunnel, Tuft method, chemical coating, interferometer, Schlieren and Shadowgraph method, Heleshaw Apparatus, Hydraulic analogy, limitations of analogy, Measurement systems, data acquisition, signal conditioning, multiplexing, data conversion, uncertainty analysis

**Text Book:**

1. Rathakrishnan. E “Instrumentation, Measurement and Experiments in Fluids”, CRCPress, London, 2000

**Reference Books:**

1. Rae W.H and Pope. A “Low speed wind tunnel testing” John Wiley Publication, 1999
2. Pope. AandGoin. L “High speed wind tunnel testing” John Wiley, 1985

| | B. Tech (7th Semester) Aeronautical Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| AEO-407A | MICROPROCESSOR AND INTERFACING | | | | | | |
| L | T | P | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | - | 3 | 75 | 25 | 100 | 3h |
| Purpose | To introduce students with the advanced concepts of microprocessors used in Avionics | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Understanding the basics of 8086 Architecture | | | | | | |
| CO2 | Introduction to the principles of 8086 microprocessor programming | | | | | | |
| CO3 | Understanding the concept of memory system design | | | | | | |
| CO4 | Introduction to the input output interfacing techniques | | | | | | |

## Unit-I

**INTRODUCTION:** Evolution of microprocessors, technological trends in microprocessor development. The Intel family tree. CISC versus RISC. Applications of Microprocessors.
**8086 CPU ARCHITECTURE:** 8086 Block diagram; description of data registers, address registers; pointer and index registers, PSW, Queue, BIU and EU. 8086 Pin diagram descriptions. Generating 8086 CLK and reset signals using 8284. WAIT state generation. Microprocessor BUS types and buffering techniques, 8086 minimum mode and maximum mode CPU module.

## Unit-II

**8086 INSTRUCTION SET:** Instruction formats, addressing modes, Data transfer instructions, string instructions, logical instructions, arithmetic instructions, transfer of control instructions; process control instructions; Assembler directives.
**8086 PROGRAMMING TECHNIQUES:** Writing assembly Language programs for logical processing, arithmetic processing, timing delays; loops, data conversions. Writing procedures; Data tables, modular programming. Macros.

## Unit-III

**MAIN MEMORY SYSTEM DESIGN:** Memory devices, 8086 CPU Read/Write timing diagrams in minimum mode and maximum mode. Address decoding techniques. Interfacing SRAMS; ROMS/PROMS.
Interfacing and refreshing DRAMS. DRAM Controller – TMS4500.

## Unit-IV

**BASIC I/O INTERFACE:** Parallel and Serial I/O Port design and address decoding. Memory mapped I/O Vs Isolated I/O Intel's 8255 and 8251- description and interfacing with 8086. ADCs and DACs, - types, operation and interfacing with 8086. Interfacing Keyboards, alphanumeric displays, multiplexed displays, and high power devices with 8086.
**INTERRRUPTS AND DMA:** Interrupt driven I/O. 8086 Interrupt mechanism; interrupt types and interrupt vector table. Intel's 8259. DMA operation. Intel's 8237. Microcomputer video displays.

**Text Books:**

1. D.V.Hall , Microprocessors and Interfacing , McGraw Hill 2nd ed.
2. J Uffenbeck , The 8086/8088 family , (PHI).

**Reference Book:**
1. Liu,Gibson , Microcomputer Systems – The 8086/8088 family, (2nd Ed-PHI).

## Program Elective-III

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **B. Tech (7th Semester) Aeronautical Engineering** | | | | | | |
| **AEP-401A** | **PRINCIPLES OF HELICOPTER ENGINEERING** | | | | | | |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To introduce students with the advanced concepts of rotor aerodynamics and stability** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **Understanding the basics of rotor blade motion** | | | | | | |
| **CO2** | **Understanding the concept of Actuator Disk Theory** | | | | | | |
| **CO3** | **Understanding the concept of Forward Flight Theory** | | | | | | |
| **CO4** | **Introduction to the stability of rotor and its embedded vibrations** | | | | | | |

### Unit-I

Historical development of helicopter and overview, Basic concepts, Introduction to hovering and forward flight theory, Rotor blade motion – flapping, feathering and lagging motion, Composite structures.

### Unit-II

The actuator-disc theory, Working states of rotor, Optimum rotor, Efficiency of rotor, Ground effect on lifting rotor, The effect of finite number of blades, Induced velocity and induced power in forward flight – Mangler and Squire method, flight and wind tunnel test, The vortex wake, Aerofoil characteristics in forward flight.

### Unit-III

Blade forces and motion in forward flight, Force, torque and flapping coefficient, Helicopter trim analysis, Performance in forward flight.

### Unit-IV

Longitudinal and lateral stability, Equations of motion, Stability characteristics, Auto stabilization,
Control response.
Exciting forces, Fuselage response, Vibration absorbers, Measurement of vibration in flight.

### Text Books:

1. Helicopter Dynamics: Bramwell, A.R.S.
2. Principles of Helicopter Engineering: Jacob Shapiro

### Reference Book:

1. Aerodynamics of Helicopter, Gessow, A, and Myers GC

| | B. Tech (7th Semester) Aeronautical Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| AEP-403A | BOUNDARY LAYER THEORY | | | | | | |
| L | T | P | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | - | 3 | 75 | 25 | 100 | 3h |
| Purpose | To introduce students with the advanced concepts of boundary layer theory | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Understanding the basics of boundary layer theory | | | | | | |
| CO2 | Understanding the concept of Navier Stokes Equation | | | | | | |
| CO3 | Understanding the solution of Navier Stokes Equation | | | | | | |
| CO4 | Introduction to the turbulent boundary layer concept | | | | | | |

## Unit-I

Basic laws of fluid flow- Continuity, momentum and energy equations as applied to system and control volume – Concept of flow fields- Viscous fluid flow with historical out lines of viscous flow, Boundary conditions for viscous flow problems, Development of boundary layer- Prandtl's hypothesis, Estimation of boundary layer thickness- Displacement thickness, momentum and energy thickness for two-dimensional flows. Viscosity and thermal conductivity, thermodynamic properties.

## Unit-II

General stress system in a deformable body, the rate at which the fluid element is strained in a flow, Relation between stress and rate of deformation, Stoke's hypothesis, bulk viscosity and thermodynamic properties, The Navier – Stokes Equation (N-S) –General properties of Navier – Stokes Equation.

Two dimensional flow through a straight channel. Hagen- Poiseulle flow, suddenly accelerated plane wall, Stagnation in plane flow (Hiemenz problem), Flow near a rotating disk, Very slow motion, Parallel flow past a sphere.

## Unit-III

Analysis of flow past a flat plate and a cylinder, Integral relation of Karman, Integral analysis of energy equation, Laminar boundary layer equations, Flow separation. Similarity solutions for steady two dimensional flows; Blasius solution for flat- plate flow, Boundary layer temperature profiles for constant wall temperature, Falkner Skan Wedge flows, Free shear flows- plane laminar jet, plane laminar wake. Integral equation of Boundary layer, Karman-Pohlhausen method. Digital computer solutions. Thermal boundary layer calculations- One parameter (U0 and two parameters (U0 and $\Delta T$) integral methods. Stability of laminar flows

## Unit-IV

Two dimensional turbulent boundary layer equations, Integral relations, Eddy-Viscosity theories, Velocity profiles; the law of the wall, the law of the wake. Turbulent flow in pipes and channels. Turbulent boundary layer on a flat pate, Boundary layers with pressure gradient.

Introduction to the compressible boundary layer on a flat plate, shock wave boundary layer interaction.

**Text Books:**

1. Viscous Fluid Flow 3rd Ed. Frank M White McGraw Hill 2006
2. Boundary Layer theory 6th Ed. H. Schlichting McGraw Hill 1968

**Reference Book:**

1 Aerodynamics for Engineers 4th Ed. John Bertin Pearson 2004

| | B. Tech (7th Semester) Aeronautical Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| AEP-405A | AIRCRAFT MAINTENANCE OF POWERPLANT AND SYSTEMS | | | | | | |
| L | T | P | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | - | 3 | 75 | 25 | 100 | 3h |
| Purpose | To introduce students with the maintenance of Powerplant and aircraft systems | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Understanding the basics of Piston Engines | | | | | | |
| CO2 | Understanding the concept of Propellers and aviation fuel | | | | | | |
| CO3 | Understanding the concept of Superchargers and Gas Turbine | | | | | | |
| CO4 | Introduction to the concept of Engine Maintenance | | | | | | |

## Unit-I

Piston Engines: Two and four stroke engines. Efficiency, factors affecting engine performance. Knowledge of the function and construction of various parts and accessories of the engine including induction, exhaust and cooling system, engine mounting. Engine fire detection and protection systems.

## Unit-II

Propellers: Knowledge of purpose and functioning of parts of constant speed, variable pitch and feathering propellers and associated control system components. Engine fuel and Oil System: Construction, features of carburettors, engine fuel and oil systems. Characteristics of aviation fuel and oil.

## Unit-III

Common methods of checking contamination. Sources of contamination, Ignition and starting systems: Magnetos and ignition system components, various types of engine starters. Engine Instruments: Principle of operation. Superchargers constructional features and principles of operation and function of various types of superchargers and its related component.
Gas Turbine: Induction, exhaust and cooling systems, Anti Icing of engine, engine mountings, thrust augmentation. Compressor surge and stall, bleed control system. Principles of operation.

## Unit-IV

General constructional details and functions of fuel and oil systems, ignition and starting systems and their components. Engine controls of various types, including Full Authority Digital Electronic Control Engine instruments. Power augmentation devices, thrust reversers and auxiliary power units.
Engine Maintenance: Piston/Gas Turbines: Periodical servicing procedures, engine installation checks, control rigging, ground running checks, priming, and bleeding and performance checks. Engine on condition maintenance. Trouble shooting and rectification. Inspection after shock landing. Crack detection. Procedure for long and short terms storage of engine and accessories, engine preservation.

**Text Books:**


1. E Mangham and A Peace, Jet Engine Manual, Himalayan Books
2. Jet Engines, Rolls Royce Ltd. 1992
3. Casamassa and Bent, Jet Aircraft Power Systems, Tata McGraw Hill
4. Civil Aircraft Inspection Procedures (CAP 459), Himalayan Books


**Reference Books:**


1. Pratt and Whitney, Gas Turbine Engine
2. Michacl J. Krose Thomas W.Wild, Bent, Aircraft Power Plants, McGraw Hill 1994
3. H Cohen, G F C Rogers and H I H Sarvanmutto, Gas Turbine Theory, John Wiely
4. Irvine Treager, Aircraft Gas Turbine Engine Technology, Tata McGraw Hill

| | B. Tech (7th Semester) Aeronautical Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| AEP-407A | FUELS AND PROPELLANT TECHNOLOGY | | | | | | |
| L | T | P | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | - | 3 | 75 | 25 | 100 | 3h |
| Purpose | To introduce students with the properties of aviation fuels and rocket propellants | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Providing the knowledge of aviation turbine fuels | | | | | | |
| CO2 | Understanding the concept of liquid propellants | | | | | | |
| CO3 | Introduction to concept of cryogenic propellants | | | | | | |
| CO4 | Experimental studies of propellant properties | | | | | | |

## Unit-I

Properties and tests for petroleum products - Motor gasoline - Aviation gasoline - Aviation turbine fuels - Requirements of aviation turbine fuels of Kerosene type and high flash point type - Requirements for fuel oils Single base propellants - Double base propellants – composite propellants - CMDB propellants – Metalized composite Propellants - Brief introduction to combustion theory of composite and double base propellants

## Unit-II

Various liquid propellants and their properties - Monopropellant and bipropellant systems - Concept of ullage - Ignition studies of liquid propellants - Propellant loading tolerances - Inventory-Volume versus mass loading - Loading measurement and control - Outage control

## Unit-III

Introduction to cryogenic propellants - Liquid Hydrogen, liquid Oxygen, Liquid nitrogen and liquid helium - Theory behind the production of low temperature - Expansion Engine – Cascade process - Joule Thompson Effect - Magnetic effect - Ortho and Para H2 - Hilium4 and Helium3 - Ideal cycles and Efficiency of cryo systems - Storing of cryogenic propellants - Cryogenic loading problems

## Unit-IV

Laboratory testing - Arc Image Furnace - Ignitability studies - Differential Thermal Analysis - Thermo gravimetric analysis - Particle size measurement Micro-merograph - Strand burner tests Impulse Bomb - Performance estimation

### Text Books:-

1. Sutton, G.P., Rocket Propulsion Elements, John Wiley, 1993.
2. Sharma, S.P. and Mohan. C., Fuels and Combustion, Tata McGraw Hill Publishing Co., Ltd., 1984

### Reference Book:-

1. Mathur, M. and Sharma. R.P., Gas Turbines and Jet and Rocket Propulsion, Standard Publishers, New Delhi, 1988

## Program Elective – IV

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **B. Tech (7th Semester) Aeronautical Engineering** | | | | | | |
| **AEP-409A** | **COMPUTATIONAL FLUID DYNAMICS** | | | | | | |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To introduce students with the numerical methods to solve fluid problems** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **Understanding the basics of equilibrium equation** | | | | | | |
| **CO2** | **Understanding the concept of Finite Difference and control volume** | | | | | | |
| **CO3** | **Understanding the concept of Boundary conditions used in discretisation** | | | | | | |
| **CO4** | **Introduction to the SIMPLE algorithm to find solutions** | | | | | | |

### Unit-I

Methods of prediction: comparison of experimental investigation Vs theoretical calculation; Mathematical description of physical phenomena; significance of governing differential equations; the general form of governing differential equation. Classification of problems: Physical classification: Equilibrium problems and Marching problems; Mathematical classification: Elliptic, parabolic and hyperbolic partial differential equations; Nature of co-ordinates; one way and two-way co-ordinates; Proper choice of co-ordinates.

### Unit-II

The concept of discretisation; Finite differences; Taylor series formulation; Finite difference discretisation of ordinary and partial derivatives; Truncation error, round-off error, discretization error; Consistency and stability of numerical schemes; Variation formulation; Method of weighted Residuals, control volume formulation.

### Unit-III

Steady one- dimensional Conduction, The inter-face conductivity, Non linearity, Source-Term Linearization, Types of Boundary Conditions. Unsteady one-dimensional Conduction: Explicit, Crank-Nicolson and Fully Implicit scheme's Discretisation of two and threedimensional problems, Stability analysis.

### Unit-IV

Steady one dimensional convection and diffusion, The up wind scheme, Generalized Formulation, Discretisation equation for two and three dimensional problems, The outflow Boundary condition, false Diffusion. Basic difficulty, Vorticity Based methods, Representation of the continuity equation, the staggered grid: the momentum equations, the pressure velocity corrections, and SIMPLE algorithm.

**Text Book:**

1. Computational Fluid Dynamics - By Anderson, McGraw-Hill

**Reference Book:**

1. Numerical Heat Transfer and fluid flow- By Patankar, McGraw-Hill

| | B. Tech (7th Semester) Aeronautical Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| **AEP-411A** | **FINITE ELEMENT METHODS** | | | | | | |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To introduce students with the finite element methods to solve advance structural problems** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **Understanding the basics of finite element modelling** | | | | | | |
| **CO2** | **Understanding the concept of potential energy approach** | | | | | | |
| **CO3** | **Understanding the concept of Stiffness Matrix** | | | | | | |
| **CO4** | **Introduction to the solution of axisymmetric problems** | | | | | | |

## Unit-I

Introduction to FEA - historical background - Review of various approximate methods – Raleigh Ritz's, Galerkin and finite difference methods- Governing equation and convergence criteria of finite element method, Examples of Finite Element Modeling

## Unit-II

Direct stiffness method – spring element- Derivation of the stiffness matrix- Example of a spring assemblage Assembly of global stiffness matrix-Types of boundary conditions- The Potential energy approach, Examples Prismatic bar under axial loading- bending of beams, Fundamentals of Finite Element Modeling, Element Division - Numbering Scheme, Coordinate and Shape Functions, The Potential Energy Approach, Assembly of Global Stiffness Matrix and Load Vector, Treatment of Boundary Conditions, Temperature Effects, Shear Force and Bending Moment, Examples.

## Unit-III

Plane truss structure: Introduction, Plane Trusses, Coordinate Transformation, Local & Global Coordinate, the Element Stiffness Matrix- Stress Calculations, Temperature Effects –Examples. Plane stress & strain – Constant Strain Triangle (CST)- Iso - parametric Representation- Potential Energy Approach - Element Stiffness; Force Terms Stress Calculations- Temperature Effects- Examples

## Unit-IV

Axisymmetric formulation – Element stiffness matrix and force vector – Galerkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions and Nodal Solution; Mapping and Numerical Integration– Four node quadrilateral for axisymmetric problems –Applications to cylinders under internal or external pressures – Rotating discs

**Text Books:**

1. Tirupathi.R. Chandrapatha and Ashok D. Belegundu,"Introduction to Finite Elements in Engineering", Prentice Hall India,Fourth Edition, 2011.
2. Rao. S.S., "Finite Element Methods in Engineering", Butterworth and Heinemann, Fourth Edition, 2005.

**Reference Books:**

1. Reddy J.N.,"An Introduction to Finite Element Method ", McGraw Hill, 3rd edition, 2005.
2. Krishnamurthy, C.S., "Finite Element Analysis", Tata McGraw Hill, 2nd 2001.
3. Bathe, K.J. and Wilson, E.L., "Numerical Methods in Finite Elements Analysis", Prentice Hall of India, 1985.
4. Robert D Cook, David S Malkus, Michael E Plesha, "Concepts and Applications of Finite Element Analysis", John Wiley and Sons, Inc., Fourth edition, 2001.
5. Larry J Segerlind, "Applied Finite Element Analysis", John Wiley and Sons, Inc. Second Edition, 1984
6. Daryl L. Logan, "A First Course in the Finite Element Method", 5th Edition, PWS Publishing Company, Boston, 2010.

| | B. Tech (7th Semester) Aeronautical Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| AEP-413A | AIRCRAFT MAINTENANCE OF AIRFRAME AND SYSTEMS | | | | | | |
| L | T | P | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | - | 3 | 75 | 25 | 100 | 3h |
| Purpose | To introduce students with the maintenance of airframe and aircraft systems | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Introduction to the aircraft structure parts | | | | | | |
| CO2 | Introduction to the concept of Honeycomb Construction | | | | | | |
| CO3 | Understanding the concept of aircraft systems used in structures | | | | | | |
| CO4 | Introduction to the inspection techniques in aircraft systems | | | | | | |

## Unit-I

Airframe Structure: Various types of structures in aiframe construction, tubular, braced monocoque, semimonocoque, etc, longerons, stringers, formers, bulkhead, spars and ribs,

## Unit-II

Honeycomb construction. Airplane controls, ailerons, elevators, rudder, trimming and control tabs, leading and trailing edge flaps, tailplane and fins. Basics of structure and structural components fabricated from metal, glass fibre, vinyl, prespex, composites.
Finishing materials, paints, surface finishes and associated materials.

## Unit-III

Aircraft systems : Flying controls including power operated controls, hydraulic, pneumatic, landing gear various types, shock struts, nose wheel steering, ice and rain protection, fire detection warning and extinguishing, oxygen, air - conditioning and pressurisation systems, wheels, tyres, brakes, antiskid system. Windows, doors and emergency exists. Reliability and redundancy of systems design.

## Unit-IV

Inspection: Basic principles of inspection, inspection gauges, and tools. Standard Inspection techniques and procedures. Go/No go gauges, gauge calibration and maintenance, limits and tolerance. NDT techniques in Airframe maintenance, Major and minor damage, damage tolerance. Corrosion and corrosion prevention. Major and minor defects. Defect reporting, rectification and investigation. Rigging of aircraft, symmetry checks. Balancing of control surfaces, Periodical inspections, heavy landing, overweight landing checks, abnormal flight loads. Aircraft weighing, weight schedule, calculation of centre of gravity.

**Text Books:**

1. Aircraft Manual, government of India.
2. Civil Airworthiness requirements CAA, UK.
3. FAR's FAA, U.S.A.
4. Parkinson, Engineering Inspection, Wheeler
5. Michael J. Kroes and James R Faren, Aircraft Basic Science, McGraw Hill

**Reference Books:**

1. Michael J. Kroes and William A Watkins, Aircraft Maintenance and Repair, McGraw Hill
2. Civil Aircraft Inspection Procedures (CAP 459) Pt II Aircraft, Himalayan Books
3. Airframe and Power Plant Mechanic (AC 65-15A) Airframe Hand Book, Himalayan Books.1991

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | B. Tech ($7^{th}$Semester) Aeronautical Engineering | | | | | | |
| AEP-415A | ERGONOMICS IN AEROSPACE | | | | | | |
| L | T | P | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | - | 3 | 75 | 25 | 100 | 3h |
| Purpose | To introduce students with the workplace design in aerospace industry | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Understanding the basics of ergonomics | | | | | | |
| CO2 | Understanding the concept of technology in ergonomics | | | | | | |
| CO3 | Understanding the concept of design and simulation in ergonomics | | | | | | |
| CO4 | Introduction to the case studies related to ergonomics | | | | | | |

## Unit-I

Basic Principles of Ergonomics, Anthropometry, Posture and Health; Anthropometry Practical; Displays, Controls and HMI; Tools and Equipment Design; Workplace Design and Assessment; Task Analysis; Questionnaire and Interview Design; Product Design and Evaluation; Designing for manufacture and maintenance; Health and Safety Legislation and Ergonomics.

## Unit-II

Application of Ergonomics Principles, Cognitive Ergonomics, Human Information Processing; Memory; Reading; Perception; Navigation; Problem Solving; Decision Making, Human-Computer Interaction, Input/Output Technology, Usability; Evaluation; Health problems.

## Unit-III

Future Systems, Job Design, Scientific Management, Enrichment, Enlargement, Rotation, Cells, Shift work, Management Style and Job Design, Change Management. New Technology, Unemployment, Deskilling, Introducing new technology. Questionnaire design and assessment. Task analysis techniques. Measurement of human error and risk. Use of simulation and prototypes. Product Evaluation. Experimental Design

## Unit-IV

Case Studies: A set of case studies will be used to demonstrate how ergnomics has led to changes in work activity, safety and product design. Case studies will include advanced computer applicatons, workplace assessment and re-design, accident analysis and industrial inspection, and in manufacturing. Students will be required to apply the principles to a real life ergonomic design as applied to a product, service or computer application.

### Text Books:

1. Work Design: Industrial Ergonomics – Knoz, Stephan A., Johnson, Steven, Holcomb Hathaway, Scottsdale, AZ.
2. Human factors in engineering and design – Sanders, M.S. & McCormick, E.J., 6th ed., McGraw-Hill, New York.

### Reference Books:

1. Ergonomics: Man in his working environment- Murrell, K.F.H, Champan& Hall, and London.
2. Man – Machine Engineering – Chapanis A: Wordsworth Publishing Co.
3. The Practice and Management of Industrial Ergonomics – Alexander, D.C., Prentice-Hall, Englewood Cliffs, NJ

| | B. Tech (8th Semester) Aeronautical Engineering | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **AER-402A** | **PROJECT – IV** | | | | | | | |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **10** | **5** | **0** | **100** | **100** | **200** | **3h** |
| **Purpose** | **To familiarize the students with the applications of engineering problems as a major project.** | | | | | | | |
| **Course Outcomes** | | | | | | | | |
| **CO1** | **Demonstrate a through and systematic understanding of project contents.** | | | | | | | |
| **CO 2** | **Understand methodologies and professional way of documentation and communication.** | | | | | | | |
| **CO 3** | **Know the key stages in development of the project** | | | | | | | |
| **CO 4** | **Extend or use the idea in real life applications** | | | | | | | |

The students expected to take up a project under the guidance of teacher from the college. The project must be based on (Aeronautical Engineering / Mechanical Engineering) problems, which can be extended up to the full academic session. The students may be asked to work individually or in a group not more than four students.

Students need to submit a model which can be a physical working model or simulation based virtual model with a full preliminary report in a proper format as instructed by Project Guide. Viva- Voce must be based on the preliminary report submitted by students related to the project.

## Elective Subjects for 8th Semester Aeronautical Engineering Students

In **8th Semester**, there will be four electives, **OPEN ELECTIVE – II**, **OPEN ELECTIVE – III, PROGRAM ELECTIVE – V**, **PROGRAM ELECTIVE – VI**

| **OPEN ELECTIVE – II** | |
|---|---|
| **Course Code** | **Course Title** |
| AEO-402A | Wind Tunnel Techniques |
| AEO-404A | Robotics and Automation |
| AEO-406A | Computer Aided Design |
| AEO-408A | Product Design and Manufacturing |

| **OPEN ELECTIVE – III** | |
|---|---|
| **Course Code** | **Course Title** |
| AEO-410A | Rockets and Missiles |
| AEO-412A | Introduction to Automatic Flight Control |
| AEO-414A | Aerospace Power Electronics |
| AEO-416A | Non-Destructive Testing |

| **PROGRAM ELECTIVE – V** | |
|---|---|
| **Course Code** | **Course Title** |
| AEP-402A | Space Dynamics |
| AEP-404A | Aircraft Quality Control, Quality Assurance and Certification |
| AEP-406A | Aircraft Systems and Instrumentation |
| AEP-408A | Theory of Vibrations |

| **PROGRAM ELECTIVE – VI** | |
|---|---|
| **Course Code** | **Course Title** |
| AEP-410A | Air Transportation and Aircraft Maintenance Management |
| AEP-412A | Aircraft Modeling and Simulation |
| AEP-414A | Control Theory and Practices |
| AEP-416A | Mechatronics |

**The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section*

## .OPEN ELECTIVE – II

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **B. Tech (8th Semester) Aeronautical Engineering** | | | | | | |
| **AEO-402A** | **WIND TUNNEL TECHNIQUES** | | | | | | |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To introduce students with the wind tunnel experimental techniques** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **Introduction to the test section and other parts of wind tunnel** | | | | | | |
| **CO2** | **Introduction to the concept of parameter measurement** | | | | | | |
| **CO3** | **Understanding the concept of wind tunnel balances** | | | | | | |
| **CO4** | **Introduction to the applications of wind tunnel** | | | | | | |

### Unit-I

Test section, diffuser, fan section, fan design, return passage, cooling, The breather- vibration, test section flow quality, diffuser design, wind tunnel construction, energy ratio, final form.

### Unit-II

Measurement of pressure, velocity, turbulence, flow angularity, hot wire anemometry, laser velocimeter, data acquisition, flow visualization techniques, wind tunnel calibration.

### Unit-III

Wind tunnel balances- Internal & External balances, design of wind tunnel balances, Wake survey method.

Method of Images, boundary corrections, buoyancy corrections, wake blockage, solid blockage- (2D & 3D corrections).

### Unit-IV

Applications in wind engineering, Surface vehicle testing, testing of buildings for wind forces, pollution, other applications at low Reynolds numbers.

**Text Book:**

1. Low speed wind tunnel testing:W.E.Rae and A.Pope, John Wiley 1985.

**Reference Book:**

1. Measurement of Airflow Pankhrust and Ower ,Pergamon Press

| | B. Tech (8th Semester) Aeronautical Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| **AEO-404A** | **ROBOTICS AND AUTOMATION** | | | | | | |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To introduce students with robotics and automation applications in aerospace** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **Understanding the basics of construction of types of robots and its parts** | | | | | | |
| **CO2** | **Introduction to the principles of sensor technology** | | | | | | |
| **CO3** | **Understanding the concept of automation and its levels** | | | | | | |
| **CO4** | **Introduction to the automated flow lines** | | | | | | |

## Unit-I

Introduction. Construction of manipulators, advantages and disadvantages of various kinematic structures. Applications, Non-servo robots, motion planning. Feedback systems, encoders Kinematics, homogeneous coordinates solution of the inverse kinematic problem, multiple solutions, jacobian, work envelopes. Trajectory planning. Joint Interpolated Trajectory, Link joints and their Manipulator dynamics and force control. Sensors: Vision, ranging, laser, acoustic, tactile.
.

## Unit-II

Developments in sensor technology, sensory control. Programming Language: VAL, RAIL, and AML. Mobile robots, walking devices. Robot reasoning

## Unit-III

Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations. Production Economics: Methods of Evaluating Investment Alternatives, Costs in Manufacturing, Break Even Analysis, Unit cost of production, Cost of Manufacturing Lead time and Work-in-process.

## Unit-IV

Automated Flow lines, Methods of Workpart Transport, Transfer Mechanism, Buffer Storage, Control Functions, and Automation for Machining Operations, Design and Fabrication Considerations. Analysis of Automated Flow Lines: General Terminology and Analysis, Analysis of Transfer Lines Without Storage, Partial Automation, Automated Flow Lines with Storage Buffers, Computer Simulation of Automated Flow Lines

**Text Book:**

1. K.S Fu, R.C. Gonzalez, C.S.G. Lee, Robotics, McGraw Hill, 1987.

**Reference Book:**

1. “Automation, Production Systems and Computer Integrated Manufacturing”- M.P.Grover, Pearson Education.

| | B. Tech ($8^{th}$Semester) Aeronautical Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| **AEO-406A** | **COMPUTER AIDED DESIGN** | | | | | | |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To familiarize students with the computer aided design concepts used in aerospace** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **Understanding the types of lines, projections and transformations** | | | | | | |
| **CO2** | **Understanding the design of curves, surfaces and solids** | | | | | | |
| **CO3** | **Understanding the numeric control programming** | | | | | | |
| **CO4** | **Introduction to the group technology and flexible systems** | | | | | | |

## Unit-I

Introduction to CAD/CAM, Historical developments, Industrial look at CAD/CAM, Introduction to CIM; Basics of geometric and solid modeling, explicit, implicit, intrinsic and parametric equations, coordinate systems.

Transformations: Introduction, transformation of points and line, 2-D rotation, reflection, scaling and combined transformation, homogeneous coordinates, 3-D scaling, shearing, rotation, reflection and translation, combined transformations, orthographic and perspective projections, reconstruction of 3-D objects.

## Unit-II

Curves: Algebraic and geometric forms, tangents and normal, blending functions re-parametrization, straight lines, conics, cubic splines, Bezier curves and B-spline curves.

Surfaces: Algebraic and geometric forms, tangents and normal, blending functions, re-parametrization, sixteen point form, four curve form, plane surface, ruled surface, surface of revolution, tabulated cylinder, bi-cubic surface, biezer surface, B-spline surface.

Solids: Solid models and representation scheme, boundary representation, constructive solid geometry, sweep representation, cell decomposition, spatial occupancy enumeration

## Unit-III

Automation and Numerical Control: Introduction, fixed, programmable and flexible automation, types of NC systems, MCU and other components, NC manual part programming, coordinate systems, G & M codes, Part program for simple parts, computer assisted part programming.

## Unit-IV

Group Technology: Part families, part classification and coding, production flow analysis, Machine cell design, Advantages of GT
Flexible Manufacturing Systems & Computer aided process planning: Introduction, FMS components, types of FMS, FMS layouts, planning for FMS, advantages and applications Coventional process planning, types of CAPP, Steps in variant process planning, planning for CAPP.

**Text Books:**

1. CAD/ CAM by Groover and Zimmer, Prantice Hall.
2. CAD/ CAM Theory and Practice by Zeid, McGraw Hill
3. Numerical Control and Computer Aided Manufacturing by Kundra, Rao & Tiwari, TMH.


**Reference Books:**

1 CAD/CAM (Principles, Practice & Manufacturing Management) by Chirs Mc Mohan & Jimmie Browne, Published by Addison- Wesley.

| | B. Tech (8th Semester) Aeronautical Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| **AEO-407A** | **PRODUCT DESIGN AND MANUFACTURING** | | | | | | |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To introduce students with the concept of product design and its manufacturing** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **Understanding the basics of product development** | | | | | | |
| **CO2** | **Introduction to the principles of design process** | | | | | | |
| **CO3** | **Understanding the planning for manufacturing and its management** | | | | | | |
| **CO4** | **Introduction to the intellectual property rights regarding product design** | | | | | | |

## Unit-I

**INTRODUCTION:** Product Development – Characteristics, Duration, Challenges, Organizations. Development Process– Processes, Process Flow. Product Planning – Identifying Opportunities, Prioritization, Resource allocation and Pre-Project Planning. Customer Needs – Data gathering, Organizing Needs.

**CONCEPT DEVELOPMENT:** Product and Target specification, various steps in concept generation, Brainstorming, Morphological analysis, Selection of Concepts – Subjective decision-making, Criteria ranking, Criteria weighting, Datum method, EVAD (Design Evaluation) method, Principles of Computer aided decision making

## Unit-II

**DESIGN PROCESS:** Concept Testing – Survey, Response and Interpretation. Product Architecture, Platform planning, System level design issues. Embodiment design - Introduction, Size and strength, Scheme drawing, Form design, Provisional material and process determination, Design for assembly and manufacture, Industrial design. Modeling - Introduction, Mathematical modeling, Optimization, Scale models, Simulation.

## Unit-III

**PLANNING FOR MANUFACTURE AND MANAGEMENT:** Detail Design - Factor of safety, Selection procedure for bought out components, Material Selection, Robust design, Experimental Plan. Design Management - Management of design for quality, Project planning and control, Production design specification (PDS), Quality function deployment (QFD), Design review, Value analysis/engineering

## Unit-IV

**INTELLECTUAL PROPERTY RIGHTS AND PROJECT ECONOMICS:** Intellectual Property Rights – Introduction, Study prior inventions, Write the description of the invention, Refine Claims, Pursue application. Economics and Management – Financial Model, Project Trade – Off, Accelerating Projects, Project Execution.

**Text Book:**

1. Dieter G E, ―Engineering Design‖, McGraw – Hill, 2009.

**Reference Book:**

1. A K Chitale, R C Gupta, ―Product Design and Manufacturing‖, Prentice Hall of India, 2009

## OPEN ELECTIVE – III

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | B. Tech (8th Semester) Aeronautical Engineering | | | | | | |
| AEO-410A | ROCKETS AND MISSILES | | | | | | |
| L | T | P | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | - | 3 | 75 | 25 | 100 | 3h |
| Purpose | To introduce students with the advanced concepts of propulsion in Rockets and Missiles | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Understanding the combustion system used in solid rockets | | | | | | |
| CO2 | Introduction to the principles of burnout velocity approximations and estimation | | | | | | |
| CO3 | Understanding the concept of solid rocket motors | | | | | | |
| CO4 | Introduction to the advanced trajectory analysis and introduction to electric propulsion | | | | | | |

### Unit-I

**Classification of Rockets and Missiles**-Differences-Uses-Advantages and Disadvantages. Ignition system in Rockets - Types of igniters - Igniter design considerations – Design consideration of liquid rocket combustion chamber, injector propellant feed lines, valves, Propellant tanks outlet and helium Pressurized and turbine feed systems - Propellant slosh and propellant hammer - Elimination of geysering effect in missiles .

**Combustion system of solid rockets:**Airframe components of rockets and missiles - Forces acting on a missile while passing through atmosphere - Method of describing aerodynamic forces and moments - Lateral aerodynamic moment – Lateral Damping moment and longitudinal moment of a rocket - Lift and drag forces – Drag

### Unit-II

**Estimation** - body up wash and downwash in missiles - rocket dispersion – Numerical problems. One dimensional and two dimensional rocket motions in free space and homogeneous gravitational fields - Description of vertical, inclined and gravity turn trajectories - Determination of range and altitude

**Simple Approximations to burnout velocity: -**Rocket vector control - Methods - Thrust termination - SITVC - Multistage of rockets – Vehicle optimization - Stage separation dynamics - Seperation techniques.

### Unit-III

**Selection of materials** - Special requirements of materials to perform under adverse conditions.

**Solid Rocket Motors:** General description, interior ballistics component design Techniques.

### Unit-IV

**Liquid Rocket Engines:** General description, engine cycles, power balance calculation, component design fundamentals.
**Electric Propulsion:** Classification of electric propulsion systems.
**Trajectory Analysis:** The rocket equation, vertical trajectories, multistage rockets, generalized 2D trajectory

**Text Books:**

1. Sutton, G.P., et al., "Rocket Propulsion Elements" John Wiley & Sons Inc., NewYork, 1993.
2. Mathur, M., and Sharma, R.P., "Gas Turbines and Jet and Rocket Propulsion ", Standard Publishers, New Delhi, 1998.

**Reference Books:**

1. Cornelisse, J.W.., "Rocket Propulsion and Space Dynamics ", J.W., Freeman & Co., Ltd., London, 1982.
2. Parket, E.R., "Materials for Missiles and Spacecraft ", McGraw Hill Book Co., Inc., 1982

| | B. Tech (8th Semester) Aeronautical Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| **AEO-403A** | **INTRODUCTION TO AUTOMATIC FLIGHT CONTROL** | | | | | | |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To familiarize students with the concept of automatic flight control** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **Understanding the basics of control system and types of controllers** | | | | | | |
| **CO2** | **Introduction to the principles of frequency response analysis** | | | | | | |
| **CO3** | **Understanding the concept of stability of control systems** | | | | | | |
| **CO4** | **Introduction to the digital control system** | | | | | | |

## Unit-I

Introduction And Applications: Types of control systems ; Typical Block Diagram : Performance Analysis; Applications – Machine Tool Control, Boiler Control, Engine Governing, Aerospace Control, Active Vibration Control; Representation of Processes & Control Elements – Mathematical Modeling. Block Diagram Representation, Representation of Systems or Processes, Comparison Elements; Representation of Feedback Control systems – Block Diagram & Transfer Function Representation, Representation of a Temperature, Control System, Signal Flow Graphs, Problems.
Types of Controllers: Introduction, Types of Control Action; Hydraulic Controllers; Electronic Controllers; Pneumatic Controllers; Problems.

## Unit-II

Transient And Steady State Response: Time Domain Representation; Laplace Transform Representation; System with Proportional Control; Proportional – cum – Derivative control; Proportional – cum – Integral Control; Error Constants; Problems.
Frequency Response Analysis: Introduction; Closed and Open Loop Transfer Function; Polar Plots; Rectangular Plots; Nichols Plots: Equivalent Unity Feed Back Systems; Problems.

## Unit-III

Stability of Control Systems: Introduction; Characteristic Equation; Routh's Criterion; Nyquists Criterion, Gain & Phase Margins: Problems.
Root Locus Method : Introduction; Root loci of a Second Order System; General Case; Rules for Drawing Forms of Root loci; Relation between Root Locus Locations and Transient Response; Parametric Variation; Problems..

## Unit-IV

Digital Control System : Introduction; Representation of Sampled Signal; Hold Device; Pulse Transfer Function; Block Diagrams; Transient Response; Routh's Stability Criterion; Root Locus Method; Nyquists Criterion; Problems.
State Space Analysis Of Control Systems: Introduction; Generalized State Equation; Techniques for Deriving System State – Space Equations; Transfer Function from State Equations; Solution of State Vector Differential Equations; Discrete Systems; Problems.

**Text Books:**

1. Theory & Applications of Automatic Controls by B.C. Nakra, Published by New Age International Pvt. Ltd. Publishers, New Delhi.
2. Modern Control Engg. ByUgata, Prentice Hall of India, New Delhi. 69

**Reference Books:**

1. Automatic Control Systems by Kuo' Published by Prentice Hall of India, New Delhi.
2. Control System Engineering, I. J. Nagrath and M. Gopal, New Age, New Delhi.

| | B. Tech (8thSemester) Aeronautical Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| AEO-405A | AEROSPACE POWER ELECTRONICS | | | | | | |
| L | T | P | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | - | 3 | 75 | 25 | 100 | 3h |
| Purpose | To familiarize students with the power electronics concept used in aerospace applications | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Understanding the concept of power electronics | | | | | | |
| CO2 | Introduction to the concept of thyristor and its analysis | | | | | | |
| CO3 | Understanding the concept of Phase controlled converters | | | | | | |
| CO4 | Introduction to the AC Voltage Controllers | | | | | | |

## Unit-I

Power Semiconductor Devices: Introduction, Concept of Power Electronics, scope and applications, desired Characteristics of controllable switches Power semiconductor switches and their characteristics: Power Diode, Power BJT, Power MOSFET, IGBT, SCR, TRIAC, and GTO.

## Unit-II

**Thyristor:** Rating & protection, Methods of SCR commutation, Gate Drive Circuit, Series and Parallel operation.DC-DC Converters:Introduction, Control Strategies, Buck converter, Boost Converter, Buck-Boost converter, Analysis of buckconverter, Switched Mode power Supply (SMPS).

## Unit-III

**Phase Controlled Converters:**Single phase half wave controlled rectifier with various loads, Effect of free- wheeling diode. Single phase fully controlled and half controlled bridge converters with various loads. Performance Parameters of single phase uncontrolled and controlled converters.
Three phase half wave converters, three phase fully controlled and half controlled bridge converters, Effect of source impedance, Single phase and three phase dual converters

## Unit-IV

**AC Voltage Controllers:** Principle of On-Off and phase controls, Single phase ac voltage controller with resistive and inductive loads,sequence control, Introduction to Matrix converter. Cyclo Converters:
Basic principle of operation, single phase to single phase, three phase to single phase output voltage equation.

### Text Books:

1. M.H. Rashid,"Power Electronics: Circuits, Devices & Applications", Pearson India, 4th Edition,2018.
2. Ned Mohan, T.M.Undeland and W.P.Robbins, "Power Electronics: Converters, Applications and Design", Wiley India
3. P.C. Sen, "Power Electronics", McGraw Hill Education (India) Pvt. Ltd.
4. P.S. Bhimbra, "Power Electronics", Khanna Publishers.

### Reference Books:

1. M.S. Jamil Asghar, "Power Electronics" Prentice Hall of India Ltd., 2004
2. Chakrabarti&Rai, "Fundamentals of Power Electronics &Drives", Dhanpat Rai & Sons.
3. V.R. Moorthy, "PowerElectronics: Devices, Circuits and Industrial Applications" Oxford University Press,2007

| | B. Tech (8th Semester) Aeronautical Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| AEO-407A | NON DESTRUCTIVE TESTING | | | | | | |
| L | T | P | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | - | 3 | 75 | 25 | 100 | 3h |
| Purpose | To familiarize students with the non-destructive testing methods used in aerospace applications | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Understanding the basics of non-destructive testing methods | | | | | | |
| CO2 | Introduction to the principles of testing procedure and types of methods | | | | | | |
| CO3 | Understanding the concept of Thermography method | | | | | | |
| CO4 | Introduction to the Eddy current Testing Method | | | | | | |

## Unit-I

NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterisation. Relative merits and limitations, various physical characteristics of materials and their applications in NDT Visual inspection – Unaided and aided.

## Unit-II

Liquid Penetrant Testing – Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results. Magnetic Particle Testing- Theory of magnetism, inspection materials Magnetisation methods, Interpretation and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism.

## Unit-III

Thermography- Principles, Contact and non-contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation – infrared radiation and infrared detectors, Instrumentations and methods, applications.

## Unit-IV

Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.

**Text Books:**

1. Baldev Raj, T.Jayakumar, M.Thavasimuthu “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.
2. Ravi Prakash, “Non-Destructive Testing Techniques”, 1st revised edition, New Age International Publishers, 2010

**Reference Books:**

1. ASM Metals Handbook,”Non-Destructive Evaluation and Quality Control”, American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17.
2. Paul E Mix, “Introduction to Non-destructive testing: a training guide”, Wiley, 2nd Edition New Jersey, 2005
3. Charles, J. Hellier,“ Handbook of Nondestructive evaluation”, McGraw Hill, New York 2001.
4. ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NDT Handbook,Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing, Vol. 5, Electromagnetic Testing, Vol. 6, Acoustic Emission Testing, Vol. 7, Ultrasonic Testing

## PROGRAM ELECTIVE – V

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | B. Tech (8th Semester) Aeronautical Engineering | | | | | | |
| AEP-402A | SPACE DYNAMICS | | | | | | |
| L | T | P | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | - | 3 | 75 | 25 | 100 | 3h |
| Purpose | To study basics of space and astrodynamics and conceptual overview of celestial orbits. | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | To impart the knowledge in two-body, restricted three-body and n-body problem, Hamiltonian dynamics, canonical transformations, Poincare surface sections. | | | | | | |
| CO2 | To offer a rigorous vector analysis of rotational kinematics, review of the basic Newtonian dynamics and analysis of spacecraft altitude dynamics. | | | | | | |
| CO3 | To provide necessary knowledge to study the satellite and interplanetary trajectories and formal approaches for handling coordinate transformations. | | | | | | |
| CO4 | To solve the space dynamic problems related to earth satellite orbits using Hamilton's and generate interplanetary orbits in the frame work of restricted three-body problem. | | | | | | |

**Unit-I**

**INTRODUCTION TO SPACE DYNAMICS**

Basic concepts: Atmospheric and space flight basic definitions, vector operations; Coordinate systems and rotation matrix, Euler axis and principal angle, Euler angles, Euler symmetric parameters (Quaternion), Rodriguez parameters, attitude kinematics

**Unit-II**

**FUNDAMENTALS OF SPACE FLIGHT**

Newton 's law of gravitation, gravitational potential, escapes velocity, mechanics of circular orbits and circular velocity non circular orbits; The two-body problem, derivation of Kepler 's laws from Newton 's law.

**Unit-III**

**SPACE FLIGHT ORBITS AND ATMOSPHERE ENTRY**

Orbit equation, space vehicle trajectories, transfer orbit changes. Introduction to earth and planetary entry, equations of motion for atmosphere entry; Application to ballistic entry, case study.

**Unit-IV**

**ORBIT TRANSFER**

Coplanar transfer, Hohmann transfer and Bielliptic transfer; Orbital change due to impulsive thrust; Non-coplanar transfer; Interception and Rendezvous, continuous thrust transfer.

**ATTITUDE DYNAMICS**

Euler Equations of rotational motion, rotational kinetic energy; Principal body frame, torque free rotation of spacecraft, spacecraft with attitude thrusters, spacecraft with rotors, gravity gradient satellite, dual spin satellite.

**Text Books:**

1. Ashish Tewari, ―Atmospheric and space flight dynamics‖Birkhauser publications, 1st Edition, 2007
2. Vallado, David A., ―Fundamentals of Astrodynamics and Applications‖, Kluwer Academic Publishers, London, 3rd Edition, 2007.

**Reference Books:**

1. Roy, Archie E., ―The Foundation of Astrodynamics‖, The Macmillan Company, Collier Macmillan Limited, London, 3rd Edition, 2007.
2. Kaplan, Marshall H., ―Modern Spacecraft Dynamics and Control‖, John Wiely& Sons, New York, 1st Edition, 1976.

| | B. Tech (8th Semester) Aeronautical Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| AEP-404A | AIRCRAFT QUALITY CONTROL, QUALITY ASSURANCE AND CERTIFICATION | | | | | | |
| L | T | P | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | - | 3 | 75 | 25 | 100 | 3h |
| Purpose | To familiarize students with Quality control concepts used in Aerospace Industry | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | To monitoring each phase of the design process | | | | | | |
| CO2 | To acquire the analytic ability for attention to detail and a systematic thought process. | | | | | | |
| CO3 | To review documentation related to both internal and external manufacturing processes to ensure quality products. | | | | | | |
| CO4 | To develop, register and use problem analysis to proactively identify quality process solutions | | | | | | |

## Unit-I

Reversible and irreversible flight control systems. Flying qualities of aircraft-relation to airframe transfer function. Pilot's opinion ratings. Flying quality requirements- pole-zero, frequency response and time response specifications. Displacement and rate feedback determination of gains conflict with pilot input s resolution-control augmentation systems- Full authority fly-by-wire. Auto Pilot-Normal acceleration, Turn rate, Pitch rate Commands-Applications.

## Unit-II

Maintenance Procedures: Maintenance planning; Modification procedures; Stores procedures; Certification/release procedures; Interface with aircraft operation; Maintenance Inspection/Quality Control/Quality Assurance; Additional maintenance procedures; Control of life limited components

## Unit-III

Bearings: Introduction and function of bearings, loads, material, construction; Types of bearings and their application. Testing, cleaning and inspection of bearings; Lubrication requirements of bearings; Defects in bearings and their causes. 11 Transmissions: Gear types and their application; Gear ratios, reduction and multiplication gear systems, driven and driving gears, idler gears, mesh patterns; Belts and pulleys, chains and sprockets. Inspection of gears, backlash; Inspection of belts and pulleys, chains and sprockets; Inspection of screw jacks, lever devices, push-pull rod systems

## Unit-IV

General knowledge of ground handling of Aircraft, Aircraft Safety; Mooring, Jacking, Levelling, hoisting of aircraft, Towing, Mooring of an a/c during adverse conditions. Aircraft cleaning and maintaining. Ground signaling/marshalling of aircraft in day and night time. 19 Part-IV Maintenance and handling of ground equipment's used in maintenance of aircraft. Compressors, Portable hydraulic test stands, Electrical power supply equipment, charging trolley. Air-conditioning and Heating unit, Ground support air start unit. Pressure oil unit, Fire extinguishers, jacks, Hoisting cranes/gantry, Ladders, Platforms, Trestles, and Chocks.

**Text Books:**


1. Airframe and Powerplant Mechanics (AC 65-15A)-Airframe Hand Book FAA.
2. Civil Aircraft Inspection Procedure (CAP 459) Part II Aircraft.


**Reference Books:**


1. Aircraft Maintenance and Repair ByKroes, Watkin and Delph.
2. Acceptable Methods, Techniques and practices (FAA)-EA-AC 43.13-1 A and2 A.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **B. Tech (8th Semester) Aeronautical Engineering** | | | | | | |
| **AEP-406A** | **AIRCRAFT SYSTEMS AND INSTRUMENTATION** | | | | | | |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To introduce the concepts of aircraft systems and the instruments used in aerospace industry** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **Impart the knowledge in various types of Avionics systems, its components & its applications in aerospace industries.** | | | | | | |
| **CO2** | **Offer a rigorous avionics technology, Review of the basic system integration and the different type of avionics architectures** | | | | | | |
| **CO3** | **Provide necessary knowledge to study the aircraft instrumentation sensors, displays and different type of sensors.** | | | | | | |
| **CO4** | **Give knowledge about military aircraft adaptation, avionics and mission system interface and gives the difference between civilian aircraft avionics and military aircraft avionics.** | | | | | | |

**Unit-I**

**AIRPLANE CONTROL SYSTEMS**

Flight control systems- primary and secondary flight control conventional systems; Power assisted and fully powered flight controls; Power actuated systems; Engine control systems; Push pull rod system, flexible push full rod system; Control linkages, actuation- types, description and redundancy. Components; Modern control systems; Digital fly by wire systems, control laws, implementation; Auto pilot system.

**Unit-II**

**MILITARY AIRCRAFT ADAPTATION**

Avionic and mission system interface, navigation and flight management; Navigation aids, flight deck displays, communications, aircraft systems; Applications, personnel, material and vehicle transport, air-to-air refueling, maritime patrol, airborne early warning, ground surveillance; Electronic warfare, the EW spectrum, electronic support measures, electronic countermeasures, electro-optics and the infra-red.

**Unit-III**

**AIRCRAFT INSTRUMENTATION - SENSORS AND DISPLAYS**

Air data sensors, magnetic sensing, inertial sensing, and radar sensors. The electromechanical instrumented flight deck, early flight deck instruments, attitude direction indicator, horizontal situation indicator, altimeter, airspeed indicator; Advanced flight deck display system architectures, display systems, display media, future flight deck displays.

**Unit-IV**

**AIRBORNE RADAR, ASTRIONICS - AVIONICS FOR SPACECRAFT**

Propagation of Radar waves, functional elements of radar, antenna- transmitter; Types of radar- pulse Doppler, civil aviation applications, military applications; Attitude determination and control of spacecraft, magnetometers, sun sensors, star trackers, earth and horizon sensors; Command and telemetry

**Text Book:**

1. Hirst, M., The Air Transport System, Woodhead Publishing Ltd, Cambridge, England, 2008.

**Reference Books:**

1. Wensven, J.G., Air Transportation: A Management Perspective, Ashgate, 2nd Edition 2007.
2. Belobaba, P., Odoni, A. and Barnhart, C., Global Airline Industry, 2nd Edition Wiley, 2009.
3. M. Bazargan, M., Airline Operations and Scheduling, Ashgate, 1st Edition 2004.

| | B. Tech (8th Semester) Aeronautical Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| AEP-408A | THEORY OF VIBRATIONS | | | | | | |
| L | T | P | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | - | 3 | 75 | 25 | 100 | 3h |
| Purpose | To familiarize the students about the concepts of vibrations of aircraft structures | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Impart the knowledge in various types of Avionics systems, its components & its applications in aerospace industries. | | | | | | |
| CO2 | Offer a rigorous avionics technology, Review of the basic system integration and the different type of avionics architectures | | | | | | |
| CO3 | Provide necessary knowledge to study the aircraft instrumentation sensors, displays and different type of sensors. | | | | | | |
| CO4 | Give knowledge about military aircraft adaptation, avionics and mission system interface and gives the difference between civilian aircraft avionics and military aircraft avionics. | | | | | | |

**Unit-I**

**SINGLE-DEGREE-OF-FREEDOM LINEAR SYSTEMS**

Introduction to theory of vibration, equation of motion, free vibration, response to harmonic excitation, response to an impulsive excitation, response to a step excitation, response to periodic excitation (Fourier series), response to a periodic excitation (Fourier transform), Laplace transform (Transfer Function).

**Unit-II**

**TWO-DEGREE-OF-FREEDOM SYSTEMS**

Introduction, Equations of Motion for Forced Vibration, Free Vibration Analysis of an Undamped System, Torsional System, Coordinate Coupling and Principal Coordinates, Forced-Vibration Analysis, semi definite Systems, Self-Excitation and Stability Analysis, Transfer- Function Approach, Solutions Using Laplace Transform, Solutions Using Frequency Transfer Functions.

**Unit-III**

**MULTI-DEGREE-OF-FREEDOM LINEAR SYSTEMS**

Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis; Method of matrix inversion; Torsional vibrations of multi- rotor systems and geared systems; Discrete- Time systems.

**Unit-IV**

**INTRODUCTION TO AEROELASTICITY**

Static Aeroelasticity; Typical Section Model of an Airfoil: Typical Section Model with Control Surface, Typical Section Model—Nonlinear Effects. One Dimensional Aeroelastic Model of Airfoils: Beam-Rod Representation of Large Aspect Ratio Wing, Eigenvalue and Eigen function Approach, Galerkin‘s Method. Dynamic Aeroelasticity; Hamilton ‘s Principle: Single Particle, Many Particles, Continuous Body, Potential Energy, Non potential Forces, Lagrange ‘s Equations.

**Text Books:**

1. Bismarck-Nasr, M.N., ―Structural Dynamics in Aeronautical Engineering‖, AIAA Education Series, 2nd Edition, 1999.
2. Rao, S.S., ―Mechanical Vibrations‖, Prentice-Hall, 5th Edition, 2011.
3. Earl H. Dowell, ―A Modern Course in Aeroelasticity‖ Volume 217, Duke University, Durham, NC, USA.

**Reference Books:**

1. R.L. Bisplinghoff, H.Ashley, and R.L. Halfmann, ―Aeroelasticity‖, Addison Wesley Publishing Co., Inc., 2nd Edition, 1996.
2. Leissa, A.W., Vibration of continuous system, The McGraw-Hill Company, 2nd Edition, 2011.
3. Inman, D.J., Vibration Engineering, Prentice Hall Int., Inc., 3rd Edition, 2001.

## PROGRAM ELECTIVE – VI

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | B. Tech (8th Semester) Aeronautical Engineering | | | | | | |
| AEP-410A | AIR TRANSPORTATION AND AIRCRAFT MAINTENANCE MANAGEMENT | | | | | | |
| L | T | P | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | - | 3 | 75 | 25 | 100 | 3h |
| Purpose | To understand the procedures for various segments of aircraft operations and various issues involved during the airline operations. | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Understand complexity and transport operation systems. | | | | | | |
| CO2 | Understand many transport issues involved in handling passengers, freight of aircraft. | | | | | | |
| CO3 | Understand the economics behind the aviation industry | | | | | | |
| CO4 | Understand the application of ATC and RADAR Systems in Airport Management | | | | | | |

### Unit-I

**AVIATION INDUSTRY**

Introduction, history of aviation, evolution, development, growth, challenges; Aerospace industry, air transportation industry- economic impact, types and causes; Airline industry, structure and economic characteristics; Airlines as oligopolists, other unique economic characteristics; Significance of airline passenger load factors.

### Unit-II

**AIRCRAFT MANAGEMENT**

Costs- project cash-flow, aircraft price; Compatibility with the operational infrastructure; Direct and indirect operating costs; Balancing efficiency and effectiveness-payload-range, fuel efficiency. Technical contribution to performance, operating speed and altitude, aircraft field length performance; Typical operating costs; Effectiveness- wake-vortices, cabin dimensions, flight deck.

### Unit-III

**AIRPORTS AND AIRLINES**

Setting up an airport: airport demand, airport sitting, runway characteristics, length, declared distances, aerodrome areas, obstacle safeguarding; Runway capacity, evaluating runway capacity, sustainable runway capacity; Setting up an airline, modern airline objectives; Route selection and development, airline fleet planning, annual utilization and aircraft size, seating arrangements; Indirect operating costs; Aircraft- buy or lease; Revenue generation, computerized reservation systems, yield management; Integrating service quality into the revenue-generation process; Marketing the seats; Airline scheduling; Evaluating success, financial viability, regulatory compliance, efficient use of resources, effective service

### Unit-IV

**AIRSPACE**

Categories of airspace, separation minima, airspace sectors, capacity, demand and delay; Evolution of air traffic control system, procedural ATC system, procedural ATC with radar assistance, first generation ‗automated‘ ATC system, current generation radar and computer-based ATC systems; Aerodrome air traffic control equipment and operation - ICAO future air-navigation systems (FANS); Air-navigation service providers as businesses.

**Text Book:**

1. Fundamentals of Air Traffic Control, 4th Edition, Michael S. Nolan, Thomson Brooks/Cole, USA.

**Reference Book:**

1. Planning and Design of Airports, 4th Edition, Robert Horonjeff& Francis X. McKelvey, McGraw Hill Professional Publishing.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **B. Tech (8th Semester) Aeronautical Engineering** | | | | | | |
| **AEP-412A** | **AIRCRAFT MODELING AND SIMULATION** | | | | | | |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To introduce students with the advanced concepts of modeling and simulation in aerospace** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | **Understanding the basics of mathematical modelling concepts** | | | | | | |
| **CO2** | **Introduction to the applications of mathematical modelling for aircrafts** | | | | | | |
| **CO3** | **Understanding the concept of dynamic models** | | | | | | |
| **CO4** | **Introduction to the simulation models** | | | | | | |

## Unit-I

**Mathematical Modelling:**Mathematical concepts in Modelling, Why modelling, Goals of modelling studies, Process of Mathematical modeling, Real world problem, falling rock modeling, Computational problem, Basics of curve fittings, Engineering simulations and process of solving engineering problems, Analytical and numerical problem solutions with example.

.

## Unit-II

**Aircraft Modeling:**Aircraft modeling, Aircraft state-space vectors, body-fixed coordinate systems, rotation matrix for wind and stability axes, Aircraft Equation of motion, kinetic equations for translation, kinematic equations for attitude, rigid-body kinetics, sensors and measurement systems, Introduction to Perturbation, Perturbation theory, nominal and perturbation values, Linearization of rigid body kinetics, Linear state-space model based on using wind and stability axes.

## Unit-III

**Dynamic Models:** Decoupling: longitudinal and lateral modes: Longitudinal and lateral equations, Aerodynamic Forces and Moments, longitudinal and lateral forces and moments, standard aircraft maneuvers, bank to turn, altitude control dynamic models, longitudinal and lateral stability analysis, Satellite modelling, Attitude model

## Unit-IV

**Simulation models:** Software Simulation of Aircraft dynamics models, 767 longitudinal and lateral model, F-16 Longitudinal and Lateral Mode, F2B Bristol Lateral model

**Text Book:**

1. “Computational Modelling and Simulation of Aircraft and the Environment”: Dominic J. Diston, John Wiley & Sons, Ltd., 2009

**Reference Book**:

1. “Flight Stability and Automatic Control”, R. C. Nelson, McGraw-Hill Book, 1989

| | B. Tech (8th Semester) Aeronautical Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| AEP-414A | CONTROL THEORY AND PRACTICES | | | | | | |
| L | T | P | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | - | 3 | 75 | 25 | 100 | 3h |
| Purpose | To understand and gain knowledge on aircraft control systems and its application. | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Apply stability criteria to determine the stability of an aircraft, and specify the aircraft time-domain and frequency-domain response specifications. | | | | | | |
| CO2 | Understand classical control theory in the frequency domain and modern control theory in the state space are effectively mixed to provide the student with a modern view of systems theory. | | | | | | |
| CO3 | Design control techniques for aircraft control systems, and study some feedback control applications. | | | | | | |
| CO4 | Study the controllability and observability of aerospace systems, and apply the modern control techniques to design enhanced flight control systems. | | | | | | |

**Unit-I**

**INTRODUCTION TO CONTROL SYSTEMS**

Dynamical systems-principal constituents-input, output-process (plant)-block diagram representation. Inputs- control input, noise. Function of controls regulation (hold), tracking (command)-examples. Measure of effectiveness. Sensitivity of output to control input, noise and system parameters- robustness. Deterministic and stochastic control. The pervasiveness of control in nature, engineering and societal systems. The importance of study of control system. Need for stable, effective (responsive), robust control system. Modeling of dynamical systems by differential equations-system parameters. Examples from diverse fields. First and second order systems, higher order systems, single input single output systems, and multiple-input multiple-output.

**Unit-II**

**MATHEMATICAL MODELLING OF DYNAMIC SYSTEMS**

Control system performance- time domain description- output response to control inputs-- impulse and indicial response- characteristic parameters- significance- relation to system parameters- examples- first and second order linear systems, higher order systems. Synthesis of response to arbitrary input functions from impulse and indicial response. Review of Fourier transforms and Laplace transforms- inverse transforms- significance, applications to differential equations. 's' (Laplace) domain description of input-output relations- transfer function representation- system parameters- gain, poles and zeroes. Characteristic equation- significance- examples. Frequency and damping ratio of dominant poles. Relation of transfer functions to impulse response. Partial fraction decomposition of transfer functions significance

**Unit-III**

**FLYING QUALITIES OF AIRCRAFT**

Reversible and irreversible flight control systems. Flying qualities of aircraft-relation to airframe transfer function. Pilot's opinion ratings. Flying quality requirements- pole-zero, frequency response and time response specifications. Displacement and rate feedback determination of gains conflict with pilot input s resolution-control augmentation systems- Full authority fly-by-wire. Auto Pilot-Normal acceleration, Turn rate, Pitch rate Commands-Applications.

**Unit-IV**

**STEADY STATE RESPONSE ANALYSIS**

System type, steady state error, error constants- overall system stability. Application of feedback in stability augmentation, control augmentation, automatic control-examples. Composition, reduction of block diagrams of complex systems-rules and conventions. Control system components - sensors, transducers, servomotors, actuators, filters-modeling, transfer functions. Single-input single-output systems. Multiple input-multiple output systems, matrix transfer functions-examples. Types of control problems- the problem of analysis, control synthesis, system synthesis- examples-static control of aircraft. Extension to dynamic control. System identification from input output measurements importance.

**Text Books:**


1. Kuo, B.C., ―Automatic Control Systems‖, Prentice Hall India, 1992.
2. Stevens, B.L. and Lewis, F.L., ―Aircraft Control and Simulation‖, John Wiley, 1992.


**Reference Book:**


1. Mc Lean, D., ―Automatic Flight Control Systems‖, Prentice Hall, 1990 J.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | B. Tech ($8^{th}$ Semester) Aeronautical Engineering | | | | | | |
| AEP-416A | MECHATRONICS | | | | | | |
| L | T | P | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | - | 3 | 75 | 25 | 100 | 3h |
| Purpose | To understand key elements of Mechatronics system, representation into block diagram and concept of transfer function, reduction and analysis. | | | | | | |
| Course Outcomes | | | | | | | |
| CO1 | Develop a simulation model for simple physical systems and explain mechatronics design process | | | | | | |
| CO2 | Outline appropriate sensors and actuators for an engineering application | | | | | | |
| CO3 | Explain linearization of nonlinear systems and elements of data acquisition | | | | | | |
| CO4 | Explain various applications of design of mechatronic systems | | | | | | |

**Unit-I**

Introduction, synergy of systems, definition of mechatronics, applications of mechatronics in design and modeling, actuators and sensors, intelligent controls, robotics, manufacturing etc., objectives, advantages and disadvantages of mechatronics, examples of mechatronics systems in industry. Mechanical components in mechatronics, force, friction and lubrication, materials, mechanical behavior of materials, mechanisms used in mechatronics, lever and four bar mechanisms, bearing, belt, chain, cam, slider crank, clutches etc.

**Unit-II**

System modeling and analysis, control system concepts, transfer function of physical systems, block diagrams representation of systems, transfer function of a system, standard input signals, time response of a first and second order systems to a step input, frequency response analysis, automatic control systems, digital control systems. Motion control devices, actuator types & application areas, hydraulic and pneumatic actuators, electrical actuators, DC servomotor, AC servomotor and stepper servomotor, micro-actuators, drive selection and applications.

**Unit-III**

Sensors and transducers, their static and dynamic performance characteristics, internal sensors, external sensors and micro-sensors, sensors for displacement, position and proximity; velocity, motion, force, fluid pressure, liquid flow, liquid level, temperature, light sensors, selection of Sensors. Stages in designing mechatronics systems, traditional and mechatronic design, possible design solutions, case studies of mechatronics systems, pick and place robot, automatic car park systems, engine management systems etc.

**Unit-IV**

Mechatronics in industry, autotronics, bionics and avionics and their various applications, mechatronics in manufacturing, features of mechatronics in manufacturing, flexible manufacturing systems, manufacturing automatic protocol, computer integrated manufacturing, just in time production systems, CNC machines, adaptive control machine system, CNC machine operations, challenges in mechatronics production units.

**Text Book:**

1. A Kuttan, “Introduction to Mechatronics, Oxford University Press, 2010.

**Reference Book:**

1. Alciatore&Histand, “Introduction to Mechatronics & Measurement Systems, 4e”, McGrawHill Education, 2014.

## KURUKSHETRA UNIVERSITYKURUKSHETRA
### BachelorofTechnology(Electrical & ElectronicsEngineering)(CreditBased)
### Scheme of Studies/Examination (Modified)
### SemesterIV(w.e.f.session2021-2022)

| S. No. | Course No. | Subject | L:T:P | Hours/ Week | Credits | Examination Schedule (Marks) | | | | Duration of Exam (Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Major Test | Minor Test | Practical | Total | |
| 1 | BS-207A | Applied and Computational Mathematics | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | HTM-901A | Universal Human Values II: Understanding Harmony | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 3 | *EE- 206A | Electrical Machines – II | 3:1:0 | 4 | 4 | 75 | 25 | 0 | 100 | 3 |
| 4 | *EE-208A | Power Electronics | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 5 | EEN-210A | Digital Electronics | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 6 | EEN -202A | Basics of Analog Communication | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 7 | *EE-214A | Electrical Machines Lab - II | 0:0:2 | 2 | 1 | - | 40 | 60 | 100 | 3 |
| 8 | *EE-216A | Power Electronics Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 9 | EEN-218A | Digital Electronics Lab | 0:0:2 | 2 | 1 | - | 40 | 60 | 100 | 3 |
| 10 | **MC-902A | Constitution of India | 3:0:0 | 3 | - | 75 | 25 | 0 | 100 | 3 |
| | | Total | | 28 | 22 | 450 | 270 | 180 | 900 | |

* Subjects Common with IV Semester. B.Tech. [Electrical Engg.] Scheme, K.U.K.

**MC-202A is a mandatory credit-less course in which the students will be required to get passing marks in the major test.

**Note: All the students have to undergo 4 to 6 weeks Industrial Training after 4th semester which will be evaluated in 5th semester.**

| HTM-901A | Universal Human Values II: Understanding Harmony | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3.0** | **75** | **25** | **100** | **3 Hours** |
| **Purpose** | Purpose and motivation for the course, recapitulation from Universal Human Values-I | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO 1** | Development of a holistic perspective based on self-exploration about themselves (human being),family, society and nature/existence. | | | | | | |
| **CO 2** | Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence. | | | | | | |
| **CO 3** | Strengthening of self-reflection. | | | | | | |
| **CO 4** | Development of commitment and courage to act. | | | | | | |

**Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for ValueEducation**

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' andExperiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment ofaspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at variouslevels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrarinessin choice based on liking-disliking

**Module 2: Understanding Harmony in the Human Being - Harmony in Myself!**

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

**Module 3: Understanding Harmony in the Family and Society- Harmony in**

**Human-HumanRelationship**

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the othersalient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- fromfamily to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value inrelationships. Discuss with scenarios. Elicit examples from students' lives

**Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" canbe used), pollution, depletion of resources and role of technology etc.

**Module 5: Implications of the above Holistic Understanding of Harmony on ProfessionalEthics**

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and

organizations

28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. todiscuss the conduct as an engineer or scientist etc.

**READINGS:**

**Text Book**


1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010


**Reference Books**


1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J CKumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)


**MODE OF CONDUCT**

Lecture hours are to be used for lecture/practice sessions.

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at handand motivating students to reflect, explore and verify them.

Practice hours are to be used for practice sessions.

While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions, the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration. Scenarios may be used to initiate discussion. The student is encouraged to take up" ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Practice experiments are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based onbasic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.
This course is to be taught by faculty from every teaching department, including HSS faculty. Teacher preparation with a minimum exposure to at least one 8-day FDP on Universal Human Values is deemed essential.

**ASSESSMENT:**

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.

Example:

Assessment by

faculty mentor: 5 marks

Self-assessment: 5 marks

Assessment by peers: 5 marks

Socially relevant project/Group Activities/Assignments: 10 marks

Semester End Examination: 75 marks

The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

| HM- 904A | Intellectual Property Rights for Technology Development & Management | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | The objective of this course is to familiarize the students with the basic concepts of Intellectual Property Rights for technology development & management and new developments in the field of IPR | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Understand basics of Intellectual Property Rights and importance of IPR | | | | | | |
| CO2 | Understand law of copy rights and law of patents | | | | | | |
| CO3 | Learn about industrial designs & their protection law and trade marks | | | | | | |
| CO4 | Learn about Trade Secrets and new developments in the field of IPR | | | | | | |

### UNIT- I

**Introduction:** Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

### UNIT- II

**Law of copy rights:** Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

**Law of patents:** Foundation of patent law, patent searching process, Patent and kind of inventions protected by a patent, ownership rights and transfer. Case studies of patents.

### UNIT- III

**Industrial Designs:** Introduction, need to protect industrial design, **industrial designs protection law.**

**Trade Marks:** Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

### UNIT IV

**Trade Secrets:** Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation. Unfair competition: Misappropriation right of publicity, false advertising.

**New developments:** New developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

**Text Books/References**:

1. P. Ganguli; Intellectual property right – Unleashing the knowledge economy, Tate McGraw Hill Publishing company ltd.

2. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000.

3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010

4. Deborah. E. Bouchoux; Intellectual property right, Cengage learning.

5. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006

| EENP-401A | Industrial Electrical System | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | To provide knowledge about various concepts of industrial electrical systems and their automation | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Understand residential and commercial electrical systems | | | | | | |
| CO2 | Understand various types of illumination systems and lighting schemes used for a residential and commercial premises | | | | | | |
| CO3 | Understand various concepts of industrial electrical systems | | | | | | |
| CO4 | Understand the concept related to industrial electrical system automation | | | | | | |

## UNIT- I

**Residential and Commercial Electrical Systems:** Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components

## UNIT- II

**Illumination Systems:** Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting

## UNIT- III

**Industrial Electrical Systems I :** HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

## UNIT IV

**Industrial Electrical Systems II :** DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks

**Industrial Electrical System Automation:** Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation

**Text Books/References**:


1. S. L. Uppal and G. C. Garg, “Electrical Wiring, Estimating &Costing”, Khanna publishers, 2008.
2. K. B. Raina, “Electrical Design, Estimating & Costing”, New age International, 2007.
3. S. Singh and R. D. Singh, “Electrical estimating and costing”, Dhanpat Rai and Co., 1997. Web site for IS Standards.
4. H. Joshi, “Residential Commercial and Industrial Systems”, McGraw Hill Education, 2008

| .EENP-403A | Digital Control System | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | To enable students to design and analyze discrete time (digital) control system | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Represent discrete time systems under the form of z-domain transfer functions and state-space models. Also able to obtain the model of discrete-time systems by pulse transfer function | | | | | | |
| CO2 | Analyze stability, transient response and steady state behaviour of linear discrete time systems, analytically and numerically using tools such as MATLAB and Simulink | | | | | | |
| CO3 | Design sampled data control systems. | | | | | | |
| CO4 | Describe Discrete state space model and test controllability and observability of systems | | | | | | |

## UNIT- I

**Introduction to digital control**: Introduction, Discrete time system representation, Mathematical modelling of sampling process, Data reconstruction.

**Modelling discrete-time systems by pulse transfer function**

Revisiting Z-transform, Mapping of s-plane to z-plane, Pulse transfer function, Pulse transfer function ofclosed loop system, Sampled signal flow graph

## UNIT- II

**Stability analysis of discrete time systems**: Jury stability test, Stability analysis using bi-linear transformation, Time response of discrete systems, Transient and steady state responses, Time response parameters of a prototype second order system.

## UNIT- III

**Design of sampled data control systems:** Root locus method, Controller design using root locus, Root locus-based controller design using MATLAB, Nyquist stability criteria, bode plot, Lead compensator design using Bode plot, Lag compensator design using Bode plot, Lag-lead compensator design in frequency domain.

## UNIT IV

**Discrete state space model:** Introduction to state variable model, Various canonical forms, Characteristic equation, state transition matrix, Solution to discrete state equation. Controllability, observability and stability of discrete state space models: Controllability and observability, Stability, Lyapunov stability theorem.

**Text Books/References**:


1. B. C.Kuo, Digital Control Systems, Oxford University Press, 2nd Edition, Indian Edition, 2007.
2. K. Ogata, Discrete Time Control Systems,Prentice Hall, 2ne Edition, 1995.
3. M. Gopal, Digital Control and State Variable Methods, McGraw Hill, 2/e, 2003.
4. G. F. Franklin, J. D.Powell and M. L. Workman, Digital Control of Dynamic Systems, Addison Wesley, 1998, Pearson Education, 3rd Edition.
5. K. J.Astroms and B. Wittenmark, Computer Controlled Systems - Theory and Design, Prentice Hall, 3rd Edition, 1997.

| EENP-405A | High Voltage Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | To enable students to understand important concepts of high voltage engineering | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Understand the concept of electrostatic field and effect of high electrostatic field over Gases, Liquid and solid dielectric | | | | | | |
| CO2 | Understand the concept of generation of high voltages and currents in the system | | | | | | |
| CO3 | Measure high voltages and currents in the system | | | | | | |
| CO4 | Perform Non-destructive and high voltage testing on various components of power system | | | | | | |

**.UNIT I**

**Electrostatic Field and Field Stress Control:** Electric field stresses, Numerical methods for Electric field computation, Finite Element Method, Charge simulation method.

**Conduction and Break Down in Gases:** Ionization processes, Townsend's criterion, breakdown in electronegative gases, time lags for breakdown, streamer theory, Paschen's law, break down in non-uniform field, and corona discharge

**Break Down in Liquid Dielectrics:** Conduction and breakdown in pure liquid and commercial liquid.

**Break Down in Solid Dielectrics:** Intrinsic breakdown, electromechanical breakdown breakdown of solid, dielectric and composite dielectrics.

**UNIT II**

**Generation of High Voltages and Currents:** Generation of high direct current voltages, generation of high alternating voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators..

**UNIT III**

**Measurement of High Voltages and Currents:** Measurement of high direct current voltages, measurement of high alternating and impulse Voltages measurement of high direct, alternating and impulse currents, Cathode Ray Oscillographs for impulse voltage and current measurements.

**Insulation Coordination in Electric Power Systems:** Principle of Isolation Coordination in High-Voltage & Extra-High Voltage Power System.

**UNIT IV**

**Non-Destructive Testing:** Measurement of direct current resistively, measurement of dielectric constant and loss factor, partial discharge measurements

**High Voltage Testing:** Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, testing of transformers, testing of surge arresters, radio interference measurements.

**Text Books/References** :

1. M. S. Naidu and V. Kamaraju, "High Voltage Engineering, Tata Mc-Graw Hill.

2. C. L. Wadhwa, “High Voltage Engineering”, Wiley Eastern Ltd.

3. E. Kuffel and W. S. Zacngal, High Voltage Engineering”, Pergamon Press.

4. M. P. Chaurasia , “High Voltage Engineering”, Khanna Publishers

5. R. S. Jha, “High Voltage Engineering”, DhanpatRai& sons

6. M. Khalifa,’ High Voltage Engineering Theory and Practice,’ Marcel Dekker.

7. Subir Ray,’ An Introduction to High Voltage Engineering’ Prentice Hall of India

| EENP-407A | Electric Drives | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | The main objective of the course is to impart the students with the knowledge of dynamics and controls of the electric drives. | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Understand the basic fundamentals of electric drives | | | | | | |
| CO2 | Analyse the dynamics of electric drive during starting and breaking | | | | | | |
| CO3 | Understand the concepts of power electronic control of DC drives | | | | | | |
| CO4 | Understand the concepts of power electronic control of AC drives | | | | | | |

## UNIT-1

**Fundamentals of Electric Drive:** Electric Drives and its parts, advantages of electric drives, Classification of electric drives, Speed torque conventions and multi-quadrant operations, Constant torque and constant power operation, Types of load, Load torque: components, nature and classification.

**Dynamics of Electric Drive:** Dynamics of motor-load combination, Steady state stability of Electric Drive, Transient stability of electric Drive

**Selection of Motor Power rating:** Thermal model of motor for heating and cooling, classes of motor duty, determination of motor power rating for continuous duty, short time duty and intermittent duty., Load equalization

## UNIT-2

**Braking of drives:** Purpose and types of electric braking, braking of dc, three phase induction and synchronous motors

**Dynamics During Starting and Braking:** Calculation of acceleration time and energy loss during starting of dc shunt and three phase induction motors, methods of reducing energy loss during starting. Energy relations during braking, dynamics during braking

## UNIT-3

**Power Electronic Control of DC Drives:** Single phase and three phase-controlled converter fed separately excited dc motor drives (continuous conduction only), dual converter fed separately excited dc motor drive, rectifier control of dc series motor. Supply harmonics, power factor and ripples in motor current, Chopper control of separately excited dc motor and dc series motor.

## . UNIT-4

**Power Electronic Control of AC Drives:** Three Phase induction Motor Drive: Static Voltage control scheme, static frequency control scheme (VSI, CSI, and cyclo – converter based) static rotor resistance and slip power recovery control schemes.

**Three Phase Synchronous motor:** Self-controlled scheme

**Special Drives:** Switched Reluctance motor, Brushless dc motor. Selection of motor for particular applications

**Text/Reference Books:**

1. G.K. Dubey, “Fundamentals of Electric Drives”, Narosa publishing House.
2. S.K.Pillai, “A First Course on Electric Drives”, New Age International.

3. V Subrahmanyam, “Electric Drives”, Mcgrawhill Education
4. M.Chilkin, “Electric Drives”,Mir Publishers, Moscow.
5. Mohammed A. El-Sharkawi, “Fundamentals of Electric Drives”, Thomson Asia, Pvt. Ltd. Singapore.
6. N.K. De and Prashant K.Sen, “Electric Drives”, Prentice Hall of India Ltd.
7. V.Subrahmanyam, “Electric Drives: Concepts and Applications”, Tata McGraw Hill.

| EENP-409A | Wind and Solar Energy | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | The main objective of the course is to impart the students with the detailed knowledge of working of solar and wind power plants. | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Understand the current energy scenario across the country and the world .Students will also be able to get knowledge about various types of energy resources available. | | | | | | |
| CO2 | Get knowledge about various types of Solar energy systems. | | | | | | |
| CO3 | Understand the concepts related to wind energy generation. | | | | | | |
| CO4 | Design hybrid energy systems. | | | | | | |

## UNIT 1

**Introduction:** Energy demand of world and country and gap analysis, Fossil fuel based systems, Impact of fossil fuel based systems, Non conventional energy – seasonal variations and availability, Renewable energy – sources and features, Hybrid energy systems. Distributed energy systems and dispersed generation (DG).

## UNIT 2

**Solar thermal systems:** Solar radiation spectrum, Radiation measurement, Technologies, Applications, Heating, Cooling, Drying, Distillation, Power generation; Costing: Life cycle costing (LCC), Solar thermal system.

**Solar Photovoltaic systems** : Operating principle, Photovoltaic cell concepts ,Cell, module, array, Series and parallel connections, Maximum power point tracking, Applications ,Battery charging, Pumping , Lighting,Peltier cooling , Costing: Life cycle costing ,Solar PV system

## UNIT 3

**Wind Energy:** Wind power and its sources, Wind patterns and wind data, Site selection, criterion, momentum theory, Types of wind mills, Characteristics of wind generators, performance and limitations of energy conversion systems, Load matching, Life cycle costing - Wind system LCC

## UNIT4

**Hybrid Energy Systems**: Need for Hybrid Systems, Range and type of Hybrid systems, Case studies of Diesel-PV, Wind-PV, Microhydel-PV, electric and hybrid electric vehicles.

### Text Books / References:


1. Ashok V Desai, Non-Conventional Energy, Wiley Eastern Ltd, New Delhi
2. Mittal K M, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, New Delhi
3. Ramesh R & Kumar K U, Renewable Energy Technologies, Narosa Publishing House, New Delhi
4. Wakil MM, Power Plant Technology, Mc Graw Hill Book Co, New Delhi

| EENP-411A | Computational Electromagnetic | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | To understand the basics of electromagnetic fields. To understand the finite element methods and methods of moments. To study the applications of these methods in the wireless communication systems. | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | This course defines capacitors, inductors and resistors in terms of its primary electric and magnetic quantities like electric charge, electric potential, electric current, electric and magnetic flux. | | | | | | |
| CO2 | It illustrates the concept of finite difference methods and finite element methods | | | | | | |
| CO3 | It also explains universal concepts in three-dimension real world, i.e., electro-magnetic wave propagation in free-space. | | | | | | |
| CO4 | The students will learn to define electric and magnetic fields, calculate electric and magnetic fields from stationary and dynamic charge and current distributions, solve simple electrostatic boundary problems, describe simple models for electromagnetic interaction with media, be able to choose adequate models and solution methods for specific problems, solve problems analytically and numerically, it also incorporates the understanding of method of moments and their applications. | | | | | | |

**UNIT- I**

**Introduction to electromagnetic fields:** review of vector analysis, electric and magnetic potentials, boundary conditions, Maxwell's equations, diffusion equation, Poynting vector, wave equation.

**UNIT- II**

**Finite Difference Method (FDM):** Finite Difference schemes, treatment of irregular boundaries, accuracy and stability of FD solutions, Finite-Difference Time-Domain (FDTD) method

**UNIT- III**

**Finite Element Method (FEM):** Variational and Galerkin Methods, shape functions, lower and higher order elements, vector elements, 2D and 3D finite elements, efficient finite element computations

.

**UNIT- IV**

**Method of Moments (MOM):** Integral formulation, Green's functions and numerical integration, other integral methods: boundary element method, charge simulation method Applications of these methods for EM simulation of waveguides, micro-striplines and other planar components, antennas, scatterers, radars.

**Text Books / References**:

1. M. V. K. Chari and S. J. Salon, Numerical methods in electromagnetism, Academic Press.
2. M. N. O. Sadiku, Numerical techniques in electro-magnetics, CRC Press.
3. N. Ida, Numerical modeling for electromagnetic non-destructive evaluation, Chapman and Hall.
4. S. R. H. Hoole, Computer aided analysis and design of electromagnetic devices, Elsevier Science Publishing Co.
5. J. Jin, The Finite Element Method in electromagnetics, 2nd Ed., John Wiley and Sons.
6. P. P. Silvester and R. L. Ferrari, Finite elements for electrical engineers, 3rd Ed., Cambridge University Press.

| EENO-401A | Electronic Devices | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | To familiarize the students with semiconductor technology and operation of various electronic devices. | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Understand the basics of semiconductor and semiconductor technology. | | | | | | |
| CO2 | Know about various types of Semiconductor diodes | | | | | | |
| CO3 | Understand the concepts of bipolar transistor and field effect transistors. | | | | | | |
| CO4 | Know about special semiconductor devices and semiconductor power devices. | | | | | | |

## UNIT 1

**Semiconductors:** Band structure of semiconductor, Electron & hole distribution, current transport in semiconductor & concept about mobility, Diffusion & recombination, the continuity equation & it solution and Hall effect.

**Semiconductor technology :** Introduction to technology of semiconductor devices , basic of ICs-Bipolar , MOS and CMOS type.

## Unit-II

**P-N Junction Diodes** : Structures technology , V-I characteristics , charge control equation and transient response . Types of P-N junction diode: Tunnel , Zener , Shockley , schottky, varactor diode & circuit : rectifiers , clipping and clamping circuits.

**Opto –Electronics :** Basic of opto –Electronics , photo Diodes, photo transistor , P-N Junction solar cells , LED , laser and photovoltaic device .

## Unit-III

**Bipolar Transistor**: Ebers-Mole model & charge control model, Transient behavior, small signal equivalent circuit Z parameter–h-parameter and hybrid – pai, switching and power transistor.

**Field Effect Transistor:** JFET operation and V-I characteristics, high frequency response , MOS capacitor theory , MOSFET types , MOSFET operation and V-I characteristics , equivalent circuit metal semiconductor junction and MOSFET.

## Unit-IV

**Special semiconductor Device :** Metal semiconductor contact ,MIC structure surface charge transfer and charge coupled device and their applications.

**Semiconductor power devices :** Diodes, transistors, UJT, thyristor, DIAC, TRIAC,GTO,IGBT static characteristics. and principal of operation .

**Text/Refrence Books:**

1. B.G. Streetman : Solid State Electronic Devices ( PHI)
2. S.M. Sze: Physics of Semiconductor Devices (WILEY)
3. D. Nagchoudhari : Semiconductor Devices( TMH)
4. P.S. Bimbhra : Power Electronics( KP)
5. Dubey G.K. : Thyristorised Power Controllers (NAIL)

| EENO-403A | Data Structure & Algorithms | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | The main objective of the course is to impart the students with the knowledge of data structure and various algorithms used in data structure operations. Data structure and algorithms help in **understanding** the nature of the problem at a deeper level and thereby a better **understanding** of the world. | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Understand and analyze the time and space complexity of an algorithm | | | | | | |
| CO2 | Understand operations on Stack, Queue (i.e.Priority Queue , D-Queue etc.) and link lists. | | | | | | |
| CO3 | Discuss various algorithm design techniques for developing algorithms | | | | | | |
| CO4 | Discuss various searching, sorting and graph traversal algorithms | | | | | | |

## UNIT-1

**Introduction to data structure and Algorithms:** Performance analysis of Algorithm, time complexity, Big-oh notation, Elementary data organization, data structure operations, Recurrences, Arrays, Operation on arrays, representation of arrays in memory, single dimensional and multidimensional arrays, spare matrices, Character storing in C, String operations.

## UNIT-2

**Stack, Queue and Link List:** Stack operation, PUSH and POP, Array representation of stacks, Operation associated with stacks Application of stacks, Recursion, Polish expression, Representation Queue, operation on Queue , Priority Queue , D-Queue , Singly and circularly linked list, Lists operations, Lists implementations

## UNIT-3

**Trees :** Basic terminology, Binary Trees, Binary tree representation, Complete Binary Trees, Extended binary tree, representing binary tress in memory, linked representation of Binary trees, Traversing binary trees & Searching in binary trees, Inserting in binary search trees, Complexity of searching algorithm, Heaps, general trees, Threaded binary tree.

**Graphs:** Terminology & representations, Graphs & Multigraphs, Directed Graphs, Sequential representation of graphs, adjacency Matrices, Transversal, connected component and spanning trees,

Minimum Cost spanning tree, Prims and Kruskal Algorithm, BFS, DFS, Shortest path and transitive closure, Activity networks, topological sort and critical paths.

## UNIT-4

**Searching and Sorting:** Linear search, binary Search, Internal and External sorting, Bubble sorting, selection sort, Insertion sort, quick sort, Two way merge sort, Heap sort, sorting on different keys, practical consideration for internal sorting, External Sorting, Storage Devices : Magnetic tapes, Disk Storage, Sorting with disks and Indexing techniques, introduction to B tree and B+ tree, File organization and storage management, Introduction to hoisting.

**Text / Reference Books:**


1. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, Introduction to Algorithms, PHI.
2. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication.
3. Weiss, "Data Structure & Algorithm Analysis in C", Addision Wesley.
4. Basse, "computer Algorithms: Introduction to Design & Analysis", Addision Wesley.
5. Lipschutz, "Data structure, "Schaum series.
6. Aho, hopcropt, Ullman, “Data Structure & Algorithm", Addision Wesley.
7. Aho, Hopcraft, Ullman, “The Design and Analysis of Computer Algorithms” Pearson Education, 2008

| EENO-405A | Signal and Image Processing | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | The main objective of the course is to impart the students with the knowledge of various methods to convert an image or signal into digital form and perform some operations on them, in order to get an enhanced image or signal to extract some useful information from them. | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Understand basic concepts of digital signal processing and it's application. | | | | | | |
| CO2 | Understand the concepts of frequency transformations and also learn about the structures of discrete time systems. | | | | | | |
| CO3 | Understand fundamentals of digital image, image enhancement and compression | | | | | | |
| CO4 | Understand basic concepts of digital image processing | | | | | | |

## UNIT 1

**Introduction**: Basic elements of DSP system, Advantages and disadvantage of DSP over analog processing, Application of Digital signal processing.

**Z-Transform:** Direct Z-Transform and importance of ROC, properties of Z-Transform, Inverse Z-transform methods, Rational Z-transform function representation, system function of LTI systems in Z-domain, one sided Z –Transform. Solution of difference equations. Analysis of LTI system in Z- domain, transient and steady- state response. Causality and stability. Pole- Zero Cancellations.

## UNIT 2

**FREQUENCY TRANSFORMATIONS :** Introduction to DFT, Direct Computation of DFT ,Properties of DFT, Circular Convolution , Fast fourier Transform(FFT), decimation in time ,decimation in frequency algorithm, Use of FFT in Linear Filtering , Goetzel Algorithm, Chirp-Z Transform algorithm.

**Structure of Discrete-Time Systems:** Structure for FIR Systems-direct form, Linear Phase, Cascade form, Frequency-Sampling structures, Structures for IIR- Direct, Cascade, Parallel & transposed structure, signal flow graphs .

## UNIT 3

**Digital Image Fundamentals**: Introduction, image model, sampling and Quantization, relationship between pixels, imaging geometry, photographic film, discrete, Fourier transform, properties of two dimensional Fourier transform.

**Image Enhancement and Compression:** Enhancement by point processing, spatial filtering and enhancement in the frequency domain, pseudo color image processing, image compression models, error free compression, image compression standards.

## UNIT 4

**Image Restorations:** Degradation, models, diagonalizations of matrices, inverse filtering, interactive restorations, geometric transformations.

**Image Segmentation:** Detection of discontinuities, edge linking and boundary detection, thresholding, region orienting segmentation.

**Representations and Recognition**: Representations schemes, boundary descriptors, regional descriptors, morphology, recognition and interpretation, basics.

***Text books / References:***

1. Digital Signal Processing by J.G. Proakis and D.G. Manalakis-PHI
2. Digital Signal Processing by: A.V. Oppenheim and R.W. Schafer-PHI
3. Digital Signal Processing by S. K. Mitra –TMH.

4. Digital Signal Processing by Rabinar, Gold-PHI
6. Barrie W. Jervis , "digital signal processing (Pearson education India)
7. Digital Signal Processing by S. Salivahanan- TMH
8. Rafael c. Gonzalez and Richard E. Woods, digital image processing, Addison Wesley publishing company
9. William K. Pratt, digital image processing, John Wiley and sons
10. Jain, Fundamentals of digital image processing, PHI

| EENP-402A | Power Quality & FACTS | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | The main objective of the course is to impart the students with the knowledge of various power quality issues, their effects on power system and mitigation techniques used to remove them from the system. | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Familiarize with sources of power quality issues, power quality standards & regulations | | | | | | |
| CO2 | Familiarize with various power quality issues in electrical supply system | | | | | | |
| CO3 | Understand various causes of power system harmonics, harmonic effects in the system and mitigation techniques | | | | | | |
| CO4 | Understand the working of FACTS devices and custom power devices to mitigate power quality issues | | | | | | |

## UNIT 1

**Power Quality Problems & Monitoring :** Overview and Definitions of power quality, sources of pollution, international power quality standards, and regulations.

## UNIT 2

**Power Quality Problems :** Surges, voltage sag and swell, over voltage under voltage, outage voltage, and phase angle imbalance, electric noise, harmonics, frequency deviation monitoring,

## UNIT 3

**Power System Harmonics**: Harmonic analysis, harmonic sources – the static converters, transformer magnetization and non-linear machines, are furnaces, fluorescent lighting. Harmonic effect within the power system, interference with communication harmonic measurements, Harmonic Mitigation Techniques

## UNIT 4

**FACT Systems:** Introduction – Terms & definition, Fact Controllers, Type of FACT devices i.e. SSC, SVC, TSC, SSS, TCSC, UPFC, Basic relationship for power flow control.

**Introduction to Custom Power Devices**-Network Reconfiguration devices; Load compensation and voltage regulation using DSTATCOM; protecting sensitive loads using DVR; Unified power Quality Conditioner. (UPQC), uninterruptible power suppliers

***Text books/ References:***


1. Roger C Dugan, McGrahan, Santoso&Beaty, "Electrical Power System Quality" McGraw Hill
2. Arinthom Ghosh & Gerard Ledwich, "Power Quality Enhancement Using Custom Power Devices" Kluwer Academic Publishers
3. C. Sankaran, "Power Quality" CRC Press
4. Narain G. Hingorani & Laszlo Gyugyi "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems" Wiley

| EENP-404A | Control System Design | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | The course is useful for the students to get an idea of ideal practices in the field of control systems design. Students will get in touch with recent trends in the field of modern control engineering. Here importance of designing the control systems is emphasized. | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Define fundamental control system design specifications and basic principles of controller design | | | | | | |
| CO2 | Design modern controllers based on the state space techniques and recognize the importance of observability and controllability for system design. | | | | | | |
| CO3 | Understand concept of optimal control and robust control techniques. | | | | | | |
| CO4 | Understand concept of Lyapunov's stability Criteria and optimal control | | | | | | |

## UNIT 1

**Design of Feedback Control Systems :** Introduction, Approaches to System Design, Cascade Compensation Networks, Phase-Lead Design Using the Bode Diagram, Phase-Lead Design Using the Root Locus, System Design Using Integration Networks, Phase-Lag Design Using the Root Locus, Phase-Lag Design Using the Bode Diagram, Design on the Bode Diagram Using Analytical Methods, Systems with a Pre-filter, Design for Deadbeat Response; Design Examples.

## UNIT 2

**Design of State Variable Feedback Systems:** Introduction, State space representation of physical systems, State space models of some common systems like R-L-C networks, DC motor, inverted pendulum etc., Controllable Canonical Form, Observable Canonical Form, Diagonal Canonical Form, State transition matrix, Solution of state equations, Controllability and Observability, Full-State Feedback Control Design; Observer Design; Integrated Full-State Feedback and Observer; Tracking Reference Inputs; Internal Model Design; Design Examples

## UNIT 3

**Introduction to Robust Control and optimal control :** Robust control system and system sensitivities to parameter perturbations, analysis of robustness, systems with uncertain parameters, considerations in design of robust control system, robust PID controller.

## UNIT 4

**Lyapunov's stability and optimal control:** Positive/negative definite, positive/negative semi-definite functions, Lyapunav stability criteria, introduction to optimal control, Riccatti Equation, Linear Quadratic Regulator, Design Examples.

**Text books / References:**


1. Modern Control Engineering by K. Ogata, PHI.
2. Discrete Time Control Systems by K. Ogata, PHI.
3. Automatic Control Systems by B C Kuo, PHI.
4. Control Systems, Principles and Design by M. Gopal, MC Graw Hill, 2012.

| EENP-406A | Electrical & Hybrid Vehicles | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | To provide knowledge of Electrical and hybrid vehicles to the students. | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | To learn about Electrical and Hybrid Vehicles. | | | | | | |
| CO2 | Understand about types of machinery used in Electric propulsion unit | | | | | | |
| CO3 | Understand about various methods of energy storage in Electric and hybrid vehicles | | | | | | |
| CO4 | Learn about sizing methodology of drive system and energy management strategies used in electric and hybrid vehicles | | | | | | |

## UNIT 1

**Introduction to Hybrid Electric Vehicles:** History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles.

**Hybrid Electric Drive-trains:** Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

**Electric Drive-trains:** Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

## UNIT 2

**Electric Propulsion unit:** Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

## UNIT 3

**Energy Storage:** Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

## UNIT 4

**Sizing the drive system:** Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems.

**Energy Management Strategies:** Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

**Text / Reference Books:**

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003
3. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004

| EENP-408A | HVDC Transmission System | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | The main objective of the course is to impart the students with the knowledge of high voltage direct current (HVDC) transmission system. | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Understand about HVDC transmission systems, it's merits and demerits over EHVAC System. | | | | | | |
| CO2 | Understand about various control strategies of HVDC links, harmonics, it's effects & mitigation techniques. | | | | | | |
| CO3 | Understand about various types of faults in HVDC system and their protection schemes. | | | | | | |
| CO4 | Understand about MTDC systems, it's type, control & protection schemes. | | | | | | |

**UNIT I**

Merits and Demerits of HVDC over EHVAC, type of HVDC links, Analysis Of 3- phase bridge converter with grid control for $U \leq 60^o$ and $U > 60^o$, derivation of equivalent circuit of HVDC link.

**UNIT II**

Basic means of control of HVDC link, C.C.A., C.C. and C.E.A, Control Characteristics of a converter, Harmonics in HVDC Operation, types of filters used for harmonic elimination, characteristics harmonics, characteristic AC current harmonics, Non characteristics AC harmonics, harmful effects.

**UNIT III**

Protection aspects of a HVDC link, types of faults, over current protection, over voltage protection, ground and short circuit fault & their protection.

**UNIT IV**

Multi Terminal DC systems (MTDC): Types, control, protection and applications, Corona & R.I characteristics of HVDC link.

**Suggested Text / Reference books:**


1. K.P. Padyar, "HVDC Power Transmission Systems", Wiley Eastern Ltd.
2. E.W. Kimbark, "Direct Current Transmission", Vol.I, Wiley Intersect
3. J. Arrillage, "High Voltage Direct Current Transmission", Peter Peregrines
4. S. Rao," EHV-AC and HVDC transmission Engineering Practice", Khanna publishers

| EENP-410A | Power System Dynamics and Control | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | This subject is designed to give a basic understanding of dynamic modeling of synchronous machines and associated governor, turbine and excitation system modeling to the students. This course will help the students to develop in-depth knowledge of modeling & control of large power systems. | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Understand the basic concept of power system dynamics, stability and control. | | | | | | |
| CO2 | Students will learn about development of various types of models used for synchronous machines. | | | | | | |
| CO3 | Understand the concept of modeling of synchronous machines & excitation systems. | | | | | | |
| CO4 | Analyze single machine system. | | | | | | |

### UNIT I

**Basic Concepts:** Introduction to system dynamics, Power system stability states of operation and system security, system dynamics Problems, system model, analysis of steady State stability and transient stability, simplified representation of excitation control.

### UNIT II

**Modeling of Synchronous Machine**: Synchronous machine – park's Transformation, analysis of steady state performance, per unit quantities, Equivalent circuits of synchronous machine, determination of parameters of equivalent circuits.

### UNIT III

**Excitation System:** Modeling of excitation system, block diagram of excitation system, system representation by state equations, Dynamics of a synchronous generator connected to infinite bus, system model Synchronous machine model, stator equations, rotor equations, Synchronous machine model with field circuit , one equivalent damper winding on q axis (model 1.1), calculation of Initial conditions.

### UNIT IV

**Analysis of Single Machine System:** Small signal analysis with block diagram representation, Characteristic equation and application of Routh Hurwitz criterion, synchronizing and damping torque analysis, small signal model, State equations.

**Application of Power System Stabilizers:** power system stabilizers, basic concepts in applying PSS, Control signals , Structure and tuning of PSS, Washout circuit , Dynamic compensator analysis of single machine infinite bus system with and without PSS.

## Suggested Text / Reference books:


1. K. R. Padiyar," Power system dynamics "- B.S. Publications.
2. P.M. Anderson and A. A. Fouad, "Power system control and stability", IEEE Press
3. R. Ramanujam, "Power Systems Dynamics"- PHI Publications.
4. Padiyar K R, Power System Dynamics, Stability and Control, Interline Publishing, 1996.
5. Machowski J, Bialek J W, and Bumby J R, Power System Dynamics and Stability, John Wiley and Sons, 1997.
6. Prabha Kundur, Power System Stability and Control, Tata McGraw Hill Edn, 2006.

| EENP-412A | Advanced Electric Drives | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | To impart knowledge about fundamentals of Electric drives and control, operational strategies of dc and ac motor drives as per different quadrant operations | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Understand the basic fundamentals of electric drives | | | | | | |
| CO2 | Acquire knowledge of DC motor drive and its operational strategies | | | | | | |
| CO3 | Acquire knowledge of AC motor drives and its operational strategies. Students will also be able to know about open loop dynamic performance of AC & DC drives. | | | | | | |
| CO4 | Understand operations of various industrial drives. Students will also be able to acquire the knowledge of selection of drives as per practical operational industrial requirement. | | | | | | |

## UNIT I

**Introduction:** Definition of electric drive, type of drives; Speed torque characteristic of driven unit/loads, motors, joint speed-torque characteristic; Classification and components of load torque; Review of power converters used in drives, multi-quadrant operation of electric drive, example of hoist operation in four quadrant.

## UNIT II

**DC Motor Drive and its Operational Strategies:** Dynamic model of machine with armature voltage control only and converters with continuous conduction only; Closed loop control using single (speed) and two loops (speed, current), Implementation using circulating current type three phase dual converter and four quadrant transistorized chopper, Closed loop control of solid state DC drives

.

## UNIT III

**AC Drives and its Operational Strategies:** Induction Motor Drives. Starting & braking, VSI control, CSI control, Direct torque and flux control of induction motor, Variable frequency operation of three phase symmetrical induction machine, Scalar control methods for constant power and constant torque modes, Vector control of induction machine

**Open-loop Dynamic Performance of AC & DC Drives:** Starting & reversal time, Energy consumption & energy savings principle. Drives Application Engineering for Fan, Pump, Compressor, Lift-Elevator, Kiln, Winder-Un-Winder, Traction application. Synchronization and master-slave configuration.

## UNIT IV

Self controlled synchronous motor drive, Vector control of synchronous motor, Switched reluctance motor drive, Brushless DC motor drive, Permanent magnet drives, Switched Reluctance Motors, performance characteristics, Stepper motor and switch reluctance motor drives, solar and battery powered drives

## Suggested Text / Reference books:


1. G.K.Dubey, Power semi conductor controlled drives, Prentice Hall, January 1989
2. G.K.Dubey, Fundamentals of Electrical Drives, 2nd Revised edition, Alpha Science International Ltd, 15 October 2001
3. B.K. Bose, Power electronics and variable frequency drives, Wiley-Blackwell, 21 September 1996
4. Bose B.K., Modern Power Electronics & AC Drives, PHI Pvt. Ltd., (2001)

5. Mohan, N., Electric Drives: An Integrative Approach, MNPERE (2001).
6. Mohan, N., Advanced Electric Drives: Analysis, Control, and Modeling Using Simulink, MNPERE (2001).
7. Krishnan, R., Electric Motor & Drives: Modeling, Analysis & Control, PHI Pvt. Ltd. (2001).
8. Leonard, W., Control of Electric Drives, Springer-Verlag, New York, (1985)
9. Miller, T.J.E., Brushless Permanent Magnet and Reluctance Motor Drives, Oxford Science, Oxford (1989).

| EENO-402A | Analog & Digital Communication | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | To make students aware about various analog and digital modulation techniques used in communication system | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **After completion of course students will be able to** | | | | | | | |
| CO1 | Understand the Amplitude Modulation in communication system. | | | | | | |
| CO2 | Comprehend the Frequency & Phase modulation | | | | | | |
| CO3 | Realize the Pulse Modulation Techniques | | | | | | |
| CO4 | Get the Digital Modulation Techniques and their use in communication system. | | | | | | |

## UNIT-I

Elements of communication system and its limitations, Amplitude modulation and detection, Generation and detection of DSB-SC, SSB and vestigial side band modulation, carrier acquisition AM transmitters and receivers, Super hetrodyne Receiver, IF amplifiers, AGC circuits, Frequency Division multiplexing

## UNIT-II

**Angle Modulation:** Basic definition, Narrow-Band and wideband frequency modulation, transmission bandwidth of FM signals, Generation and detection of frequency modulation, Generation and detection of Phase Modulation.

**Noise:** External noise, internal noise, noise calculations, signal to noise ratio.

## UNIT-III

**Pulse Modulation:** Introduction, sampling process, Analog Pulse Modulation Systems, Pulse Amplitude Modulation (PAM), Pulse width modulation (PWM) and Pulse Position Modulation (PPM).

Waveform coding Techniques: Discretization in time and amplitude, Quantization process, quantization noise, Pulse code Modulation, Differential Pulse code Modulation, Delta Modulation and Adaptive Delta Modulation

## UNIT-IV

**Digital Modulation Techniques:** Types of digital modulation, waveforms for amplitude, frequency and phase shift keying, coherent and non-coherent methods for the generation of ASK, FSK and PSK. Comparisons of above digital modulation techniques.

**Time Division Multiplexing:** Fundamentals, Electronic Commutator, Bit/byte interleaving, TI carrier system, synchronization and signaling of TI, TDM and PCM hierarchy, synchronization techniques.

### Text / Reference Books:


1. B.P. Lathi, “Modern Digital and Analog Communication Systems”, 4th Edition, Oxford University Press.
2. G.Kennedy and B. Davis,” Electronic Communication Systems” 4th Edition, McGraw Hill
3. R.P. Singh & S.D. Sapre, “Communication Systems Analog and Digital”, 3th Edition, McGraw Hill.
4. John G. Proakis, "Communication Systems Engineering 2nd Edition, Pearson Education, 2015
5. H. Taub, D L Schilling, Gautam Saha, “Principles of Communication”, 4th Edition, McGraw Hill.
6. (Schaum's Outline Series) H P HSU & D Mitra, “Analog and Digital Communications”, McGraw Hill 3rd Edition.
7. Simon Haykin, “Communication Systems”, 5th Edition, Wiley India.
8. T.L. Singal, “Analog & Digital Communication”, McGraw Hill

| EENO-404A | Wavelets Transform | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | The main objective of the course is to impart the students with the knowledge of various types of Wavelets transform and their application for data compression and other uses. | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Understand the concept of continuous & descrete wavelet transform and orthogonal wavelet decomposition | | | | | | |
| CO2 | Learn about MRA, Orthonormal wavelets and their relationship with filter banks | | | | | | |
| CO3 | Understand the use of wavelets transform for Data compression & video coding | | | | | | |
| CO4 | Understand the various applications of wavelets transform | | | | | | |

## UNIT 1

**Continuous Wavelet Transform:** Introduction, Definition of the CWT, the VWT as a Correlation, Constant-Factor Filtering Interpretation and Time-Frequency Resolution, the VWT as an Operator, Inverse CWT, Problems.

**Introduction to Discrete Wavelet Transform and Orthogonal Wavelet Decomposition**: Introduction, Approximation of Vectors in Nested Linear Vector Subspaces, Examples of an MRA, Problems.

## UNIT 2

**MRA, Orthonormal Wavelets, and their Relationship to Filter Banks:** Introduction, Formal Definition of an MRA, Construction of General Orthonormal MRA, a wavelet Basic for the MRA, Digital Filtering Interpretation, Examples of Orthogonal Basic Generating Wavelets, Interpreting Orthonormal MRAs for Discrete-Time signals, Miscellaneous Issues Related to PRQME Filter Banks, generating Scaling Functions and wavelets from Filter Coefficient, Problems.

## UNIT 3

**Wavelet Transform and Data Compression:** Introduction, Transform Coding, DTWT for Image Compression, Audio Compression, Video Coding Using Multi-resolution Techniques: a Brief Introduction.

## UNIT 4

**Applications of Wavelet Transforms:** Introduction, Wavelet denoising speckles Removal, Edge Detection and Object Isolation, Image Fusion, Object Detection by Wavelet Transform of Projections, Communication application.

**Text Books / References:**

1. James S. Walker, "A Primer on Wavelets and their Scientific Applications", CRC Press, (1999).
2. Rao, "Wavelet Transforms", Pearson Education, Asia.
3. C. Sidney Burrus, Ramesh A. Gopinath, "Introduction to Wavelets and Wavelets Transforms", Prentice Hall, (1997).

| EENO-406A | Embedded System | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | To introduce the students to concepts of embedded systems. To offer them a level of confidence in microcontroller based system design. To introduce them to the concepts of ARM architectures and RTOS. | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Understand various concepts of embedded system | | | | | | |
| CO2 | Learn about 8051 Microcontroller | | | | | | |
| CO3 | Understand the operating system of Embedded system and also learn about higher embedded system | | | | | | |
| CO4 | Learn about communication basics and interfacing of various devices to the microcontroller | | | | | | |

## UNIT 1

**Introduction to embedded system:** Embedded System, Embedded versus external memory devices, CISC and RISC processors, Harvard and Von Neumann Architecture, Application of Embedded System, Embedded operating system, Design Parameters of embedded and its Significance, Design life cycle, Hardware fundamentals, Digital circuit parameter, O.C and Tristate outputs, I/O sink and Source, Custom single purpose processor Optimization, FSMD, data path & FSM , General purpose Processor and ASIP'S

## UNIT 2

**8051 Microcontrollers:** 8051 microcontrollers-Assembly language, Architecture of 8051, Registers, Addressing Modes, Instruction Set, I/O ports, memory organization, Programs showing use of I/O Pins, Interrupts, Interrupt Programming, Timer and counters, Serial Communication, Programming of serial communication.

## UNIT 3

**Introduction to operating system and basics of higher embedded system:** Introduction to RTOS, Tasks, Data, Semaphores and shared data, Operating system services, Message queues, Mailboxes, Advanced processor (Only architecture), 80386, 80486, Introduction to ARM, features, architecture, instruction set

## UNIT 4

**Communication basics and interfacing of various devices the microcontroller:** Microprocessor interfacing I/O addressing, direct memory access (DMA), Arbitration, multilevel bus architecture, serial protocol, parallel protocols and wireless protocol, Real world interfacing: LCD, Stepping motor, ADC, DAC, LED, Pushbuttons, Keyboard, Latch connection, PPI

**Text / Reference Books:**

1. Embedded system Design-Frank Vahid/ Tony Givargis. John Willey
2. Microcontroller (Theory and applications) Ajay V Deshmukh, Tata , McGraw-Hill
3. An Embedded Software Primer-David E.Simon, Pearson Education
4. The 8051 Microcontroller and embedded systems-Muhammad Ali Mazidi and Janice Gillispie.
5. Microcontrollers (Architecture, Implementation & Programming) Kenneth Hinz, DanielTabak,Tata McGraw-Hill
6. 8051 Microcontrollers & Embedded Systems 2nd edition Sampath Kr. Katson books

| EENO-408A | Mobile Communication & Networks | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | To introduce the students to the concepts of Wireless & Mobile communication and networks. Study of this subject will also provide knowledge to students about various mobile telephony generations such as 1G, 2G, 3G, 4G systems etc. and their abilities and limitations. | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Familiarize with fundamentals of mobile communication systems. | | | | | | |
| CO2 | Familiarize with the role of equalization in Mobile communication and also learn about different types of Equalizers. Students will also able to know about different types of multiplexing and multiple access techniques used in mobile communication system. | | | | | | |
| CO3 | To learn about the concept of GSM in real time applications (in mobile telecommunication) | | | | | | |
| CO4 | Familiarize with Wireless and Mobile Networks and higher generation cellular standards | | | | | | |

## UNIT 1

Evolution of mobile radio communication fundamentals. General Model of Wireless Communication Link, Types of Signals, Cellular Infrastructure, Cellular System Components, Antennas for Cellular Systems, Operation of Cellular Systems, Channel Assignment, Frequency reuse, Channel Assignment strategies, Handoff Strategies Cellular Interferences, Sectorization; Wireless Channel and Radio Communication, Free Space Propagation Model, Channel Noise and Losses, Fading in Land Mobile Systems, Multipath Fading, Fading Effects on Signal and Frequency, Shadowing.

## UNIT 2

**Equalization Techniques:** Transversal Filters, Adaptive Equalizers, Zero Forcing Equalizers, Decision Feedback Equalizers, and related algorithms.

**Multiplexing and Multiple Access Techniques:** FDMA, TDMA, CDMA, OFDMA, SCFDMA, IDMA Schemes and Hybrid Method of Multiple Access Schemes, RAKE Receiver; Multiple Access for Radio Packet Systems: Pure ALOHA, Slotted ALOHA, CSMA and their versions; Packet and Pooling Reservation Based Multiple Access Schemes.

## UNIT 3

**GSM system for mobile Telecommunication**: General Packet Radio Service, Edge Technology; CDMA 2000, Wireless Local Loop, IMT 2000 and UMTS, Long Term Evolution (LTE), Mobile Satellite Communication, Introduction to Mobile Adhoc Networks, Li-Fi Communication, Ultra-Wideband Communication, Mobile data networks, Wireless Standards IMT 2000

## UNIT 4

**Wireless and Mobile Networks:** Networks introduction, Network Coverage, Network topologies, Network Architecture, Network Technologies, Evolution of Cellular Networks (0G ~4G) , Wireless Area networks ( WLANs) , Bluetooth and Personal Area networks (PANs), Adhoc networks

**Higher Generation Cellular Standards:** 3G Standards: evolved EDGE, enhancements in 4G standard, Architecture and representative protocols, call flow for LTE, VoLTE, UMTS, Introduction to 5G.

**Text / Reference Books:**

1. T.S. Rappaport, “Wireless Communication-Principles and practice”, Pearson Publications, Second Edition.
2. Misra, Wireless Communication & Network: 3G & Beyond, McGraw Hill Education
3. Jaganathan, Principles of Modern Wireless Communication System, McGraw Hill Education
4. Upena Dalal, “Wireless Communication and Networks”, Oxford Press Publications.
5. T L Singal ,“Wireless Communications ”, McGraw Hill Education.
6. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press.
7. S. Haykin & M. Moher, “Modern wireless communication”, Pearson, 2005.
8. “Mobile Communication”, Jochen Schiller, Pearson Education, 2nd Edition

9. G.Sasibhushana Rao, "*Mobile Cellular Communication*", Pearson, 2013.
10. W.C.Y. Lee - Mobile Cellular Communications, 2nd Edition, MC Graw Hill, 1995.
11. Yi-Bing Lin - Wireless and Mobile Network Architectures, 2nd Edition, Wiley, 2008.

| EENO-410A | Thermal and Fluid Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | The objective of this course is to familiarize the students with the basic concepts of Thermo dynamics and Fluid engineering. | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | State the thermodynamic system, properties and equilibrium. Describe the ideal and real gas laws. | | | | | | |
| CO2 | Analyze and solve the first and second law of thermodynamics problems. | | | | | | |
| CO3 | Understand the basic concepts of fluid and learn about fluid statics. | | | | | | |
| CO4 | Understand the basic concepts of fluid kinematics and analyse the laws of fluid dynamics and its applications. | | | | | | |

## UNIT-I

**Basic Concepts: Thermodynamics:** Macroscopic and Microscopic Approach, Thermodynamic Systems, Surrounding and Boundary, Thermodynamic Property – Intensive and Extensive, Thermodynamic Equilibrium, State, Path, Process and Cycle, Quasi-static, Reversible and Irreversible Processes, Working Substance. Concept of Thermodynamic Work and Heat, Equality of Temperature, Zeroth Law of Thermodynamic and its utility.

**Ideal and Real Gases:** Concept of an Ideal Gas, Basic Gas Laws, Characteristic Gas Equation, Avagadro's law and Universal Gas Constant, P-V-T surface of an Ideal Gas. Vander Waal's Equation of state, Reduced Co-ordinates, Compressibility factor and law of corresponding states. Mixture of Gases, Bass, Mole and Volume Fraction, Gibson Dalton's law, Gas Constant and specific Heats, Entropy for a mixture of Gases.

## UNIT II

**First Law of Thermodynamics**: Energy and its Forms, Energy and 1st law of Thermodynamics, Internal Energy and Enthalpy, 1st Law Applied to Non-Flow Process, Steady Flow Process and Transient Flow Process, Throttling Process and Free Expansion Process. Numerical

**Second Law of Thermodynamics:** Limitations of First Law, Thermal Reservoir Heat Source and Heat Sink, Heat Engine, Refrigerator and Heat Pump, Kelvin- Planck and Clausius Statements and Their Equivalence, Perpetual Motion Machine of Second Kind. Carnot Cycle, Carnot Heat Engine and Carnot Heat Pump, Carnot's Theorem and its Corollaries, Thermodynamic Temperature Scale, Numerical

## UNIT III

**Fluid Properties**: Concept of fluid and flow, ideal and real fluids, continuum concept, Properties of fluid: mass density, weight density, specific volume, specific gravity, viscosity, causes of viscosity, surface tension, capillarity, vapour pressure, compressibility and bulk modulus, Newtonian and non-Newtonian fluids.

**Fluid Statics**: Pressure, Pascal's law, hydrostatic law, pressure measurement, manometers, hydrostatic forces on submerged plane and curved surfaces, buoyancy, stability of floating and submerged bodies, liquids in relative equilibrium. Problems.

## UNIT IV

**Fluid Kinematics:** Eulerian and Lagrangian description of fluid flow; types of fluid flows, stream, streak and path lines; acceleration of a fluid particle, flow rate and continuity equation, differential equation of continuity in cartesian and polar coordinates, rotation and vorticity, circulation, stream and potential functions, flow net.

**Fluid Dynamics:** Concept of system and control volume, Euler's equation, Bernoulli's equation and its practical applications, venturimeter, orificemeter, orifices, mouthpieces, Impulse momentum equation, kinetic energy and momentum correction factors.

**Text / Reference Books:**

1. Engineering Thermodynamics – C P Arora, Tata McGraw Hill
2. Engineering Thermodynamics – P K Nag, Tata McGraw Hill
3. Thermal Science and Engineering – D S Kumar, S K Kataria and Sons
4. Engineering Thermodynamics -Work and Heat transfer – G F C Rogers and Maghew Y. R. Longman
5. Introduction to Fluid Mechanics – R.W. Fox, Alan T. McDonald, P.J. Pritchard, Wiley Publications.
6. Fluid Mechanics – Frank M. White, McGraw Hill
7. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar, S.K. Kataria and Sons
8. Fluid Mechanics – Streeter V L and Wylie E B, Mc Graw Hill
9. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas, Tata McGraw Hill.
10. Mechanics of Fluids – I H Shames, Mc Graw Hill
11. Fluid Mechanics: Fundamnetals and Applications -YunusCengel and John Cimbala, McGraw Hill.
12. Fluid Mechanics: Pijush K. Kundu, Ira M. Cohen and David R. Rowling, Academic Press.

| EENO-412A | Automobile Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | To make aware the students with the study of engineering which teaches manufacturing and mechanical-mechanisms as well operations of automobiles. It is an introduction to vehicle engineering which deals with motorcycles, cars, buses trucks etc. It includes branch study of mechanical, electronic, and safety elements. Some of the engineering attributes and disciplines that are of importance to the automotive engineer. | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| **CO1** | Students will be able to Develop a strong base for understanding future developments in the automobile industry | | | | | | |
| **CO2** | Students will be able to Explain the working of various parts like engine, transmission, gear box etc. | | | | | | |
| **CO3** | Students will be able to Describe how the brakes and the suspension systems operate | | | | | | |
| **CO4** | Students will be able to Understand the steering geometry and emission control system. | | | | | | |

## UNIT I

**Introduction:** Brief history of automobiles, Main components of an automobile, Brief description of each component. Brief description of constructional details and working of a four stroke I.C. Engine (S.I. Engines and C.I. Engines) including lately developed overhead cam shaft, Multi-cylinder engines, Introduction to recent developments in I.C. Engines- Direct injection systems, Multi-point fuel injection systems, Introduction, Brief description of different components of Transmission System.

**Clutch**: Introduction to Clutch and its different types, Principle of Friction Clutch, Clutch Lining and friction materials used in Friction Clutches, Torque transmitted, Brief description of Cone Clutch, Single Plate and Multiplate Clutches, Dry and wet clutches, Automatic clutch action, Centrifugal clutches, Electromagnetic clutches, Fluid Flywheel.

## UNIT II

**Gear Box:** Gear Box Air resistance, gradient resistance and rolling resistance coming across a moving automobile, Tractive effort, Variation of tractive effort with speed, Performance curves (object and need of a gear box), Sliding mesh gear box, Control mechanism, Sliding type selector mechanism, Ball type selector mechanism, Steering column gear shift control, Constant mesh gear box, Synchromesh device, Automatic transmission in general, AP automatic gear box, Torque converter, Torque converter with direct drive, Lubrication of Gear Box.

**Propeller Shaft:** Functions and requirements of a propeller shaft, Universal joints, Constructional forms of universal joints, Flexible-ring joints, Rubber-bushed flexible joints. Constant-velocity joints. Differential : Principle of operation, Constructional details of a typical Differential unit, Traction control differentials, Multi-plate clutch type traction control device.

## UNIT III

**Brakes:** Functions and methods of operation, Brake efficiency. Elementary theory of shoe brake, brake shoe adjustments, A modern rear-wheel brake, Disc brakes, Brake linkages, Leverage and adjustment of the brake linkage, Servo- and power operated brakes, Vacuum brake operation,' Hydraulic Brakes-constructional details and working, Direct action vacuum servos, Power-operated brakes, A dual power air brake system,

**Suspension system**: Suspension principles, Road irregularities and human susceptibility, Suspension system, Damping, Double tube damper, Single tube damper, Lever arm type damper, Springs-Leaf springs, Coil and torsion springs, variable rate springs, Composite leaf springs, Rubber springs, Air springs, Adjustable and self-adjusting suspensions, Interconnected suspension system, Interconnected air and liquid suspensions, Independent suspension system, Different independent suspension layouts, McPherson strut type, Rear suspension-live axle, McPherson strut rear suspension.

**UNIT IV**

**Steering Geometry**: Castor, Camber, Kingpin inclination, Combined angle, Toe-in, Steering system-basic aims, Ackerman linkage, Steering linkages for independent suspension, Center point steering, Costarring or trailing action, Cornering power, Self-righting torque, Steering characteristics-over steer and under steer, Axle beam, Stub-axle construction, Steering column, Reversible and irreversible steering, Rack-and-pinion steering mechanism, Effect of toe-in on steering, Power steering, Vickers System. Recent trends in automobile engineering Multi fuel automobiles, Automobiles running on alternate sources of energy, Emission control through catalytic converter, Double catalytic converter, Aspects of pollution control in Automobiles.

**Reference and Text Books:**

1. The Motor Vehicle - By Newton, Steeds and Garretle Basic
2. Automobile Engineering - By Kirpal Singh
3. Automobile Engineering *' -By K.M. Gupta, Umesh Publications

## Bachelor of Technology (Computer Science and Engineering)
## Credit Based Scheme of Studies/Examination(Modified)
## Semester IV (w.e.f Session 2021-2022)

| S. No. | Course No. | Subject | L:T:P | Hours/ Week | Credits | Examination Schedule (Marks) | | | | Duration of Exam (Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Major Test | Minor Test | Practical | Total | |
| 1 | PC-CS-202A | Discrete Mathematics | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | PC-CS-204A | Internet Technology and Management | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 3 | PC-CS-206A | Operating Systems | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 4 | PC-CS-208A | Design and Analysis of Algorithms | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 5 | HTM-901A | Universal Human Values II : Understanding Harmony | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 6 | PC-CS-210AL | Internet Technology and Management Lab | 0:0:4 | 4 | 2 | 0 | 40 | 60 | 100 | 3 |
| 7 | PC-CS-212AL | Operating Systems Lab | 0:0:4 | 4 | 2 | 0 | 40 | 60 | 100 | 3 |
| 8 | PC-CS-214AL | Design and Analysis of Algorithms Lab | 0:0:4 | 4 | 2 | 0 | 40 | 60 | 100 | 3 |
| | | **Total** | | **27** | **21** | **375** | **245** | **180** | **800** | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 9 | MC-901A* | Environmental Sciences | 3:0:0 | 3 | 0 | 75 | 25 | 0 | 100 | 3 |

***MC-901A is a mandatory credit-less course and student has to get passing marks in order to qualify for the award of B.Tech. Degree.**

| HTM-901A | Universal Human Values II: Understanding Harmony | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | 0 | 3.0 | 75 | 25 | 100 | 3 Hours |
| Purpose | Purpose and motivation for the course, recapitulation from Universal Human Values-I | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| CO 1 | Development of a holistic perspective based on self-exploration about themselves (human being),family, society and nature/existence. | | | | | | |
| CO 2 | Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence. | | | | | | |
| CO 3 | Strengthening of self-reflection. | | | | | | |
| CO 4 | Development of commitment and courage to act. | | | | | | |

**Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' andExperiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment ofaspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at variouslevels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrarinessin choice based on liking-disliking

**Module 2: Understanding Harmony in the Human Being - Harmony in Myself!**

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

**Module 3: Understanding Harmony in the Family and Society- Harmony in**

**Human-HumanRelationship**

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as thefoundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the othersalient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- fromfamily to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value inrelationships. Discuss with scenarios. Elicit examples from students' lives

**Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature-recyclability and self-regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" canbe used), pollution, depletion of resources and role of technology etc.

**Module 5: Implications of the above Holistic Understanding of Harmony on ProfessionalEthics**

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and

organizations

28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. todiscuss the conduct as an engineer or scientist etc.

**READINGS:**

**Text Book**

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010

**Reference Books**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J CKumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

**MODE OF CONDUCT**

Lecture hours are to be used for lecture/practice sessions.

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at handand motivating students to reflect, explore and verify them.

Practice hours are to be used for practice sessions.

While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions, the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration. Scenarios may be used to initiate discussion. The student is encouraged to take up" ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Practice experiments are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based onbasic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.

This course is to be taught by faculty from every teaching department, including HSS faculty. Teacher preparation with a minimum exposure to at least one 8-day FDP on Universal Human Values is deemedessential.

**ASSESSMENT:**

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.

Example:

Assessment by

faculty mentor: 5 marks

Self-assessment: 5 marks

Assessment by peers: 5 marks

Socially relevant project/Group Activities/Assignments: 10 marks

Semester End Examination: 75 marks

The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

| Bachelor of Technology (Computer Science & Engineering) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Credit-Based Scheme of Studies/Examination** | | | | | | | | | | |
| **Semester VII (w.e.f. session 2021-2022 )** | | | | | | | | | | |
| **S. No.** | **Course Code** | **Subject** | **L:T:P** | **Hours/Week** | **Credits** | **Examination Schedule (Marks)** | | | | **Duration of Exam (Hrs)** |
| | | | | | | **Major Test** | **Minor Test** | **Practical** | **Total** | |
| 1 | PE | Elective-IV | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | PE | Elective-V | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 3 | OE | Open Elective-II | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 4 | PROJ-CS-401A | Project-II | 0:0:12 | 12 | 6 | 0 | 40 | 60 | 100 | 3 |
| 5 | PE- LA | Elective-IV Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 6 | PE- LA | Elective-V Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| **Total** | | | | **21** | **17** | **225** | **115** | **60** | **400** | |
| 7 | SIM-401* | Seminar on Summer Internship | 2:0:0 | 2 | 0 | 0 | 50 | 0 | 50 | |

| **PE Elective-IV** | **PE Elective-V** |
|---|---|
| Data Mining: PE-CS-D401A | **Soft Computing: PE-CS-D409A** |
| Software Verification and Validation and Testing:: PE-CS-D403A | Neural Networks and Deep Learning: PE-CS-D411A |
| Information Retrieval: PE-CS-D405A | Object Oriented Software Engineering: PE-CS-D413A |
| Speech and Natural Processing : PE-CS-D407A | Expert Systems: PE-CS-D415A |
| **OE Elective-II** | |
| Cyber Law and Ethics: OE-CS-401A | |
| Bioinformatics: OE-CS-403A | |
| Fiber Optic Communications: OE-CS-405A | |
| Industrial Electrical Systems: OE-CS-407A | |

**The course of both PE & OE will be offered at 1/3$^{rd}$ strength or 20 students (whichever is smaller) of the section.**

***Note:** SIM-401* is a mandatory credit-less course in which the students will be evaluated for Summer Internship undergone after 6$^{th}$ semester and students will be required to get passing marks to qualify.

| PE-CS-D401A | Data Mining | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | **To provide the knowledge of data mining and its techniques.** | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | To learn data mining concepts in details. | | | | | | |
| **CO2** | Expose the criteria for data generalization. | | | | | | |
| **CO3** | To explore knowledge of mining associations, correlations and classification. | | | | | | |
| **CO4** | To evaluate various types of data mining. | | | | | | |

## Unit I: Basics of Data Mining

Need for data mining, data mining as the evolution of Information technology, data mining as a step in the process of knowledge discovery, Transactional database, Major issues in data mining, data preprocessing, data cleaning, data integration, data reduction, data transformation, data warehousing and Online Analytical Processing (OLAP).

## Unit II: Mining Frequent Itemsets with Associations and Correlations

Data cube technology, multidimensional data mining, multi-dimensional data analysis, Mining Frequent Patterns, Associations and Correlations: Basic concepts and methods, market basket analysis example with rule of support and confidence, frequent itemsets, closed itemsets, and association rules, frequent itemset mining methods-Apriori algorithm.

## Unit III: Mining Associations and Correlations

Advanced pattern mining, mining multilevel patterns, multi-dimensional patterns, classification: basic concepts, decision tree induction, naive bayesian classification methods, rule based classification, cluster analysis: basic concepts and methods, partitioning methods, hierarchical methods, density based methods, grid based methods.

## Unit IV: Data Mining Trends

Mining spatial data, mining spatiotemporal data, mining multimedia data, mining text data, mining web data, stastical data mining, data mining applications-data mining for financial data analysis, intrusion detection and prevention, retail and telecommunication industries, science and engineering, privacy, security and social impacts of data mining, data mining trends.

**Suggested Books**


- J.Han, M.Kamber, Data Mining: Concepts and Techniques, Academic Press, Morgan Kanfman Publishers, 2015.
- Pieter Adrians, DolfZantinge, Data Mining, Addison Wesley 2013.
- C.S.R. Prabhu, Data Ware housing: Concepts, Techniques, Products and Applications, Prentice Hall of India, 2014.
- Berry and Lin off, Mastering Data Mining: The Art and Science of Customer Relationship Management, John Wiley and Sons, 2012.
- Seidman, Data Mining with Microsoft SQL Server, Prentice Hall of India, 2016.

| PE-CS-D403A | Speech and Natural Language Processing | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To provide the understanding of the mathematical and linguistic foundations underlying approaches to the various areas in NLP. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Be familiar with syntax and semantics in NLP. | | | | | | |
| **CO2** | To implement various concepts of knowledge representation using Prolog. | | | | | | |
| **CO3** | To classify different parsing techniques and understand semantic networks. | | | | | | |
| **CO4** | To identify/explain various applications of NLP. | | | | | | |

### Unit-I

**Speech recognitionand speech synthesis:** concept overview, key algorithms in the noisy channel paradigm. Fundamental components of Natural Language Processing: Lexicography, syntax, semantics, prosody, phonology, pragmatic analysis, world knowledge.Knowledge Representation schemes: Semantic net, Frames, Conceptual Dependency, Scripts.

### Unit-II

**Representing knowledge using rules:** Logic Programming, Introduction to LISP and Prolog, Rules based deduction systems, General concepts in knowledge acquisition.**Syntax Analysis:** Formal Languages and grammars, Chomsky Hierarchy, Left- Associative Grammars, ambiguous grammars, resolution of ambiguities.

### Unit-III

**Computation Linguistics:** Recognition and parsing of natural language structures- ATN and RTN, General Techniques of parsing- CKY, Earley and Tomitas algorithm.Semantics: Knowledge representation, semantics networks logic and inference pragmatics, graph models and optimization.

### Unit-IV

**Applications of NLP:** Intelligent work processor, Machine translation, user interfaces, Man-Machine interfaces, natural language querying, tutoring and authoring systems, speech recognition, commercial use of NLP.

**Suggested Books:**


- Daniel Jurafsky, James H. Martin, "Speech *and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition"*, 2$^{nd}$ edition, Pearson Edu., 2013.
- James Allen, "Natural Language Understanding", Pearson Education, Second Edition, 2003.
- Ivan Bratko, "Prolog: Programming for Artificial Intelligence", 3$^{rd}$ Edition, Pearson Education, Fifth Impression 2009.
- G. Gazder, "Natural Language processing in prolog", Addison Wesley, 1989.

| PE-CS-D405A | Information Retrieval | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To provide an overview of Information Retrieval and comprehensive details about various Evaluation methods. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | To provide an overview of Information Retrieval process and models. | | | | | | |
| **CO2** | To understand the experimental evaluation of performance metrics. | | | | | | |
| **CO3** | To gain knowledge about various web search engines. | | | | | | |
| **CO4** | To understand the application of appropriate text classification and clustering. | | | | | | |

### Unit I

**Introduction:** Goals and history of IR. The impact of the web on IR. The role of artificial intelligence (AI) in IR. Basic IR models: boolean and vector-space retrieval models; ranked retrieval; text similarity metrices; TF-IDF (term frequency/ inverse document frequency) weighting; cosine similarity.

**Basic Tokenizing Indexing, and Implementation of Vector space Retrieval:** Simple tokenizing, stop word removal, and stemming, inverted indices, efficient processing with sparse vectors, python implementation.

### Unit II

**Experimental evaluation of IR:** performance metrics: recall, precision, and F-measure, evaluations on benchmark text collections.

**Query Operations and Languages:** Relevance feedback; query expansion; query languages.

### Unit III

**Text Representation:** Word statistics; Zipf's law; porter stemmer; morphology; index term selection; using thesauri, metadata and markup languages (SGML, HTML, XML).

**Web Search:** search engines; spidering; metacrawlers; directed spidering; link analysis (e.g. hubs and authorities, google pagerank); shopping agents.

### Unit IV

**Text Categorization and Clustering:** Categorization algorithms: naïve bayes; decision trees; and nearest neighbour. Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM). Applications to information filtering; organization; and relevance feedback.

**Recommender System:** collaborative filtering and content based recommnadation of documents and products.

**Suggested Books:**


- Introduction to Information Retrieval Manning, Raghavan and Schutze, Cambridge University Press, 2008.
- Ricardo Baeza-Yates and Berthier Ribeiro-Neto, Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.
- Ricci, F, Rokach, L. Shapira, B.Kantor, Recommender Systems Handbook, First Edition, 2011.
- Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

| PE-CS-D407A | Software Verification and Validation and Testing | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To provide an understanding of concepts and techniques for testing software and assuring its quality. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | Expose the criteria and parameters for the generation of test cases. | | | | | | |
| **CO 2** | Learn the design of test cases and generating test cases. | | | | | | |
| **CO 3** | Be familiar with test management and software testing activities and V&V activities. | | | | | | |
| **CO 4** | Be exposed to the significance of software testing in web and Object orient techniques. | | | | | | |

### Unit-I

**Introduction:** Overview of software evolution, SDLC, Testing Process, Terminologies in Testing: Error, Fault, Failure, Verification, Validation, Difference between Verification and Validation, Definition of software testing, test cases, test oracles, testing process, limitations of testing.

### Unit-II

**Functional Testing:** Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique.

**Structural Testing:** Path testing, DD-Paths, Cyclomatic Complexity, Graph Metrics, Data Flow Testing, Mutation testing.

### Unit-III

**Reducing the number of test cases:** Prioritization guidelines, Priority category, Scheme, Risk Analysis, Regression Testing and Slice based testing.

**Testing Activities:** Unit Testing, Levels of Testing, Integration Testing, System Testing, Debugging, Domain Testing.

### Unit-IV

**Overview of SQM:** Concepts of Software Quality, quality attributes, software quality models: McCall, Boehm, ISO-9000, CMM.

**Misellaneous Topics:** Stress testing, Adhoc testing, Buddy testing, Exploratory testing, Agile and extreme testing.

**Suggested Books:**


- Naresh Chauhan, “Softearw Testing Principles and Practices” Oxford publications, 2012.
- William Perry, “Effective Methods for Software Testing”, John Wiley & Sons, New York, 1995.
- Cem Kaner, Jack Falk, Nguyen Quoc, “Testing Computer Software”, Second Edition, Van Nostrand Reinhold, New York, 1993.
- Boris Beizer, “Software Testing Techniques”, Second Volume, Second Edition, Van Nostrand Reinhold, New York, 1990.
- Louise Tamres, “Software Testing”, Pearson Education Asia, 2002
- Roger S. Pressman, “Software Engineering – A Practitioner’s Approach”, Fifth Edition, McGraw-Hill International Edition, New Delhi, 2001.

- Boris Beizer, "Black-Box Testing – Techniques for Functional Testing of Software and Systems", John Wiley & Sons Inc., New York, 1995.
- K.K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International Publishers, New Delhi, 2003.
- Marc Roper, "Software Testing", McGraw-Hill Book Co., London, 1994.

| PE-CS-D409A | Soft Computing | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **MajorTest** | **MinorTest** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hour** |
| **Purpose** | To familiarize the students with the concepts of soft computing | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | Identify and describe soft computing techniques and their roles in building intelligent machines | | | | | | |
| **CO 2** | Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems. | | | | | | |
| **CO 3** | To learn non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms. | | | | | | |
| **CO 4** | Apply genetic algorithms to combinatorial optimization problems. | | | | | | |

### Unit I

**Introduction:** Soft Computing and Neural Networks: Evolution of Computing: Soft Computing Constituents, Soft Vs Hard Computing, From Conventional AI to Computational Intelligence: Machine Learning Basics

### Unit II

**Fuzzy Logic:** Fuzzy Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation. Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations. Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

### Unit III

**Neural Networks:** Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks: Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks, Implementation using Python/ Matlab

### Unit IV

**Genetic Algorithm (GA):** Evolutionary computing, conditions for evolution, Simple Genetic Algorithm (SGA), different types of operators: Selection, Crossover, mutation and replacement, optimization problems and traditional optimization methods, differences between GA & traditional methods, Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition.

**Suggested Books:**


- S. N. Sivanandam & S. N. Deepa, Principles of Soft Computing, Wiley India Pvt. Ltd.
- Goldberg D. E., Genetic Algorithms in Search, Optimization, and Machine Learning, Pearson Education.
- Jang, Sun, Mizutani, Neuro-Fuzzy and Soft computing, Pearson Education.
- Haykin, Neural networks: a comprehensive foundation, Pearson Education.
- George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic: Theory and Applications”, Prentice Hall, 1995.

| PE-CS-D411A | Neural Networks and Deep Learning | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To provide knowledge of various artificial neural networks and deep learning algorithms for optimization | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | To learn the basics of artificial neural networks concepts, various neural networks architecture | | | | | | |
| **CO 2** | To explore knowledge of special types of Artificial neural networks | | | | | | |
| **CO 3** | To understand the basics of Deep learning and its applications | | | | | | |
| **CO 4** | To imprise about the different deep learning algorithms | | | | | | |

**Unit-I**

**Artificial Neural Networks:** Human brain, Model of an artificial neuron, Basic concepts of neural networks, fundamentals of biological neural network and artificial neural network, evolution of neural networks, Characteristics of Neural Networks, learning methods-supervised, unsupervised and reinforcement, taxonomy of neural network architectures, terminologies-weights, bias, threshold, learning rate, applications of Neural Networks.

**Unit-II**

**Supervised and Unsupervised Neural Networks:** Hebb network theory and training algorithm, perceptron networks architecture and training algorithms, Back Propagation networks architecture and Training Algorithms, Associative Memory network architecture and Training Algorithms, Hopfield networks architecture and Training Algorithms, Counter Propagation networks architecture and Training Algorithms, adaptive resonance theory networks architecture and Training Algorithms.

**Unit-III**

Advanced neural networks: Kohonan self organising feature, maps architecture and training algorithm, learning vector quantization architecture and training algorithm, boltzman machine, cognitron network, neocognitron network, optical neural networks electro-optical multipliers and holographic correlators.

**Unit-IV**

**Deep learning:** Machine learning basics, simple machine learning algorithms-linear regression, underfitting and overfitting challenges in machine learning, supervised learning approach for support vector machine, Deep Forward Networks, Convolutional networks, deep recurrent networks, deep boltzmann machine, applications in speech recognition and natural language processing.

**Suggested Books:**


- Li Min Fu, "Neural Networks in Computer Intelligence", McGraw-Hill, Inc. 2012.
- S N Sivanandam, "Neural Networks using MATLAB 6.0", TMH, 4th. Reprint 2015.
- S N Sivanandam, "Principles of Soft Computing", 2nd. Edition, Wiley, Reprint 2014.
- Freeman J.A. & D.M. Skapura, "Neural Networks: Algorithms, Applications and Programming Techniques", Addison Wesley, Reading, Mass, 2014.
- Deep Learning (Ian J. Goodfellow, Yoshua Bengio and Aaron Courville), MIT Press, 2016.
- Deep Learning with Python: A Hands-On Introduction by Ketkar, Apress

| PE-CS-D413A | Object Oriented Software Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hour** |
| **Purpose** | To provide the thorough knowledge to use the concepts and their design attributes for Object Oriented Software Engineering approaches and platforms to solve real time problems. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | To learn the basic concepts of object oriented systems and software engineering. | | | | | | |
| **CO 2** | To get exposure of various object modeling methodologies, tools for analyzing and designing software based systems using UML. | | | | | | |
| **CO 3** | To explore problems using Use Cases, analyzing relations, responsibilities and collaborations among classes and their behavior in problem domain. | | | | | | |
| **CO 4** | To evaluate object oriented design processes using models, design patterns, interfaces designs and communication mechanisms for performing required tasks. | | | | | | |

**Unit-I**

An Overview of Object-Oriented system Development, Objects Basis, Class Hierarchy, Inheritance, Polymorphism, Object Relationships and Associations, Aggregations and Object Containment, Object Persistence, Meta-Classes, Object Oriented Systems Development Life Cycle: Software Development Process, Object Oriented Systems Development: A Use-Case Driven Approach.

**Unit-II**

Object Oriented Methodologies: Rumbaugh Methodology, Jacobson Methodology, BoochMethodology, Patterns, Frameworks, The Unified approach, Unified Modeling Language (UML)

**Unit-III**

Object Oriented Analysis Process, Use Case Driven Object Oriented Analysis, Use Case Model, Object Analysis: Classification, Classification Theory, Approaches for identifying classes, Responsibilities and Collaborators, Identifying Object Relationships, Attributes and Methods: Associations, Super-Sub Class relationships, A-Part-of-Relationships-Aggregation, Class Responsibilities, Object Responsibilities.

**Unit-IV**

Object Oriented Design process and Design Axioms, Corollaries, Design Patterns, Designing Classes: Object Oriented Design Philosophy, UML Object Constraint Language, Designing Classes: The Process, Class Visibility, Refining Attributes, Designing Methods and Protocols, Packages and Managing classes, View Layer: Designing Interface objects,Designing View layer Classes, Macro and Micro Level Interface Design Process.

**Suggested Books:**


- Ali Bahrami, Object Oriented Systems Development, McGraw Hill Publishing Company Limited, New Delhi, 2013.
- Rumbaugh *et al.*, Object Oriented Modeling and Design, PHI, 2006.
- Robert Laganière and Timothy C. Lethbridge, Object-Oriented Software Engineering: Practical Software Development, McGraw-Hill Publishing Company Limited, New Delhi, Sixth Print 2008.

- Ivar Jacobson, MagnosChristerson, Patrick Jonsson, Gunnar Overgaard, Object-oriented Software
- Engineering: A Use Case Driven Approach, Pearson Education, New Delhi, Seventh Edition Reprint, 2009.
- David C. Kung, Object-Oriented Software Engineering: An Agile Unified Methodology, McGraw-Hill Publishing Company Limited, New Delhi, 2013

| PE-CS-D415A | Expert Systems | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | In this course the student will learn the methodologies used to transfer the knowledge of a human expert into an intelligent program that can be used to solve real-time problems. | | | | | | |
| **Course Outcomes(CO)** | | | | | | | |
| **CO1** | Examining the fundamentals and terminologies of expert system. | | | | | | |
| **CO2** | To facilitate students to implement various knowledge representation techniques for acquisition and validate various structures in experts system domain. | | | | | | |
| **CO3** | Signifying AI techniques to solve social, industrial and environmental problems. | | | | | | |
| **CO4** | Application of professional aspects in multi-disciplinary approach to meet global standards towards design, realizing and manufacturing. | | | | | | |

## Unit-I

**Introduction to Expert Systems:** Introduction to Expert Systems, Representation and organization of knowledge, Basics characteristics, Architecture of expert system, types of problems handled by expert systems, case study of PROSPECTOR.

## Unit-II

**Expert System Tools:** Techniques of knowledge representations in expert systems, knowledge engineering, System-building aids, support facilities, stages in the development of expert systems.

## Unit-III

**Building an Expert System:** Expert system development, Selection of tool, Acquiring Knowledge, Building process.

## Unit-IV

**Problems with Expert Systems:** Difficulties, common pitfalls in planning, dealing with domain expert, difficulties during development.

**Suggested Books**


- Waterman D.A., “A Guide to Expert Systems”, Addison Wesley Longman, 1985.
- Hayes-Roth, Lenat and Waterman: Building Expert Systems, Addison Wesley, 1983.
- Weiss S.M. and Kulikowski C.A., “A Practical Guide to Designing Expert Systems”, Rowman &Allanheld, New Jersey, 2011.

| PE—CS-D401AL | Data Mining Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **40** | **60** | **100** | **3hrs** |
| **Purpose** | Learning of data mining tools and extracting knowledge by applying various data mining techniques. Also explore the different validation techniques on the given training data set to get output metrics. | | | | | | |
| **Course Outcomes(CO)** | | | | | | | |
| **CO1** | Learning of Data Mining tools. | | | | | | |
| **CO2** | Understanding of various Data Mining Algorithms. | | | | | | |
| **CO3** | Developing the application for association mining, classification and clustering. | | | | | | |
| **CO4** | Providing solutions for real world problems using various data mining techniques. | | | | | | |

**List of Practicals**

1. Study of WEKA data mining tool.
2. Study of ORANGE and KNIME open source data mining tools.
3. Develop an application to identify underlying relations between different items by extracting
1. association rule mining.
4. Develop an application for distinguishing the data classes using classification technique.
5. Develop an application for partitioning a set of data objects using clustering technique.
6. Develop an application by implementing Naive Bayes Classifier.
7. Develop an application by implementing Association Mining Rule based Apriori Algorithm.
8. Develop an application for Decision Tree from class-labeled training tuples.
9. Develop a Decision Tree from a given training data set.
10. Develop a Decision Tree with cross validation training data set.
11. Develop a Decision Tree by using prune method and reduced error pruning. Also show the
2. accuracy for cross validation trained data set.

| PE—CS-D403AL | Software Verification and Validation and Testing Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **40** | **60** | **100** | **3hrs** |
| **Purpose** | To gain a broad understanding of the discipline of software engineering implementation. | | | | | | |
| **Course Outcomes(CO)** | | | | | | | |
| **CO1** | To understand the basic concepts of Software Engineering. | | | | | | |
| **CO2** | To understand the different design techniques. | | | | | | |
| **CO3** | To understand different software development models. | | | | | | |
| **CO4** | To understand different types of Testing. | | | | | | |

**List of Practical**

1. To identify the role of the software in today's world across a few significant domains related to day to day life.
2. To identify any scenario and identify suitable software development model for the given scenario.
3. To classify the requirement into functional and non-functional requirements and list four functional and non functional requirements for any scenario.
4. Do comparative study of various software development models.
5. Preparation of requirement document for standard application problems in standard format.(e.g Library Management System, Railway Reservation system, Hospital management System, University Admission system)
6. To identify the usage of Regression Testing.
7. To identify the usage of Agile Testing.
8. To understand the importance of SDLC and STLC process.

| PE—CS-D405AL | Information Retrieval Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **40** | **60** | **100** | **3hrs** |
| **Purpose** | To provide an overview of Information Retrieval and implementation insight about various evaluation methods. | | | | | | |
| **Course Outcomes(CO)** | | | | | | | |
| **CO1** | Understanding about Information Retrieval models. | | | | | | |
| **CO2** | Learn experimental evaluation of performance matrices. | | | | | | |
| **CO3** | Learn implementation of web search engines. | | | | | | |
| **CO4** | Learn the implementation of text clustering and classification algorithms. | | | | | | |

**List of Practicals**

1. Implementation of Simple tokenization and Stop-word removal on a document.
2. Write a program to compute similarity between two text documents.
3. Write a map reduce program to count the number of occurrence of each alphabetic character in a document. The count for each letter should be case-insensitive.
4. Write a program to parse XML text, generate web graph and compute topic specific page rank.
5. Write a program to implement Simple web crawler.
6. Implementation of Naïve Bayes algorithm.
7. Implementation of Decision tree algorithm.
8. Implementation of K-nearest neighbour algorithm.
9. Implementation of K- means algorithm.
10. Evaluate the performance matrix using any algorithm.

| PE-CS-D407AL | Speech and Natural Processing | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **40** | **60** | **100** | **3hrs** |
| **Purpose** | The objective of Natural Language Processing lab is to introduce the students with the basics of NLP which will empower them for developing advanced NLP tools and solving practical problems in the field. | | | | | | |
| **Course Outcomes(CO)** | | | | | | | |
| **CO1** | To understand the basic concepts of Speech and Natural Processing. | | | | | | |
| **CO2** | To understand the different word analysis techniques. | | | | | | |
| **CO3** | To understand different Speech and Natural Processing models. | | | | | | |
| **CO4** | To understand different types of chunking. | | | | | | |

**List of Practical**

1. Word Analysis
2. Word Generation
3. Morphology
4. N-Grams
5. N-Grams Smoothing
6. POS Tagging: Hidden Markov Model
7. POS Tagging: Viterbi Decoding
8. Building POS Tagger
9. Chunking
10. Building Chunker

| PE--CS-D409AL | Soft Computing Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **40** | **60** | **100** | **3hrs** |
| **Purpose** | Soft Computing achieves practicability, robustness, and low cost solution for complex problems in real world using neural network, fuzzy systems ,optimization approaches. | | | | | | |
| **Course Outcomes(CO)** | | | | | | | |
| **CO1** | Understand Fuzzy Concepts. | | | | | | |
| **CO2** | Learn Neural Network with back propagation and without back propagation. | | | | | | |
| **CO3** | Learn the operators of Genetic algorithms. | | | | | | |
| **CO4** | Learn the implementation of Optimization algorithms. | | | | | | |

**List of Practicals**

1. Write a program to implement artificial neural network with back propagation.
2. Write a program to implement artificial neural network without back propagation.
3. Implementation of operations on Fuzzy Sets.
3. Implement Travelling Sales man problem with genetic algorithm..
4. Implement Crisp partitions for real life iris dataset.
5. Write a program to implement Logic gates.
6. Implement SVM classification of Fuzzy Concepts.
7. Implement ABC (Artificial Bee Colony) optimization Technique.
8. Implement DE (Differential Evolution) algorithm.

| PE—CS-D411AL | Neural Networks and Deep Learning Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **40** | **60** | **100** | **3hrs** |
| **Purpose** | Demonstrate knowledge and apply engineering and management principles to manage projects and in multi-disciplinary environment and use research-based knowledge and research methods including design of experiments, analysis and interpretation of data for valid conclusions. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Apply learning algorithms on perceptron and apply back propagation learning on Neural Network. | | | | | | |
| **CO2** | Apply Feedback NN and plot a Boltzmann machine and associative memory on various application. | | | | | | |
| **CO3** | Apply different types of auto encoders with dimensionality reduction and regularization. | | | | | | |
| **CO4** | Design Convolutional Neural Network and classification using Convolutional Neural Network. | | | | | | |

**List of Practicals**

1. To Write a program to implement Perceptron.
2. To write a program to implement AND OR gates using Perceptron.
3. To implement Crab Classification using pattern net Objective.
4. To write a program to implement Wine Classification using Back propagation.
5. Write a MatLab Script containing four functions Addition, Subtraction, Multiply and Divide functions.
6. Write a program to implement classification of linearly separable Data with a perceptron.
7. To study ImageNet, GoogleNet, ResNet convolutional Neural Networks.
8. To study Convolutional Neural Network and Recurrent Neural Network.

| PE—CS-D413AL | Object Oriented Software Engineering Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **40** | **60** | **100** | **3hrs** |
| **Purpose** | Object-Oriented Software Development is an approach/paradigm of developing software byidentifying and implementing a set of objects and their interactions to meet the desired objectives. The first step towards this kind of software development is to learn and master the various concepts, tools and techniques that are to be used design and implementation of such systems. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | To learn and understand various O-O concepts along with their applicability contexts. | | | | | | |
| **CO2** | To learn various modeling techniques to model different perspectives of object-oriented software design (UML) | | | | | | |
| **CO3** | To learn software development life cycle for Object-Oriented solutions for Real-World Problems. | | | | | | |
| **CO4** | Learn how to test and document software. | | | | | | |

## List of Practicals

1. Choose any one project and Write the complete problem statement.
2. Write the software requirement specification document
3. Draw the entity relationship diagram
4. Draw the data flow diagrams at level 0 and level 1
5. Draw use case diagram
6. Draw activity diagram of all use cases.
7. Draw state chart diagram of all use cases
8. Draw sequence diagram of all use cases
9. Draw collaboration diagram of all use cases
10. Assign objects in sequence diagram to classes and make class diagram.

| PE—CS-D415AL | Expert System Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **40** | **60** | **100** | **3hrs** |
| **Purpose** | In this course the student will learn different techniques of AI and Expert system that can be used to solve real-time problems. | | | | | | |
| **Course Outcomes(CO)** | | | | | | | |
| **CO1** | Examining the fundamentals and terminologies of expert system. | | | | | | |
| **CO2** | Study of various trends and issues related to AI and expert system. | | | | | | |
| **CO3** | Implement general problems using AI and expert system techniques. | | | | | | |
| **CO4** | Student will capable to handle real time problems related to AI and expert system. | | | | | | |

**List of Practicals**

1. Study of Prolog.
2. Write simple fact for the statements using PROLOG.
3. Write predicates One converts centigrade temperatures to
4. Write predicates One converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing.
5. Write a program to solve the Monkey Banana problem.
6. WAP to implement factorial, Fibonacci of a given number.
7. Write a program to solve 4-Queen problem.
8. Write a program to solve traveling salesman problem.
9. Write a program to solve water jug problem using LISP
10. Solve any problem using depth first search and best first search.

| OE-CS-401A | **Cyber Law and Ethics** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To provide an overview of Cyber Law and also explores technical, legal, and social issues related to cybercrimes, Laws Cyber Ethics | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Understand Cyber laws, Cyber space. | | | | | | |
| **CO2** | Describe Information Technology act and Related Legislation. | | | | | | |
| **CO3** | Demonstrate Electronic business and legal issues. | | | | | | |
| **CO4** | Interpret Cyber Ethics, significance and its need. | | | | | | |

## Unit I

**Cyber Law:** Emergence of cyber space, Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, CyberspaceWeb space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.

## Unit II

**Information Technology Act:** Overview of IT Act 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public and Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.

## Unit III

**Cyber law and Related Legislation:** Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code.

## Unit IV

**Cyber Ethics:** The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block-Chain Ethics.

**Suggested Books:**

- Cyber Laws: Intellectual property & E Commerce, Security- Kumar K, dominant Publisher
- Cyber Ethics 4.0, Christoph Stuckelberger, Pavan Duggal, by Globethic
- Information Security policy & Implementation Issues, NIIT, PHI
- Legal Dimensions of Cyber Space, Verma S, K, Mittal Raman, Indian Law Institute, New Delhi
- Cyber Crimes and Law Enforcement, Vasu Deva, Commonwealth Publishers, New Delhi, (2003).

| OE-CS-403A | Bioinformatics | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **MajorTest** | **MinorTest** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hour** |
| **Purpose** | To familiarize the students with the concepts of bioinformatics. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | Explain concepts of bioinformatics and its significance in biological data analysis. | | | | | | |
| **CO 2** | Apply various bioinformatics tools to manage different type of biological data. | | | | | | |
| **CO 3** | Explain computational method and algorithms for biological data interpretation. | | | | | | |
| **CO 4** | Classify different types of biological databases. | | | | | | |

## Unit-I

**Introduction to Bioinformatics:** Introduction, outline of proteins, primary structure: the 20 amino acids – chemical structure & properties; polypeptide geometry: the folding chain, nomenclature, molecular graphics, Structure evolution and mutation genetic information- the triplet code; DNA structure Synthesis of proteins: cell biology background; transcription; RNA polymerase, introns, exons, splicing translation: ribosomes, strat/stop codons, post-translational processing

## Unit-II

**Computing evolution:** Phylogenetic Analysis Sequence- based taxonomy: overview and assumptions, from Multiple Alignment to phylogeny Neighbor, Joining Maximum Likelyhood Vs. Parsimony, The molecular Clock, Computer Tools for patterns, mapping and phylogenetic analysis, Mathematical tools of proteins and nucleic acids, sequence- Function Relationships Sequence Homology and Conserved Regions , Conserved DNA Sequences.

## Unit-III

**Bioinformatics tools:** Networks- WWW, CERN EMBnet; EMBL Database, SEQNET, GenBank, NLM , etc., Sequence Databases and Sequence Analysis: Genomic , CDNA EMBL database GenBank Protein sequence, Pattern recognition tools Similarity searching, secondary sources, genome databases, Molecular graphics software and other packages, To find sequences based on keywords & phrases, to grab individual sequences or whole groups of Sequences from a database

## Unit-IV

**Genomics:** Introduction , genome scale sequencing , comparative and evolutionary genomics, microarrays, proteomics, pharmacogenomics, Development using computer tools for sequencing projects, PCR and restriction mapping practical and theoretical problems in sequencing. The challenges of whole genome sequencing, web based tools for restriction mapping, new technologies and new bioinformatics tools.

**Suggested Books:**


- Teresa K. Attwood, David J. Parry-Smith: Introduction to Bioinformatics, 1999, Longman Higher Education.
- S. eddy, a. Krogh, G. Mitchison, Richard Durbin: Biological sequence analysis: probabilistic models of proteins and nucleic acids, 1999, Cambridge University Press.
- Andreas Baxevanis , B.F. Francis Ouellete: Bioinformatics : a practical guide to the analysis of genes and proteins,1998,john Wiley & sons, inc
- James D. Tisdall: Beginning perl for Bioinformatics. 2001. O`reilly & Associates.
- Michael S. Wterman: Mathematical methods for DNA sequences, 1989, CRC Press.

| OE-CS-405A | FIBRE OPTIC COMMUNICATIONS | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To familiarize the students with the concepts of Optical communication covering the contents of optical fibers, losses in fibers, optical sources, detectors etc. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Students will be able to understand the structure of fiber and the mechanism of light travelling in the fiber. | | | | | | |
| **CO2** | Students will be able to analyze various losses associated with fibers. | | | | | | |
| **CO3** | Students will learn about the optical sources and optical detecters. | | | | | | |
| **CO4** | Students will be able to understand the various components needed in optical networks | | | | | | |

### Unit I

**Introduction:** Optical Fibers: Structure, Propagation within the fiber, Numerical aperture of fiber, step index and graded index fiber, Modes of propagation in the fiber, Single mode and multi mode fibers. Splices and connectors. Optical Power Launching and Coupling. Fiber-to-fiber joints.

### Unit II

**Losses in Optical Fiber**: Rayleigh Scattering Losses, Absorption Losses, Leaky modes, Mode coupling losses, Bending Losses, Combined Losses in the fiber.
**Dispersion Effect**: Effect of dispersion on the pulse transmission Intermodal dispersion, Material dispersion, Wave guide dispersion, Polarization Mode Dispersion Total dispersion, Transmission rate. Dispersion Shifted Fibers, Dispersion Compensating Fibers.

### Unit III

**Light Sources**: LEDS, Laser Action in semiconductor Lasers, Semiconductor Lasers for optical communication – Laser modes, Spectral Characteristics, Power Voltage Characteristics, Frequency response.
**Detectors**: P-I-N Photodiode, APD, Noise Analysis in detectors, Coherent and non-coherent detection, Infrared sensors. Bit error rate.

### Unit IV

**The Fiber-Optic Communication System:** Design considerations of fiber optic systems: Analog and digital modulation. Optical Devices: Optical coupler, space switches, linear divider-combiners, wavelength division multiplexer and demultiplexer, optical amplifier
**Optical Networks**: Elements and Architecture of Fiber-Optic Network, Optical link network-single hop, multihop, hybrid and photonic networks.

**Suggested Books:**

- John Power, An Introduction to Fiber optic systems, McGraw Hill International.
- John Gowar, Optical communication Systems.
- R. Ramaswamy, Optical Networks, Narosa Publication
- John M. Senior,Optical Fiber Communication
- Gerd Keiser, Optical Fiber Communication

| OE-CS-407A | Industrial Electrical Systems | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To provide the conceptual knowledge of various Industrial Electrical Systems. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | To study various fundamental concepts of Electrical components. | | | | | | |
| **CO2** | To study and understand the residential and commercial electrical system. | | | | | | |
| **CO3** | To study functions and selection of Industrial Electrical components. | | | | | | |
| **CO4** | To study the basics and role of PLC & SCADA in automation. | | | | | | |

## Unit I

**Electrical System Components:** LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, relays, MPCB, electric shock and electrical safety practices.

## Unit II

**Residential and Commercial Electrical Systems:** types of residential and commercial wiring system, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, protection devices, requirements of commercial installation, earthing of commercial installation, selection and sizing of components.

## Unit III

**Industrial Electrical Systems:** HT connection, industrial substation, transformer selection, power factor correction-kVAR calculation, type of compensation, Introduction to PCC, MCC panels. Specifications of LT breakers.
DG systems, UPS system, battery banks, sizing the DG, UPS and battery banks, selection of UPS and battery banks.

## Unit IV

**Industrial Electrical System Automation:** Study of basic PLC, role of automation, advantages of process automation, PLC based control system design, Panel metering and Introduction to SCADA system for distribution automation.

**Suggested Books:**


- S.L. Uppal and G.C. Garg, “Electrical Wiring, Estimating & Costing”, Khanna publishers, 2008.
- K.B. Raina, “Electrical Design, Estimating & Costing”, New Age International, 2007.
- S. Singh and R.D. Singh, “Electrical estimating & costing”, Dhanpat Rai and Co., 1997. Website for IS standards.
- H. Joshi, “ Residential Commercial and Industrial Systems”, McGraw Hill Education, 2008.

| Bachelor of Technology (Computer Science & Engineering) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Credit-Based Scheme of Studies/Examination** | | | | | | | | | | |
| **Semester VIII (w.e.f. session 2021-2022 )** | | | | | | | | | | |
| **S. No.** | **Course Code** | **Subject** | **L:T:P** | **Hours/Week** | **Credits** | **Examination Schedule (Marks)** | | | | **Duration of Exam (Hrs)** |
| | | | | | | **Major Test** | **Minor Test** | **Practical** | **Total** | |
| 1 | PE | Elective-VI | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | OE | Open Elective-III | 2:0:0 | 2 | 2 | 75 | 25 | 0 | 100 | 3 |
| 3 | OE | Open Elective-IV | 2:0:0 | 2 | 2 | 75 | 25 | 0 | 100 | 3 |
| 4 | PROJ-CS-402A | Project-III | 0:0:12 | 12 | 6 | 0 | 40 | 60 | 100 | 3 |
| 5 | PE-LA | Elective-VI Lab | 0:0:4 | 4 | 2 | 0 | 40 | 60 | 100 | 3 |
| | | **Total** | | **23** | **15** | **225** | **155** | **120** | **500** | |

**The course of both PE & OE will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.**

| **PE Elective-VI** | |
|---|---|
| Cloud Computing: PE-CS-A402A | |
| Computer Graphics: PE-CS-A404A | |
| Software Reliability: PE-CS-A406A | |
| Mobile Apps Development: PE-CS-A408A | |
| **OE Elective-III** | **OE Elective-IV** |
| Cyber Security: OE-CS-402A | Web and Internet Technology: OE-CS-410A |
| Satellite Communication: OE-CS-404A | Automation in Manufacturing: OE-CS-412A |
| Social Networks Analysis & Mining: OE-CS-406A | IPR, Bioethics and Biosafety: OE-CS-414A |
| Agile Software Engineering: OE-CS-408A | Signal & Systems: OE-CS-416A |

| PE-CS-A402A | Cloud Computing | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To familiar the concepts of cloud services and storage to deploy various resources and arbitrary software. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Summarize main concepts, key technologies, strengths and limitations of Cloud Computing. | | | | | | |
| **CO2** | Explore various cloud service and deployment models to utilize different cloud services. | | | | | | |
| **CO3** | Interpret various data, scalability & cloud services in order to get efficient database for cloud storage. | | | | | | |
| **CO4** | To deal with various security threats and their controlling mechanism for accessing safe cloud services. | | | | | | |

### Unit-I

Overview of Computing Paradigm: Recent trends in Computing, Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing, evolution of cloud computing, Business driver for adopting cloud computing. Cloud Computing (NIST Model): History of Cloud Computing, Cloud service providers, Properties, Characteristics & Disadvantages, Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing, Role of Open Standards.

### Unit-II

Cloud Computing Architecture: Cloud computing stack, Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services, Service Models (XaaS) - Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Deployment Models- Public cloud, Private cloud, Hybrid cloud, Community cloud, Cloud Architecture and open source.

### Unit-III

Service Management in Cloud Computing: Service Level Agreements (SLAs), Billing & Accounting, comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously, Managing Data- Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing, Cloud management with Puppet.
Case study: Eucalyptus, Microsoft Azure, Amazon EC2.

### Unit-IV

Cloud Security: Infrastructure Security, Network level security, Host level security, Application level security, Data security and Storage, Data privacy and security Issues, Jurisdictional issues raised by Data location, Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations, DROPS: Division and Replication of data in Cloud for Optimal Performance and Security.

**Suggested Books:**

- Barrie Sosinsky, Cloud Computing Bible, Wiley-India, 2010.
- Rajkumar Buyya, James Broberg, Andrzej M. Goscinski,Cloud Computing: Principles and Paradigms, Wiley, 2011.
- Nikos Antonopoulos, Lee Gillam, Cloud Computing: Principles, Systems and Applications, Springer, 2012.
- Ronald L. Krutz, Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley-India, 2010.

| PE-CS-A404A | Computer Graphics | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **MajorTest** | **MinorTest** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hour** |
| **Purpose** | **Introduces Computer Graphics that help in designing different kinds of static and movable objects.** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | Explore the background and standard line and circle drawing algorithms. | | | | | | |
| **CO 2** | Exposure of various transformation approaches and its comparative analysis. | | | | | | |
| **CO 3** | Illustrate Projection and clipping with explore different techniques. | | | | | | |
| **CO 4** | Apply design principles to create different curves and explore hidden lines and surface techniques. | | | | | | |

### Unit-I

Computer Graphics applications, Display Devices, Point & Positioning Devices, Plotting Techniques for point and Line, Line drawing algorithms: DDA, Bresenhams's Circle drawing algorithms, Filled area algorithms: Scan line, Polygon filling algorithms, Boundary filled algorithms.

### Unit-II

Window to view port transformation, Window to view port mapping, Two Dimensional transformation: translation, scaling, rotation, reflection and Shear, Homogeneous Coordinate system.
3-D transformation: Rotation, Shear, translation, Numerical Problems of transformation viewing pipeline.

### Unit-III

Clipping: Point & Line clipping algorithm, 4-bit code algorithm, Cohen-Sutherland Line clipping algorithms, Liang-Barsky line clipping algorithms. Polygon clipping: Sutherland-Hodgeman Polygon clipping algorithm. Curve clipping, Text clipping. Projection: Parallel, Perspective, Vanishing Points.

### Unit-IV

Representation of 3-D Curves and Surfaces: interpolation and approximation alpines, parametric conditions, Geometric continuity conditions, Beizer curves and surfaces: properties of beizer curves, beizer surfaces.
Hidden Surfaces removal: Hidden surface elimination, depth buffer algorithm, scan line coherence and area coherence algorithm, painter's algorithm

**Suggested Books:**


- Donald Hearn & M.Pauline Baker, Computer Graphics, 2nd Edition, Pearson Education.
- William M. Newmann & Robert F. Sproull, Principles of Interactive Computer Graphics, Tata McGraw-Hill Second Edition, New Delhi, India.
- Zhigang Xiang & Roy A Plastock , Computer Graphics, Second Edition, Schaum's Outline, Tata McGraw Hill Education Private Limited, New Delhi, India.
- Foley, van Dam, Feiner, and Hughes. Computer Graphics: Principles and Practice, 3rd edition in C.
- Hearn, D. Basker, Computer Graphics, Prentice Hall

| PE-CS-A406A | Web and Internet Technology | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To gain a broad understanding of the discipline of Web engineering and its application to the development and management of Web Applications. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Learn the basic concepts of internet and its conncetivity. | | | | | | |
| **CO2** | Learn about the services of internet, designing and its architecture. | | | | | | |
| **CO3** | Understand the basic concepts of Python and its applications as per information industry standards. | | | | | | |
| **CO4** | Acquaint the latest programming language for the implementation of object based and procedure based applications using Python. | | | | | | |

**Unit I**

Intenet, growth of internet, owners of the internet, anatomy of internet, ARPANET and internet history of the worls wide web, basic internt terminology, internet applications-commerce on the internet, governance on the internet, impact of internet on society- crime on/through the internet, the role of information architect, collaboration and communication. Organizing information, Organizing web sites and Intranets, Creating cohesive organization systems, designing navigation systems, types of navigation systems, Integrated navigation elements, designing navigation systems, Searching systems, Searching your web site, designing the search interface.

**Unit II**

Setting up a connection: Hardware requirement, selection of a modem, software requirement, modem configuration, common terminologies: Node, Host, Workstation, bandwidth, interoperability, network administrator, netwotk security, network components: servers, clients, communication medis, service options- email, News firewall etc.

**Introduction to XHTML and HTML5**: Origins and Evolution of HTML and XHTML, Basic Syntax, Standard XHTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, HTML5, Syntactic Differences between HTML and XHTML.

**Cascading Style Sheets**: Introduction, Levels of Style Sheets, Style Specification Formats, Selector Forms, Property Value Forms, Font Properties, List Properties, Color, Alignment of Text, Box Model, Background Images

**Unit III**

**Introduction to Python**: Applications of python in information industry, Introduction to Python, Data Types, branching programs, control structures, array and input, iteration.

Functions and scoping: Functions and scoping, recursion and global variables. Creation, insertion and deletion of items: strings, tuples, lists and dictionaries.

**Unit IV**

Classes and objects-oriented programming: Abstract data types and classes, inheritance, encapsulation and information hiding. File handling, exception handling, database (MySQLdb) operation: file check, table creation, insertion and deletion of data, regular expressions-Res in Python and plotting.

**Suggested Books:**

- By Peter Morville, Louis Rosenfeld, “Information Architecture on the World Wide Web”,

O'Reilly Media, 2006.

- Robert W. Sebesta, “Programming The World Wide Web”, Eight Edition, Pearson India, 2015.
- Kenneth A. Lambert, “The Fundamentals of Python: First Programs”, 2011, Cengage Learning.
- Thomas A Powell, “HTML The Complete Reference”, Tata McGraw Hill Publications.

| PE-CS-A408A | Mobile Apps Development | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To introduce the concepts of developing the mobile applications. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Be exposed to technology and Mobile apps development aspects. | | | | | | |
| **CO2** | Be competent with the characterization and architecture of mobile applications. | | | | | | |
| **CO3** | Appreciation of nuances such as native hardware play, location awareness, graphics, and multimedia. | | | | | | |
| **CO4** | Perform testing, signing, packaging and distribution of mobile apps. | | | | | | |

## Unit I

**Introduction to Mobility:** Mobility landscape, Mobile platforms, Mobile apps development, Overview of Android platform, setting up the Mobile App Development environment along with an Emulator.App User Interface Designing – Mobile UI resources (Layout, UI elements, Drawable, Menu).

## Unit II

**Building blocks of Mobile Apps:** Activity- States and Life Cycle, Interaction amongst Activities. App functionality beyond user interface - Threads, Async task, Services – States and Life Cycle, Intents: concept, types, Use of Intents to transfer various type of data, Notifications, Broadcast receivers, Content provider.

## Unit III

**Sprucing up Mobile Apps:** Fragments: Concept, Use of fragments in Android Apps, Nested Fragments, Graphics and animation – Custom views, Canvas, Animation APIs, Multimedia – Audio/Video playback and record, Location awareness. Native data handling–file I/O, shared preferences, mobile databases such as SQLite, and enterprise data access (via Internet/Intranet).

## Unit IV

**Testing Mobile Apps:** Debugging mobile apps, White box testing, Black box testing, and test automation of Mobile apps, JUnit for Android, Testing tools. Loading data using loaders, permissions, performance & security, firebase and admob and publish.

**Suggested Books:**


- Dawn Griffiths, David Griffiths, Head First Android Development, 2nd Edition, O'Reilly Media, 2017.
- Barry Burd, Android Application Development All in one for Dummies, Wiley publications, 2nd Edition 2015.
- Android Developer Fundamentals Course– Concepts (Learn to develop Android applications) Concepts Reference Developed by Google Developer Training Team, 2016.
- Valentino Lee, Heather Schneider, and Robbie Schell, Mobile Applications: Architecture, Design, and Development, Prentice Hall, 2004.
- Brian Fling, Mobile Design and Development, O'Reilly Media, 2009.
- Maximiliano Firtman, Programming the Mobile Web, O'Reilly Media, 2010.

| PE—CS-A402AL | Cloud Computing Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| - | - | 4 | 2 | 40 | 60 | 100 | 3hrs |
| **Purpose** | Design and Implement various mobile applications using emulators and learn how to Deploy applications to hand-held devices. | | | | | | |
| **Course Outcomes(CO)** | | | | | | | |
| **CO1** | Know the components and structure of mobile application development frameworks for Android based mobiles. | | | | | | |
| **CO2** | Understand how to work with various mobile application development frameworks. | | | | | | |
| **CO3** | Learn the basic and important design concepts and issues of development of mobile applications. | | | | | | |
| **CO4** | Understand the capabilities of mobile devices. | | | | | | |

**List of Practicals**

1. Write a program to use the API's of Hadoop to interact with it.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Show the virtual machine migration based on the certain condition from one node to the other.
6. Write a word count program to demonstrate the use of Map and Reduce tasks.
7. Find procedure to set up the one node Hadoop cluster and run simple applications like word count.

| PE—CS-A404AL | Computer Graphics Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **-** | **-** | **4** | **2** | **40** | **60** | **100** | **3hrs** |
| **Purpose** | To Design and implement various Line and Circle Drawing Algorithms. | | | | | | |
| **Course Outcomes(CO)** | | | | | | | |
| **CO1** | To Implement basic algorithms related to Line & Circle Drawing. | | | | | | |
| **CO2** | Implement various Line & Circle Drawing Algorithms. | | | | | | |
| **CO3** | Hands on experiments on 2-D transformations. | | | | | | |
| **CO4** | Conceptual implementation of Clipping and other drawing algorithms. | | | | | | |

## List of Practicals

1. Write a program to implement DDA line drawing algorithm.
2. Write a program to implement Bresenham's line drawing algorithm.
3. Implement the Bresenham's circle drawing algorithm.
4. Write a program to draw a decagon whose all vertices are connected with every other vertex using lines.
5. Write a program to move an object using the concepts of 2-D transformations.
6. Write a program to implement the midpoint circle drawing algorithm any Object Oriented Programming Language like Python, C++, Java.
7. Implement the line clipping algorithm using any Object Oriented Programming Language like Python, C++, Java.
8. Implement boundary fill algorithm using any Object Oriented Programming Language like Python, C++, Java.
9. Implement the depth buffer algorithm using any Object oriented language like Python, C++, Java.
10. Perform the Polygon Clipping Algorithm using any Object oriented language like Python, C++, Java.
11. Draw a Rectangle using Bresenham's and DDA Algorithm using any Object oriented language like Python, C++, Java.

| PE—CS-A406AL | Software Reliability Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| - | - | 4 | 2 | 40 | 60 | 100 | 3hrs |
| **Purpose** | In this course the student will understand the working of software reliability models and reliability prediction models, and able to design reliability models. | | | | | | |
| **Course Outcomes(CO)** | | | | | | | |
| **CO1** | To study the computation method for evaluation of software reliability | | | | | | |
| **CO2** | Understand the mechanisms for Evaluation Testing methods in Software Reliability | | | | | | |
| **CO3** | Understand the working of Software Reliability Models | | | | | | |
| **CO4** | To Study and understand procedure of software Reliability Prediction | | | | | | |

**List of Practicals**

1. To study the Computation of software reliability
2. To implement software Reliability Evaluation Testing methods
3. To understand the working of Functional and Operational Profiles
4. To understand the concept of Time Dependent Software Reliability Models
5. To understand the concept of Time Independent Software Reliability Models.
6. To study Software Reliability Modeling
7. To identify the role of various phases included in software Reliability Prediction
8. To study software Reliability Analyzing Predictive
9. To study software Reliability Recalibration

| PE—CS-A408AL | Mobile Apps Development Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| - | - | 4 | 2 | 40 | 60 | 100 | 3hrs |
| **Purpose** | To understand the components and structure of mobile application development frameworks for Android based mobiles | | | | | | |
| **Course Outcomes(CO)** | | | | | | | |
| **CO1** | To understand the components and structure of mobile application Development frameworks for Android based mobiles. | | | | | | |
| **CO2** | To understand how to work with various mobile application development frameworks. | | | | | | |
| **CO3** | To learn the basic and important design concepts and issues of development of mobile applications. | | | | | | |
| **CO4** | To understand the capabilities and limitations of mobile devices. | | | | | | |

### List of Practicals

1. Develop an application that uses GUI components, Font and Colors
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Implement an application that implements Multi threading
6. Develop a native application that uses GPS location information.
7. Implement an application that writes data to the SD card.
8. Implement an application that creates an alert upon receiving a message.
9. Write a mobile application that creates alarm clock.
10. Develop a sign-in page with appropriate validation.
11. Develop a real life application that makes use of database.

| OE-CS-402A | Cyber Security | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **MajorTest** | **MinorTest** | **Total** | **Time** |
| **2** | **0** | **0** | **2** | **75** | **25** | **100** | **3 Hour** |
| **Purpose** | To gain a broad understanding in order to get predictive ways out related to cyber security. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | To facilitate the basic knowledge of cyber security. | | | | | | |
| **CO 2** | To explore and sort issues related to different types of activities in cyber crime. | | | | | | |
| **CO 3** | To get enable to fix the various cyber attacks. | | | | | | |
| **CO 4** | To deal with the digital forensics and related scenarios of cyber crimes. | | | | | | |

## Unit-I

**Introduction:** Fundamentals of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime: crime against individual, Crime against property, Cyber extortion, Drug trafficking, cyber terrorism.

Cryptanalysis-steganography, stream and block ciphers, modern block ciphers: Block cipher principles, Shannon's theory of confusion and diffusion, fiestal structure, Data Encryption Standard (DES), strength of DES, differential and linear crypt analysis of DES, block cipher modes of operations, triple DES-AES

## Unit-II

Integrity checks and authentication algorithms MD5 message digest algorithm, Secure Hash Algorithm (SHA), Digital Signatures, authentication protocols, digital signature standards (DSS), proof of digital signature algorithm, authentication application, Kerberos and X.509, directory authentication service, electronic mail security, pretty good privacy (PGP), S/MIME.

## Unit-III

**Introduction to cyber attacks:** passive attacks, active attacks, Cyber crime prevention methods, Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control,Hardware protection mechanisms, OS Security.

**Web Security:** Secure socket layer and transport layer security-secure electronic transaction (SET)-system security: Intruders-Viruses and related threats, firewall design principles, trusted systems.

## Unit-IV

**Digital Forensics:** Introduction to Digital Forensics, historical background of digital forensics, Forensic Software and Hardware, need for computer forensics science, special tools and techniques digital forensic life cycle, challenges in digital forensic.

**Law Perspective:** Introduction to the Legal Perspectives of Cybercrimes and Cyber security, Cybercrime and the Legal Landscape around the World, Why Do We Need Cyber laws, The Indian IT Act, Cybercrime Scenario in India, Digital Signatures and the Indian IT Act, Cybercrime and Punishment.

**IP Security:** Architecture-Authentication header-Encapsulating security payloads, combining security associations, key management.

**Suggested Books:**

- Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.
- Robert M Slade," Software Forensics", Tata McGraw - Hill, New Delhi, 2005.
- Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt. Ltd.

| OE-CS-404A | Satellite Communication | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **0** | **0** | **2** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To familiarize the students with the concepts of Satellite communication and various terms, laws and multiple access schemes used in its working**.** | | | | | | |
| | **Course Outcomes** | | | | | | |
| **CO1** | To understand the concept of basics of satellite communication and various basic laws and terms of satellite communication. | | | | | | |
| **CO2** | To understand the concept and processes of various communication satellites used in satellite communication. | | | | | | |
| **CO3** | To familiarize with the concept and design issues of satellite link design and satellite access. | | | | | | |
| **CO4** | To familiarize with the concepts of Multiple access schemes used in satellite communication. | | | | | | |

## Unit I

**Satellite Orbits:** Orbital Mechanics- Kepler's laws ,locating the satellite in the Orbit, locating the satellite with respect to the earth, Orbital elements, look angle determination, Sub satellite point, Azimuth and elevation angle calculation, Orbital perturbations, Longitudinal and Inclination changes; Launches and launch vehicles-ELV's, Placing the satellite into geostationary orbit, Doppler shift, range variations, solar eclipse, sun transit outage.

## Unit II

**Communication Satellites:** Satellite Subsystems, Attitude and Orbit Control system(AOCS), Telemetry, Tracking, Command and Monitoring (TTC&M), Power System, Communication Subsystems-description, Transponders, satellite antennas-basic antenna types, basic antennas in practice.

## Unit III

**Satellite Link Design and Satellite Access:** Basic transmission theory**,** system noise temperature and G/T ratio; Downlink design-link budget; Uplink design; design for specified C/N, uplink and downlink attenuation in rain, communication link design procedure; system design examples.

## Unit IV

**Multiple Access Schemes:** FDMA, TDMA, CDMA, DAMA; VSAT systems-basic techniques, VSAT earth station engineering, system design; DBS systems-C-band and Ku band home TV, digital DBS; satellite mobile systems; GPS

**Suggested Books:**

- Timothy Pratt, Satellite Communications, Wiley India edition
- Anil K Maini, Satellite Communication, Wiley India edition

| OE-CS-406A | Social Networks | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **0** | **0** | **2** | **75** | **25** | **100** | **3 Hour** |
| **Purpose** | To study the role of Social networks and how they make convenient to access information, provide information and communicate via social media by providing a platforms for the benefit of their | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | To understand the concept of social networking | | | | | | |
| **CO 2** | To know the various social networks and their working | | | | | | |
| **CO 3** | To study the frameworks of social networks | | | | | | |
| **CO 4** | To extract the information from social networks | | | | | | |

## UNIT-I

Introduction to social networks, google page rank, link prediction, importance of acquaintances, web graph, introduction: emergence of connectedness, granovetter's strength of weak ties, triads, clustering coefficient and neighbourhood overlap, structure of weak ties, bridges, and local bridges, embeddedness, betweenness measures and graph partitioning, finding communities in a graph (Brute Force Method), community detection using Girvan Newmann algorithm, strong and weak relationship.

## UNIT II

Introduction to homophily, selection and social influence, Foci closure and membership closure, Introduction to Fatman Evolutionary model, triadic closure, spatial segregation, an introduction, schelling model implementation, positive and negative relationships- introduction, structural balance, creating graph, displaying it and counting unstable triangles, equal coin distribution, random walk coin distribution

## UNIT III

Matrices in social network analysis (Betweenness, centrality, equivalence relation, centralization, clustering Coefficient and structural cohesion), Diffusion in networks, Impact of communities on diffusion, cascade and clusters, introduction to hubs and authorities, hubs and authorities, page rank as a matrix operation, introduction to power law, rich get richer phenomena, implementing a random graph (Erdos Renyi Model)

## UNIT IV

Rich Get Richer- The long tail, Epidemics- an introduction, simple branching process for modelling epidemics, basic reproductive number, SIR and SIS spreading models, percolation model, milgram's experiment, the generative model, decentralized search, basic of equivalence concepts in social networks.

**Suggested Books**


- David Easley and Jon Kleinberg, "Networks, crowd and Markets", Cambridge University Press.
- Matthew O. Jackson, "Social and Economic Networks", Princeton University Press
- Matthew A. Russeil, "Mining the Social web", O'Reilly and SPD Second Edition New Delhi
- Hanneman, R.A., & Riddle, M., "Introduction to social network methods, Riverside, California: University of California Riverside retrieved from http://faculty.ucr.edu/~hanneman/nettext/
- John scott, Peter J. Carrington,"social network analysis", sage publishing ltd.

| OE-CS-408A | Agile Software Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **0** | **0** | **2** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | **Introduces the business value of adopting Agile approaches and provide complete understanding of the Agile development practices** | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Understand the background and driving forces for taking an Agile approach to software development. | | | | | | |
| **CO2** | Understand the business value of adopting Agile approaches. | | | | | | |
| **CO3** | Drive development with unit tests using Test Driven Development. | | | | | | |
| **CO4** | Apply design principles and refactoring to achieve Agility. | | | | | | |

**Unit I**

**Fundamentals of Agile:** The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools

**Unit II**

**Agile Scrum Framework:** Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum case study, Tools for Agile project management.

**Unit III**

**Agile Testing:** The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester.

**Unit IV**

**Agile Software Design and Development:** Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control.

**Suggested Books**:


- Ken Schawber, Mike Beedle, *Agile Software Development with Scrum*, Pearson publications.
- Robert C. Martin, *Agile Software Development, Principles, Patterns and Practices*, Prentice Hall.
- Lisa Crispin, Janet Gregory, *Agile Testing: A Practical Guide for Testers and Agile Teams*, Addison Wesley.
- Alistair Cockburn, *Agile Software Development: The Cooperative Game*, Addison Wesley.
- Mike Cohn, *User Stories Applied: For Agile Software,* Addison Wesley.

| OE-CS-410A | Software Quality Models | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **0** | **0** | **2** | **75** | **25** | **100** | **3 Hour** |
| **Purpose** | To provide an understanding of various concepts related to software quality, reliability and maintenance. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | To understand the concept of software quality | | | | | | |
| **CO 2** | To study the various quality models | | | | | | |
| **CO 3** | To understand the testing and reliability concepts | | | | | | |
| **CO 4** | Relation of maintenance and quality | | | | | | |

## Unit-I

**Software Quality:** Meaning and scope, software quality factors, software quality metrics, relationship b/w quality factors and quality metrics, quality management system, software reviews, formal technical reviews, correctness proof, statistical quality assurance, clear room, software engineering, standards of software quality assurance.

## Unit-II

**Software Reliability:** meaning and its relation with software quality, reliability modelingexponential failure time models (viz., Jelinski Moranda model, Schneidiwind's model, Musa's basic execution time model, hyberexponential model), Weibull and gamma failure time model (viz. Weibull model, S-shaped reliability growth model), and infinite failure category models (viz. Duane's model, geometric model, Muse-Okumto model). Types of failure, bath-tub Curve, Exponential law of reliability.

## Unit-III

**Software Testing:** Meaning. Scope and its relationship with software quality, software testing techniques: white box testing, basis path testing, control structure testing and black box testing, etc. Software testing strategies: unit testing, integration testing, validation testing and system testing, etc.

## Unit-IV

**Software Maintenance:** Concept of repair and maintenance, concept of availability and its relation with reliability and maintainability, preventive maintenance, Software maintenance, the management of reliable software, automatic error detection and error correction.

**Suggested Books:**


- Software Quality: Concepts and Plan, by Robert H Dunn Prentice Hall International 71
- Software Reliability: Measurement, Prediction and application by John D.Musa, McGraw Hill
- Software Reliability Engineering By Michele R Lyu , McGraw Hill
- Software Reliability By K.K. Aggarwal
- Software Reliability by H Koptez.
- C.R. Vick & C.V. Rama Moorthy: Handbook of Software Engineering CBS Publishers & Distributors, Delhi.
- Software Engineering, K K Aggarwal, New Age International Publication, New Delhi
- Mark Paulik, The capability Maturity Model-Guidelines for improving the software Process, Addison Wesley.
- Michael, Deutsch, Willis, Ronald r-Software Quality Engineering –A Total Techinical and Management approach, Prentice Hall.

| OE-CS-412A | Automation in Manufacturing | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **0** | **0** | **2** | **75** | **25** | **100** | **3 Hour** |
| **Purpose** | The purpose of this course is to impart knowledge of production automation, Robotics, flexible manufacturing, CNC programming, material handling and automated storage systems. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | To explain the role of automation in manufacturing and Robotics in industry. | | | | | | |
| **CO 2** | To describe the group technology and flexible manufacturing techniques in the automated production line and manufacturing system. | | | | | | |
| **CO 3** | To explain computer aided process planning and shop floor manufacturing activities. | | | | | | |
| **CO 4** | To develop CNC programs and understand the concept automated guided vehicle and automated storage system in material handling | | | | | | |

## Unit l

**Introduction:** Production system, automation in production system, manual labour in production system, automation principle and strategies, manufacturing industries and products, manufacturing operations, product facilities, product/production relationship, basic elements of an automation system, advance automation function, level of automation.

**Industrial Robotics:** Robot anatomy and related attributes, joint and links, common robot configuration, joint drive system, sensors in Robotics, robot control system, end effectors, grippers and tools, applications of industrial robots, material handling, processing operation, assembly and inspection, robot programming.

## Unit ll

**Group technology and cellular manufacturing:** Part families, part classifications and coding, production flow analysis, cellular manufacturing-composite part concept, machine cell design, applications of group technology, grouping parts and machines by rank order clustering technique, arranging machines in G.T. cell.

**Flexible manufacturing:** Introduction, FMS components, flexibility in manufacturing-machine, product, routing operation, types of FMS, FMS layouts, FMS planning and control issues, deadlock in FMS, FMS benefits and applications.

## Unit lll

**Process planning:** Introduction, manual process planning, computer aided process planning- variant, generative, decision logic decision tables, decision trees, introduction to artificial intelligence.

**Shop floor control:** Introduction, shop floor control features, major displays, major reports, phases of SFC, order release, order scheduling, order progress, manufacturing control, methodology, applications, shop floor data collections, types of data collection system, data input techniques, automatic data, collection system.

## Unit lV

**CNC basic and part programming:** Introduction, historical, background, basic components of an NC steps in NC, verification of numerical control machine tool programs, classification of NC machine tool, basics of motion control and feedback for NC M/C, NC part programming, part programming methods, modern machining system, automatically programmed tools, DNC, adaptive control.

**Automated Guided Vehicle and Storage System:** Functions of AGV, types of AGV, safety consideration for AGV, design of AGV, Introduction to storage system, storage system performance, storage location strategies, conventional storage method and equipment, automated storage system, fixed aisle automated storage/retrieval system, carousel storage system, analysis of storage system, fixed aisle automated storage/retrieval systems, carousel storage system.

**Suggested Books**

- Automation, production system and computer integrated manufacturing- Mikell P. Groover, Pearson 4th edition.
- CAD/CAM: Computer Aided Design and manufacturing Groover- M.P. and Zimmers E. W., Prentice Hall International, New Delhi 1992
- CAD/CAM/CIM-P. Radhakrishnan, S. Subramanayan and V. Raju, New Age International (P) Ltd., New Delhi
- Computer Integrated Manufacturing- Alavudeen and Venkateswaran, Prentice Hall of India Pvt. Ltd. New Delhi.

| OE-CS-414A | IPR, Bioethics and Biosafety | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **0** | **0** | **2** | **75** | **25** | **100** | **3 Hour** |
| **Purpose** | The course concentrates on technology, knowledge and business management aspect of intellectual property, including patenting aspect. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | To provide an understanding on biosafety and risk assessment of products, ethical issues in biological research | | | | | | |
| **CO 2** | To introduce about the IPR and its role | | | | | | |
| **CO 3** | To examine the role of Biosafety and bioethics | | | | | | |
| **CO 4** | To know the procedure of applying IPR | | | | | | |

### Unit I

**Biotechnology and society:** Introduction to science, technology and society, issues of access-Case studies/experiences from developing and developed countries. Ownership, monopoly, traditional knowledge, biodiversity, benefit sharing, environmental sustainability, public vs. private funding, biotechnology in international relations, globalization and development divide. Public acceptance issues for biotechnology: Biotechnology and hunger: Challenges for the Indian Biotechnological research and industries

### Unit II

**Bioethics & legal issues:** Principles of bioethics: Legality, morality and ethics, autonomy, human rights, beneficence, privacy, justice, equity etc. Expanding scope of ethics from biomedical practice to biotechnology, bioethics vs. business ethics, ethical dimensions of IPR, technology transfer and other global biotech issues. Legal, institutional and socio-economic impacts of biotechnology; biotechnology and social responsibility, Public education to increase the awareness of bioethics with regard to generating new forms of life for informed decision making-with case studies.

### Unit III

**Biosafety:** Good Lab Practices, Introduction to Biological Safety Cabinets, Primary Containment for Biohazards, Biosafety Levels GMOs and LMOs and their environmental impact, Roles of Institutional Biosafety Committee, RCGM, GEAC etc. For GMO applications in food and agriculture Risk analysis, assessment and management

**Bioethics:** Bioethical issues related to Healthcare & medicine Food & agriculture Genetic engineering, The Human Genome Project and Genetic Testing Environmental problems

### Unit IV

**IPR, Patents and Patents Laws:** Intellectual property rights-TRIP- GATT International conventions patents, Requirement of patentable novelty Methods of application of patents Legal implications Biodiversity and farmer rights Objectives of the patent system, Basic principles and general requirements of patent law, Biotechnological inventions and patent law. Legal development: Patentable subjects and protection in biotechnology, Patenting of living organisms, procedure for applying for patent Patent Infringement and related case studies Biological Patentability.

**IPR and Biotechnology:** Biopiracy and Bioprospecting Farmers Rights and Plant breeders rights Biodiversity.

**Suggested Books:**

- Biosafety in Microbiological and Biomedical Laboratories, (2009) 5th Ed, www.cdc.gov/ od/ ohs/ biosfty/ bmbl5/ bmbl5toc.html.
- V. Shree Krishna, (2007), Bioethics and Biosafety in Biotechnology, New Age International Pvt. Ltd. Publishers.
- Deepa Goel, ShominiParashar, (2013), IPR, Biosafety and Bioethics, Pearson.
- R. Ian Freshney, Culture of Animal Cells: a Manual of Basic Technique and Specialized Applications, 6th Ed, John Wiley & Blackwell
- Biotechnology and Safety Assessment Thomas J.A., Fuch R.L Academic Press 3rd Edition 2002
- Biological safety Principles and practices Fleming D.A., Hunt D. ASM Press 3rd. ed. 2000
- Bioethics Ben Mepham Oxford University Press 2008
- Bioethics & Biosafety R Rallapalli&Geetha Bali APH Publication 2007

| OE-CS-416A | Big Data and Analytics | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **0** | **0** | **2** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | **To provide knowledge of Big Data Analytics and Distributed File Systems.** | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | To learn in details the concepts of big data. | | | | | | |
| **CO2** | Expose the criteria of big data analytics and big data storage. | | | | | | |
| **CO3** | To explore knowledge of big data compression techniques. | | | | | | |
| **CO4** | To explore learning of big data tools and state-of-the-art knowledge with implementation for big data. | | | | | | |

### Unit I

**Big Data Background:** Big data definition and features of big data, big data value, development of big data, challenges of big data, NoSQL databases, technologies related to big data including cloud computing, Internet of Things, data center, Hadoop, relationship between IoT and big data, relationship between hadoop and big data, big data generation and acquisition includes data collection, data transmission, data pre-processing, big data applications.

### Unit II

**Big Data Analytics and Storage:** Big data analysis, big data analytic methods and tools, Pig, Hive, Flume, Mahout, Big data storage, distributed storage system for massive data, storage mechanism for big data GFS, HDFS, HBase, MongoDB, Cassandra, big data storage deduplication techniques, fixed-size and variable-size blocks based deduplication, content defined chunking, frequency based chunking, byte and multi-byte indexing techniques, Cloud storage.

### Unit III

**Big Data Compression:** Big data delta compression, Xdelta implementation, Message Digest (MD5), Secure Hash Algorithm (SHA-1/SHA-256), Gear Hash, Tiger Hash, Rabin and Incremental Secure Fingerprint based deduplication, lossless duplicate and similar data elimination approaches, Parallel deduplication and compression using PCOMPRESS, Scalable Decentralized Deduplication Store (SDDS) using Cassandra.

### Unit IV

**Big Data Processing:** Installation procedure with system requirements for Apache Hadoop, Cassandra, Spark, Pig, Hive, HBase, MongoDB large scale distributed storage systems, Map Reduce programming model working, YARN architecture, Apache Pig and Hive architecture, Single node and Multi-nodes Hadoop Cluster Set up and running a Big Data example, NoSQL implementation.

**Suggested Books**:

- "Big Data" by Viktor Mayer-Schönberger, Kenneth Cukier, ISBN:978-0544002692, Eamon Dolan/Houghton Mifflin Harcourt 2013.
- “Big Data Now”, by O’Reilly Media Inc., ASIN: B0097E4EBQ, O’Reilly 2012.
- “Hadoop Operation”, by Eric Sammer, ISBN: 978-1449327057, O’Reilly 2012.
- “MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems”, by Donald Miner, Adam Shook, ISBN:978-1449327170, O’Reilly 2012.
- “Programming Hive”, by Edward Capriolo, ISBN: 978-1449319335,O’Reilly 2012.
- “HBase: the Definitive Guide”, by Lars George, ISBN: 978-1449396107, O’Reilly 2011.

- “Mahout in Action”, by Sean Owen, Robin Anil, Ted Dunning, Ellen Friedman, ISBN: 978-1935182689, Manning 2011.
- “Programming Pig”, by Alan Gates, ISBN: 978-1449302641, O’Reilly 2011.
- “Cassandra, the Definitive Guide”, by Eben Hewitt ISBN: 978-1449390419 O’Reilly 2011. “MongoDB: The Definitive Guide” by Kristina Chodorow, Michael Dirolf,ISBN: 978-1449381561, O’Reilly, 2010.

**B. Tech Computer Science and Engineering (Artificial Intelligence and Machine Learning)**
**Scheme of Studies/Examination**
**Semester III**

| S. No. | Course No. | Subject | L:T:P | Hours/ Week | Credits | Examination Schedule | | | | Duration of Exam (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Major Test | Minor Test | Practical | Total | |
| 1 | BS- CS-AIML-201A | Applied Statistical Analysis for AI | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | ES- CS-AIML-203A | Data Structure | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 3 | PC- CS-AIML-205A | Object Oriented Programming | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 4 | PC- CS-AIML-207A | Introduction to AI | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 5 | ES- CS-AIML-209A | Programming Language | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 6 | HM-902A | Business Intelligence and Entrepreneurship | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 7 | PC- CS-AIML-213LA | Data Structure Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 8 | PC- CS-AIML-215LA | Object Oriented Programming Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 9 | PC- CS-AIML-217LA | **Python –Lab-I** | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| | | **Total** | | **24** | **21** | **450** | **270** | **180** | **900** | |
| 11 | SIM-201A* | Seminar on Summer Internship | 2:0:0 | 2 | 0 | 0 | 50 | 0 | 50 | |

| BS-CS-AIML-201A | Applied Statistical Analysis for AI | | | | | |
|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **75** | **25** | **100** | **3** |
| **Purpose** | To gain a broad understanding of the statistical analysis in Artificial Intelligence. | | | | | |
| **Course Outcomes(CO)** | | | | | | |
| **CO1** | To study the Statistical Analysis concepts with their relationships and process. | | | | | |
| **CO2** | To familiarize with describing data, transforming and summarizing. | | | | | |
| **CO3** | To understand testing hypothesis with real time applications. | | | | | |
| **CO4** | To apply the examining relationships to find the correlation and regression. | | | | | |
| **CO5** | To demonstrate and analyse using basic statistical techniques with different use cases. | | | | | |
| **CO6** | To understand the advanced techniques with applications of decision trees, neural networks. | | | | | |

**UNIT – I**

Introduction, Meaning of Statistics, The Scientific Method, Basic Steps of the Research Process, Experimental Data and Survey Data, Populations and Samples, Census and Sampling Method, Parameter and Statistic, Independent and Dependent Variables, Examining Relationships, Introduction to SPSS Statistics.

**UNIT – II**

Introduction, Types of Data, Data Transformation, Summarizing Data: Graphical Methods, Summarizing Data: Measures of Central Tendency, Summarizing Data: Measures of Dispersion, Levels of Measurement, Random Variables and Probability Distributions, Discrete and Continuous Random Variable, Making Inferences about Populations from samples, Estimator and Estimate, Confidence Interval for Population Mean (Large Sample).

**UNIT – III**

Introduction, Null and Alternative Hypothesis, Type I and Type II Error, The Procedure of Hypothesis Testing; Hypothesis Testing of a Population Mean: Sample, a propotion(One Sample), Population Variance, Population Mean: Two Independent Samples(), Dependent Samples (Paired Samples), Two Population Proportion, Two Population Variances; Analysis of Variance (ANOVA).

**UNIT – IV**

Introduction, Types of Correlation, Karl Pearson Coefficient Correlation, Spearman's Rank Order Correlation, Partial Correlation, Residuals and Plots, Simple Linear Regression, Multiple Regression Model, Repeated Measures, Non-linear Regression, Polynomial Regression Models, Decision Trees, Neural Networks, Cluster Analysis, Factor Analysis.

**SUGGESTED BOOKS:**

1. Probability for Statistics and Machine Learning: Anirban DasGupta - 2011
2. An Introduction to Statistics with Python With Applications in the Life Sciences By Thomas Haslwanter, 2016
3. Applied Statistics: A handbook of techniques- Zenon Reynarowych, springer verlag
4. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media Media.
5. Jain V.K., "Data Sciences", Khanna Publishing House, Delhi.
6. Applied Statistics-principles and Examples-D.R.Cox and E.J.Snell.
7. Applied statiscal methods, Irving W. Burr, Academic press.
8. Probability, Statistics and Random process, Dr.K.Murugesan & P.Gurusamy by Anuradha Agencies, Deepthi publications.
9. Jain V.K., "Big Data and Hadoop", Khanna Publishing House, Delhi.
10. Jiawei Han and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Morgan Kaufmann Publishers

| ES-CS-AIML-203A | Data Structure | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | To introduce the principles and paradigms of Data Structures for design and implement the software systems logically and physically. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO 1** | To introduce the basic concepts of Data structure , basic data types ,searching and sorting based on array data types. | | | | | | |
| **CO 2** | To introduce the structured data types like Stacks and Queue and its basic operations' implementation. | | | | | | |
| **CO 3** | To introduce dynamic implementation of linked list. | | | | | | |
| **CO 4** | To introduce the concepts of Tree and graph and implementation of traversal algorithms. | | | | | | |

**Unit-I**

**Introduction to Data Structures**, Data Types, Built in and User Defined Data Structures, Applications of Data Structure, Algorithm Analysis, Worst, Best and Average Case Analysis, Notations of Space and Time Complexity, Basics of Recursion.

**Arrays**, One Dimensional Arrays, Two Dimensional Arrays and Multi-Dimensional Arrays, Sparse Matrices, Searching from array using Linear and Binary Searching Algorithm, Sorting of array using Selection, Insertion, Bubble, Radix Algorithm

**Unit-II**

**Stacks**: Definition, Implementation of Stacks and Its Operations, Evaluation of Infix, prefix and Postfix Expression, Inter-conversion of Infix, Prefix and Post-Fix Expression, Implementation of Merge Sort and Quick Sort Algorithm.

**Queues**: Definition, Sequential Implementation of Linear Queues and Its Operations, Circular Queue and Its Implementation, Priority Queues and Its Implementation, Applications of queues.

**Unit-III**

**Linked Lists**: Need of Dynamic Data Structures, Single Link List and Its Dynamic Implementation, Traversing, Insertion, Deletion Operations on Single Link Lists. Comparison between Static and Dynamic, Implementation of Linked List. Circular Link Lists and Doubly Link List, Dynamic Implementation of Primitive Operations on Doubly Linked Lists and Circular Link List. Dynamic Implementation of Stacks and Queues.

**Unit-IV**

**Trees**: Definition, Basic Terminology, Binary Tree, External and Internal Nodes, Static and Dynamic Implementation of a Binary Tree, Primitive Operations on Binary Trees, Binary Tree Traversals: Pre-Order, In-Order and Post-Order Traversals. Representation of Infix, Post-Fix and Prefix Expressions using Trees.

**Introduction to Binary Search Trees:** B+ trees, AVL Trees, Threaded Binary trees, Balanced Multi-way search trees, Implementation of Heap Sort Algorithm.

**Graphs**: Basic Terminology, Definition of Undirected and Directed Graphs, Memory Representation of Graphs, Minimum-Spanning Trees, Warshal Algorithm, Graph Traversals Algorithms: Breadth First and Depth First.

**SUGGESTED BOOKS:**

1. Theory and Problems of Data Structures by Jr. Symour Lipschetz, Schaum's outline, TMH.
2. Data Structures and Algorithms by PAI, TMH.
3. Fundamentals of Data structures by Ellis Horowitz and Sartaj Sahni, Pub, 1983, AW.
4. Data Structures and Algorithms by A.V. Aho, J.E. Hopcroft and T.D. Ullman, Original edition, Addison-Wesley, 1999, Low Priced Edition.
5. Data Structures and Program Design in C by Robert Kruse, PHI,
6. Shukla, Data Structures using C++, Wiley India

7. Introduction to Computers Science -An Algorithms Approach, Jean Paul Tremblay, Richard B. Bunt, 2002, T.M.H.
8. Data Structure and the Standard Template library – Willam J. Collins, 2003, T.M.H.

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| PS-CS-AIML-205A | Object-Oriented Programming | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | To introduce the basic concepts of object oriented programming language and the its representation. | | | | | | |
| **CO2** | To allocate dynamic memory, access private members of class and the behavior of inheritance and its implementation. | | | | | | |
| **CO3** | To introduce polymorphism, interface design and overloading of operator. | | | | | | |
| **CO4** | To handle backup system using file, general purpose template and handling of raised exception during programming. | | | | | | |

**Unit–I**

Introduction to C++, C++ Standard Library, Illustrative Simple C++ Programs. Header Files, Namespaces, Application of object oriented programming.

Object Oriented Concepts, Introduction to Objects and Object Oriented Programming, Encapsulation, Polymorphism, Overloading, Inheritance, Abstract Classes, Accessifier (public/ protected/ private), Class Scope and Accessing Class Members, Controlling Access Function, Constant, Class Member, Structure and Class.

**Unit-II**

Friend Function and Friend Classes, This Pointer, Dynamic Memory Allocation and Deallocation (New and Delete), Static Class Members, Constructors, parameter Constructors and Copy Constructors, Deconstructors, Introduction of inheritance, Types of Inheritance, Overriding Base Class Members in a Derived Class, Public, Protected and Private Inheritance, Effect of Constructors and Deconstructors of Base Class in Derived Classes.

**Unit-III**

Polymorphism, Pointer to Derived class, Virtual Functions, Pure Virtual Function, Abstract Base Classes, Static and Dynamic Binding, Virtual Deconstructors.

Fundamentals of Operator Overloading, Rules for Operators Overloading, Implementation of Operator Overloading Like <<,>> Unary Operators, Binary Operators.

**Unit-IV**

Text Streams and binary stream, Sequential and Random Access File, Stream Input/ Output Classes, Stream Manipulators.

Basics of C++ Exception Handling, Try, Throw, Catch, multiple catch, Re-throwing an Exception, Exception specifications.

Templates: Function Templates, Overloading Template Functions, Class Template, Class Templates and Non- Type Template arguments.

**SUGGESTED BOOKS:**

- The complete reference C ++ by Herbert shieldt Tata McGraw Hill.
- Object Oriented Programming in Turbo C++ by Robert Lafore, 1994, The WAITE Group Press.
- Shukla, Object Oriented Programming in c++, Wiley India.
- C++ How to Program by H M Deitel and P J Deitel, 1998, Prentice Hall.
- Programming with C++ By D Ravichandran, 2003, T.M.H.

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| PC-CS-AIML-207A | Introduction to AI | | | | | |
|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **75** | **25** | **100** | **3** |
| **Purpose** | To gain a broad understanding of the discipline of Artificial Intelligence and its scope in various emerging areas. | | | | | |
| **Course Outcomes(CO)** | | | | | | |
| **CO1** | Demonstrate fundamental understanding of Artificial Intelligence (AI) and its foundation | | | | | |
| **CO2** | Demonstrate basic concepts of problem solving, searching, inference, perception | | | | | |
| **CO3** | Demonstrate proficiency in applying AI techniques in various domains | | | | | |
| **CO4** | Apply basic principles of AI in solutions that require real world knowledge representation and learning | | | | | |
| **CO5** | Demonstrate the real life examples of Artificial Intelligence | | | | | |
| **CO6** | Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications | | | | | |

**UNIT – I**

**Scope of AI**: Introduction to Artificial Intelligence, History of Artificial Intelligence, Artificial Intelligence Languages, Multi Agent Systems, natural language processing, vision and speech processing, robotics, expert systems, Case study: Google Duplex, Dialogflow.

**UNIT – II**

**Problem Solving, Searching and Planning**: Problem spaces and search, Heuristic and Informed search strategies, Minmax search, Alpha-beta pruning.

Search and optimization (gradient descent), Adversarial search, Planning and scheduling, Case study: Health Care System.

**UNIT – III**

**Knowledge Engineering, Representation, Reasoning and finding Optimal Paths:** Knowledge and Knowledge based system, Knowledge and rationality, Logic and inference, Propositional and predicate logic, Ontologies, Bayesian Reasoning, Temporal reasoning, Knowledge Discovery: Data and Web Mining Case study: Medical diagnosis

**UNIT – IV**

**Applications of AI in Various domains:** AI in Marketing, AI in Banking, AI in Finance, AI in Agriculture, AI in Health Care, AI in Gaming, AI in Space Exploration, AI in Autonomous vehicles, AI in Chatbots, AI in Creativity.

**SUGGESTED BOOKS:**

1. E. Rich and K. Knight, “Artificial Intelligence”, TMH, 2nd Ed., 1992.
2. N. J. Nilsson, “Principles of AI”, Narosa Publ. House, 1990.
3. M. N. Hoda, “Foundation Course in Artificial Intelligence”, Vikas Pub., 2004.
4. Artificial Intelligence’ RB Mishra,PHI
5. Knowledge and Knowledge based System’ Russell.
6. Artificial intelligence, Patrick Henry Winston:, 1992, Addition Wesley 3 Ed.
7. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach” , 3rd Edition, Prentice Hall.
8. P. H. Winston, "Artificial Intelligence", Pearson Education, 3rd Edition, 2002. Artificial Intelligence.
9. D. W. Patterson, “Introduction to AI and Expert Systems”, PHI, 1992.
10. R. J. Schalkoff, “Artificial Intelligence – An Engineering Approach”, McGraw Hill Int. Ed. Singapore, 1992.
11. M. Sasikumar, S. Ramani, “Rule Based Expert Systems”, Narosa Publishing House, 1994. 5. Tim Johns, “Artificial Intelligence, Application Programming, Wiley Dreamtech, 2005.
12. Trivedi, M.C., “A Classical Approach to Artifical Intelligence”, Khanna Publishing House, Delhi.
13. Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, 2011.
14. David Poole and Alan Mackworth, “Artificial Intelligence: Foundations for Computational Agents”, Cambridge University Press 2010.

| ES-CS-AIML-209A | Programming Language | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | To introduce the principles and paradigms of programming languages for design and implement the software intensive systems. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO 1** | To introduce the basic concepts of programming language, the general problems and methods related to syntax and semantics. | | | | | | |
| **CO 2** | To introduce the structured data objects, subprograms and programmer defined data types. | | | | | | |
| **CO 3** | To outline the sequence control and data control. | | | | | | |
| **CO 4** | To introduce the concepts of storage management using programming languages. | | | | | | |

**Unit-I**

**Introduction, Syntax and Semantics:** A brief history, Characteristics of a good programming language, Programming language translators- compiler and interpreters, Elementary data types – data objects, variable and constants, data types. Specification and implementation of elementary data types, Declarations, type checking and type conversions, Assignment and initialization, Numeric data types, enumerations, Booleans and characters.
**Syntax and Semantics:** Introduction, general problem of describing syntax, Formal method of describing Syntax, attribute grammar dynamic semantic.

**Unit-II**

**Structured data objects, Subprograms and Programmer Defined Data Types:** Structured data objects and data types, specification and implementation of structured data types, Declaration and type checking of data structure, vector and arrays, records Character strings, variable size data structures, Union, pointer and programmer defined data objects, sets, files.
**Subprograms and Programmer Defined Data Types:** Evolution of data type concept abstraction, encapsulation and information hiding, Subprograms, type definitions, abstract data types, over loaded subprograms, generic subprograms.

**Unit–III**

**Sequence Control and Data Control:** Implicit and explicit sequence control, sequence control within expressions, sequence control within statement, Subprogram sequence control: simple call return, recursive subprograms, Exception and exception handlers, co routines, sequence control. Concurrency – subprogram level concurrency, synchronization through semaphores, monitors and message passing.
**Data Control:** Names and referencing environment, static and dynamic scope, block structure, Local data and local referencing environment, Shared data: dynamic and static scope, Parameter and parameter transmission schemes.

**Unit-IV**

**Storage Management and Programming Languages:** Major run time elements requiring storage, programmer and system controlled storage management and phases, Static storage management, Stack based storage management, Heap storage management, variable and fixed size elements.
**Programming Languages:** Introduction to procedural, non-procedural, structured, logical, functional and object oriented programming language, Comparison of C and C++ programming languages.

**SUGGESTED BOOKS:**

- Terrence W. Pratt, Marvin V. Zelkowitz, Programming Languages Design and Implementation, Pearson.
- Allen Tucker and Robert Noonan, Programming Languages–Principles and Paradigms, Tata McGraw-Hill, 2009.
- Ellis Horowitz, Fundamentals of Programming Languages, Galgotia Publications, 2010.
- C. Ghezzi, Programming Languages Concepts, Wiley Publications, 2010.

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| HM-902 A | Business Intelligence and Entrepreneurship | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | To make the students conversant with the basics concepts in management thereby leading to nurturing their managerial skills. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Students will be able understand who the entrepreneurs are and what competences needed to become an Entrepreneur. | | | | | | |
| **CO2** | Students will be able understand insights into the management, opportunity search, identification of a Product; market feasibility studies; project finalization etc. required for small business enterprises. | | | | | | |
| **CO3** | Students can be able to write a report and do oral presentation on the topics such as product identification, business idea, export marketing etc. | | | | | | |
| **CO4** | Students will be able to know the different financial and other assistance available for the small industrial units. | | | | | | |

**UNIT – I**

**Entrepreneurship :** Concept and Definitions; Entrepreneurship and Economic Development; Classification and Types of Entrepreneurs; Entrepreneurial Competencies; Factor Affecting Entrepreneurial Growth – Economic, Non-Economic Factors; EDP Programmes; Entrepreneurial Training; Traits/Qualities of an Entrepreneurs; Manager Vs. Entrepreneur, Entrepreneurial challenges.

**UNIT – II**

**Opportunity / Identification and Product Selection:** Entrepreneurial Opportunity Search and Identification; Criteria to Select a Product; Conducting Feasibility Studies; Sources of business ideas, Marketing Plan : Conducting of Marketing Research, Industry Analysis, Competitor analysis, market segmentation and positioning, building a marketing plan, marketing mix, launching a new product; export marketing, Methods of Project Appraisal, Project Report Preparation; Specimen of Project Report; Project Planning and Scheduling using Networking Techniques of PERT / CPM.

**UNIT – III**

**Small Enterprises and Enterprise Launching Formalities :** Definition of Small Scale; Rationale; Objective; Scope; SSI; Registration; NOC from Pollution Board; Machinery and Equipment Selection , Role of SSI in Economic Development of India; major problem faced by SSI,MSMEs – Definition and Significance in Indian Economy; MSME Schemes, Challenges and Difficulties in availing MSME Schemes.

**UNIT – IV**

**Role of Support Institutions and Management of Small Business :** DIC; SIDO; SIDBI; Small Industries Development Corporation (SIDC); SISI; NSIC; NISBUD; State Financial Corporation SIC; Venture Capital : Concept, venture capital financing schemes offered by various financial institutions in India.

**Special Issues for Entrepreneurs**: Legal issues – Forming business entity, requirements for formation of a Private/Public Limited Company, Entrepreneurship and Intellectual Property Rights: IPR and their importance. (Patent, Copy Right, Trademarks) , Case Studies-At least one in whole course.

**Note:**

• Case studies of Entrepreneurs – successful, failed, turnaround ventures should be discussed in the class.

• Exercises / activities should be conducted on ‘generating business ideas’ and identifying problems and opportunities.

• Interactive sessions with Entrepreneurs, authorities of financial institutions, Government officials should be organized

**SUGGESTED BOOKS:**


1. "Entrepreneurship development small business enterprises", Pearson, Poornima M Charantimath,2013.
2. Roy Rajiv, "Entrepreneurship", Oxford University Press, 2011.
3. "Innovation and Entrepreneurship",Harper business- Drucker.F, Peter, 2006.
4. "Entrepreneurship", Tata Mc-graw Hill Publishing Co.ltd new Delhi- Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, 8th Edition, 2012.
5. Enterpreneurship Development- S.Chand and Co.,Delhi- S.S.Khanka 1999
6. Small-Scale Industries and Entrepreneurship. Himalaya Publishing House, Delhi –Vasant Desai 2003.
7. Entrepreneurship Management -Cynthia, Kaulgud, Aruna, Vikas Publishing House, Delhi, 2003.


**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| PC-CS-AIML-213LA | Data Structure Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **40** | **60** | **100** | **2** |
| **Purpose** | To introduce the principles and paradigms of Data Structures for design and implement the software systems logically and physically. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Implement linear and non linear data structures using linked list. | | | | | | |
| **CO2** | Apply various data structures such as stack, queue and tree to solve the problems. | | | | | | |
| **CO3** | Implement various searching and sorting techniques. | | | | | | |
| **CO4** | Choose appropriate data structure while designing the applications and analyze the complexity of the algorithms. | | | | | | |

## LIST OF PRACTICALS:

1. Write a program for Binary search methods.
2. Write a program for insertion sort, selection sort and bubble sort.
3. Write a program to implement Stack and its operation.
4. Write a program for quick sort.
5. Write a program for merge sort.
6. Write a program to implement Queue and its operation.
7. Write a program to implement Circular Queue and its operation.
8. Write a program to implement singly linked list for the following operations: Create, Display, searching, traversing and deletion.
9. Write a program to implement doubly linked list for the following operations: Create, Display, inserting, counting, searching, traversing and deletion.
10 Write a program to implement circular linked list for the following operations: Create, Display, inserting, counting, searching, traversing and deletion.
11. Write a program to implement insertion, deletion and traversing in B tree

**NOTE:** A student has to perform at least ten experiments. Seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

| PC-CS-AIML-215LA | Object Oriented Programming Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **40** | **60** | **100** | **2** |
| **Purpose** | To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| CO1 | To familiarize with the class and objects | | | | | | |
| CO2 | To implement the concept of constructors | | | | | | |
| CO3 | To familiarize the concept of operator overloading | | | | | | |
| CO4 | To implement the concepts of Inheritance | | | | | | |

## LIST OF PRACTICALS

**1**. Raising a number n to a power p is the same as multiplying n by itself p times. Write a function called power ( ) that takes a double value for n and an int value for p, and returns the result as double value. Use a default argument of 2 for p, so that if this argument is omitted, the number will be squared. Write a main ( ) function that gets values from the user to test this function.

**2**. A point on the two dimensional plane can be represented by two numbers: an X coordinate and a Y coordinate. For example, (4,5) represents a point 4 units to the right of the origin along the X axis and 5 units up the Y axis. The sum of two points can be defined as a new point whose X coordinate is the sum of the X coordinates of the points and whose Y coordinate is the sum of their Y coordinates. Write a program that uses a structure called point to model a point. Define three points, and have the user input values to two of them. Then set the third point equal to the sum of the other two, and display the value of the new point. Interaction with the program might look like this:

Enter coordinates for P1: 3 4
Enter coordinates for P2: 5 7
Coordinates of P1 + P2 are : 8, 11

**3**. Create the equivalent of a four function calculator. The program should request the user to enter a number, an operator, and another number. It should then carry out the specified arithmetical operation: adding, subtracting, multiplying, or dividing the two numbers. (It should use a switch statement to select the operation). Finally it should display the result. When it finishes the calculation, the program should ask if the user wants to do another calculation. The response can be 'Y' or 'N'. Some sample interaction with the program might look like this.

Enter first number, operator, and second number: 10/ 3
Answer = 3.333333
Do another (Y/ N)? Y
Enter first number, operator, second number 12 + 100
Answer = 112
Do another (Y/ N) ? N

**4**. A phone number, such as (212) 767-8900, can be thought of as having three parts: the area code (212), the exchange (767) and the number (8900). Write a program that uses a structure to store these three parts of a phone number separately. Call the structure phone. Create two structure variables of type phone. Initialize one, and have the user input a number for the other one. Then display both numbers. The interchange might look like this:

- Enter your area code, exchange, and number: 415 555 1212
- My number is (212) 767-8900
- Your number is (415) 555-1212

**5**. Create two classes DM and DB which store the value of distances. DM stores distances in metres and centimeters and DB in feet and inches. Write a program that can read values for the class objects and add one object of DM with another object of DB. Use a friend function to carry out the addition operation. The object that stores the results maybe a DM object or DB objects, depending on the units in which the results are required. The display should be in the format of feet and inches or metres and cenitmetres depending on the object on display.

**6**. Create a class rational which represents a numerical value by two double values- NUMERATOR and DENOMINATOR. Include the following public member Functions:

- constructor with no arguments (default).
- constructor with two arguments.
- void reduce( ) that reduces the rational number by eliminating the highest common factor between the numerator and denominator.
- Overload + operator to add two rational number.
- Overload >> operator to enable input through cin.
- Overload << operator to enable output through cout.

Write a main ( ) to test all the functions in the class.

**7**. Consider the following class definition

```
class father {
protected : int age;
public;
father (int x) {age = x;}
virtual void iam ( )
{ cout < < "I AM THE FATHER, my age is : "<< age<< end1:}
```

Derive the two classes son and daughter from the above class and for each, define iam ( ) to write our similar but appropriate messages. You should also define suitable constructors for these classes. Now, write a main ( ) that creates objects of the three classes and then calls iam ( ) for them. Declare pointer to father. Successively, assign addresses of objects of the two derived classes to this pointer and in each case, call iam ( ) through the pointer to demonstrate polymorphism in action.

**8**. Write a program that creates a binary file by reading the data for the students from the terminal. The data of each student consist of roll no., name ( a string of 30 or lesser no. of characters) and marks.

**9**. A hospital wants to create a database regarding its indoor patients. The information to store include

a) Name of the patient
b) Date of admission
c) Disease
d) Date of discharge

Create a structure to store the date (year, month and date as its members). Create a base class to store the above information. The member function should include functions to enter information and display a list of all the patients in the database. Create a derived class to store the age of the patients. List the information about all the to store the age of the patients. List the information about all the pediatric patients (less than twelve years in age).

**10**. Make a class **Employee** with a name and salary. Make a class **Manager** inherit from **Employee**. Add an instance variable, named department, of type string. Supply a method to **to String** that prints the manager's name, department and salary. Make a class **Executive** inherits from **Manager**. Supply a method **to String** that prints the string **"Executive"** followed by the information stored in the **Manager** superclass object. Supply a test program that tests these classes and methods.

**11**. Imagine a tollbooth with a class called toll Booth. The two data items are a type unsigned int to hold the total number of cars, and a type double to hold the total amount of money collected. A constructor initializes both these to 0. A member function called payingCar ( ) increments the car total and adds 0.50 to the cash total. Another function, called nopayCar ( ), increments the car total but adds nothing to the cash total. Finally, a member function called displays the two totals. Include a program to test this class. This program should allow the user to push one key to count a paying car, and another to count a nonpaying car. Pushing the ESC kay should cause the program to print out the total cars and total cash and then exit.

**12**. Write a function called reversit ( ) that reverses a string (an array of char). Use a for loop that swaps the first and last characters, then the second and next to last characters and so on. The string should be passed to reversit ( ) as an argument. Write a program to exercise reversit ( ). The program should get a string from the user, call reversit ( ), and print out the result. Use an input method that allows embedded blanks. Test the program with Napoleon's famous phrase, "Able was I ere I saw Elba)".

**13**. Create some objects of the string class, and put them in a Deque-some at the head of the Deque and some at the tail. Display the contents of the Deque using the forEach ( ) function and a user written display function. Then search the Deque for a particular string, using the first That ( ) function and display any strings that match. Finally remove all the items from the Deque using the getLeft ( ) function and display each item. Notice the order in which the items are displayed: Using getLeft ( ), those inserted on the left (head) of the Deque are removed in “last in first out” order while those put on the right side are removed in “first in first out” order. The opposite would be true if getRight ( ) were used.

**14**. Assume that a bank maintains two kinds of accounts for customers, one called as savings account and the other as current account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides cheque book facility but no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed.

Create a class account that stores customer name, account number and type of account. From this derive the classes

cur_acct and sav_acct to make them more specific to their requirements. Include necessary member functions in order to achieve the following tasks:

a) Accept deposit from a customer and update the balance.
b) Display the balance.
c) Compute and deposit interest.
d) Permit withdrawal and update the balance.
e) Check for the minimum balance, impose penalty, necessary and update the balance.
f) Do not use any constructors. Use member functions to initialize the class members.

**15**. Create a base class called shape. Use this class to store two double type values that could be used to compute the area of figures. Derive two specific classes called triangle and rectangle from the base shape. Add to the base class, a member function get_data( ) to initialize baseclass data members and another member function display_area( ) to compute and display the area of figures. Make display_area ( ) as a virtual function and redefine this function in the derived classes to suit their requirements. Using these three classes, design a program that will accept dimensions of a triangle or a rectangle interactively and display the area.

Remember the two values given as input will be treated as lengths of two sides in the case of rectangles and as base and height in the case of triangles and used as follows:

Area of rectangle = x * y

Area of triangle = ½ * x * y

**NOTE:** A student has to perform at least ten experiments. Seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

| PC-CS-AIML-217LA | **Python Lab-I** | | | | | |
|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **40** | **60** | **100** | **2** |
| **Purpose** | To gain a broad understanding of the basics of Python Programming Language. | | | | | |
| **Course Outcomes** | | | | | | |
| **CO1** | To understand the basic concepts of programming in Python. | | | | | |
| **CO2** | To implement data types, logical and mathematical operators. | | | | | |
| **CO3** | To implement list, tuples, dictionaries, arrays, strings | | | | | |
| **CO4** | To understand and implement the fundamentals of functions, recursion | | | | | |
| **CO5** | To learn and apply the concepts of looping and conditional statements | | | | | |
| **CO6** | To learn and implement the fundamentals of searching and sorting | | | | | |

**LIST OF PRACTICALS:**

1. Write a program to demonstrate basic data types in python.
2. Write a program to implement input, output operations and logical , mathematical operations.
3. Write a program for checking whether the given number is an even number or not.
4. Write a program to demonstrate string, list, tuple and dictionaries in python.
5. Write a program using a for loop that loops over a sequence.
6. Write a program to perform logical and mathematical operations.
7. Write a program to use split and join methods in the string and trace a birthday of a person with dictionary data structure.
8. Write a program to implement function and recursion.
9. Write a program to perform linear search and binary search.
10. Write a program to perform uninformed and informed search.
11. Write a program to perform Insertion sort and binary sort.
12. Write a Python program to demonstrate usage of basic regular expression.
13. Write a program to construct Bayesian Network.

NOTE: A student has to perform at least ten experiments. Seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

**B. Tech Computer Science and Engineering (Artificial Intelligence and Machine Learning)**
**Scheme of Studies/Examination**
**Semester IV**

| S. No. | Course No. | Subject | L:T:P | Hours/ Week | Credits | Examination Schedule | | | | Duration of Exam (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Major Test | Minor Test | Practical | Total | |
| 1 | BS- CS- AIML- 202M | Mathematics for Machine Learning | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | PC- CS- AIML- 204A | Intelligent Systems | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 3 | PC- CS- AIML- 206A | Database Management System | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 4 | PC- CS- AIML- 208A | Internet and Web Technology | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 5 | PC- CS- AIML- 210A | Operating System | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 6 | PC- CS- AIML- 212A | Software Engineering | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 7 | PC- CS- AIML- 216A | Database Management System Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 8 | PC- CS- AIML- 218A | Internet and Web Technology Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 9 | PC- CS- AIML-220A | Python –Lab-II | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| | | **Total** | | **24** | **21** | **450** | **270** | **180** | **900** | |
| 10 | MC-901A | Environmental Sciences | 3:0:0 | 3 | 0 | | 100 | 0 | 100 | 3 |

| BS-CS-AIML 202M | Mathematics for Machine Learning | | | | | |
|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **75** | **25** | **100** | **3** |
| **Purpose** | To understand and learn the core concepts of the prerequisite mathematics for applications in data science and machine learning | | | | | |
| **Course Outcomes(CO)** | | | | | | |
| **CO1** | To understand the basic concepts of data science & machine learning Concepts and their application in modern context | | | | | |
| **CO2** | To apply the basic statistical concepts for solving various problems | | | | | |
| **CO3** | To distinguish between various probability distributions and apply the concepts for the solution of related problems | | | | | |
| **CO4** | To learn the essential tools of matrices and linear algebra including linear transformations, eigen values, diagonalisation, orthogonalization and factorization | | | | | |
| **CO5** | To learn mathematical modelling, types of matrixs | | | | | |
| **CO6** | To Implement mathematical concepts using real-world data | | | | | |

### UNIT – I

**Overview of Data Science & Machine Learning:** Introduction and history of Data Science, Introduction and history of Machine Learning, Overlap between Data Science, Machine Learning and Artificial Intelligence, Applications of Data Science & Machine Learning in the modern context, Types of data, Basic Statistical Concepts:Scale of Measurements (Nominal, Ordinal, Ratio and Interval), Measures of Location, Measures of Variability/Spread, Measures of Shape.

**Case Studies: Bollywood Dataset, coronary heart disease dataset.**

### UNIT – II

**Probability Theory:** Principle of counting, definitions of probability theory, independent events, mutuallyexclusive events, collectively exhaustive events, conditional probability, Bayes Theorem, Discrete probability distribution (Discrete Uniform Distribution, Poisson Distribution, Bernoulli Distribution and Binomial Distribution), covariance, correlation,Continuous probability distribution, normal distribution, Central Limit Theorem, Binomial Distribution, Continuous Uniform Distribution, Exponential Distribution, P-Value, T-Value, Confidence Interval, t distribution and chi square distribution

### UNIT – III

**Linear Algebra:** Introduction to linear algebra, notations and definitions, Elementary transformations, Elementary matrices, inverse using elementary transformations, Rank of a matrix, Normal form of a matrix, Linear dependence and independence of vectors, Consistency of linear system of equations, Eigen Values and Eigen vectors, Properties of Eigen values, Cayley Hamilton theorem, Linear Transformation, Orthogonal transformation

### UNIT – IV

**Mathematical modelling:** Similar matrices, Diagonalisation of a matrix Operations on matrices - additions, subtraction, multiplication, scalar multiplication, vector multiplication, Orthogonal Matrix, Singularity of Matrix, Matrix factorization, decomposition such as LU, QR and SVD, Conceptualizing a mathematical model/curve form first principles, concept of boundary conditions

**SUGGESTED BOOKS:**

1. Probability for Statistics and Machine Learning:Anirban DasGupta - 2011
2. Probability for Machine Learning: Discover How To Harness, Jason Brownlee – 2019.
3. Machine Learning using Python: Manaranjan pradhan, U Dinesh Kumar-2020, Wiley.
4. Machine Learning using Python, PRADHAN, Manaranjan, 1st and Reprint 2019, Wiley.
5. Machine Learning (in Python and R), ) MUELLER,John Paul ,Wiley India
6. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, O'Reilly Media
**7.**Python for Probability, Statistics, and Machine Learning, José Unpingco – 2019
8.Mathematics for Machine Learning, Marc peter Deisenroth, A. Aldo Faisal and Cheng Soon Ong. Published by Cambridge University press.
9. Jeeva Jose, “Machine Learning”, Khanna Publishing House, Delhi.
10.Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press http://www.deeplearningbook.org

| PC-CS-AIML-204A | Intelligent Systems | | | | | |
|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **75** | **25** | **100** | **3** |
| **Purpose** | To impart understanding of the main abstractions and reasoning for intelligent systems. | | | | | |
| **Course Outcomes(CO)** | | | | | | |
| **CO1** | Understand the basic terminologies in artificial intelligence to develop intelligent systems | | | | | |
| **CO2** | Apply the random search and heuristic search for intelligent systems. | | | | | |
| **CO3** | Understand the abstractions and reasoning for intelligent systems | | | | | |
| **CO4** | Apply the rule based methods in intelligent systems | | | | | |
| **CO5** | Identify the characteristics and architectures of algorithms of multi agent systems | | | | | |
| **CO6** | Identify different application areas of Intelligent Systems | | | | | |

**UNIT-I**

**Introduction:** Overview of AI Problems, AI problems as NP, NP-Complete, NP-Hard, Strong and weak, neat and scruffy, symbolic and sub-symbolic, knowledge base and data driven AI.

**UNIT-II**

**Heuristic Search:** Best First Search, Hill Climbing, Beam Search, Tabu Search.

**Randomozed Search:** Simulated Annealing, Genetic Algorithm, Ant Colony Optimization, Particle Swarm Optimization, Basics of probability theory and probability distributions, information theory, Bayesian learning, Gaussian Mixture models and the EM algorithm, Factor analysis, Principal components analysis, Independent Component Analysis.

UNIT-III

**Intelligent Systems:** Knowledge acquisition, Computational intelligence, Rule-based systems, Forward-chaining (a data-driven strategy), Conflict resolution, Backward chaining (a goal-driven strategy), Sources of uncertainty, Bayesian updating, Certainty theory.

**UNIT-IV**

**Possibility theory:** fuzzy sets and fuzzy logic, Object-oriented systems, Data abstraction, Inheritance, Encapsulation, Unified Modeling Language (UML), Dynamic (or late) binding.

**Key Application Areas:** Expert System, Decision Support Systems, **Deep Learning:** Speech and vision, natural Language processing, Information Retrieval, Semantic Web.

**SUGGESTED BOOKS:**

1. Artificial Intelligence' RB Mishra, PHI
2. Introduction to Artificial Intelligence, Charnaik, Pearson.
3. Artificial Intelligence by Elaine Rich, Kevin Knight and Shivashankar B Nair, Tata McGraw Hill.
4. Introduction to Artificial Intelligence and Expert Systems by Dan W Patterson, Pearson Education.
5. Artificial Intelligence : Building Intelligent Systems, KULKARNI, Parag , REPRINT, PHI.

6. Crina Grosan, Ajith Abraham, "Intelligent Systems: A Modern Approach ",Springer-Verlag, 2011
7. Bogdan M. Wilamowski, J. David Irwin, "The Industrial Electronics Handbook. Second Edition: Intelligent Systems", CRC Press, 2011
8. Abraham-Kandel, Gideon-Langholz, "Hybrid-Architectures for Intelligent Systems", CRC-Press, 1992
9. Augmented Human, PAPAGIANNIS, Helen , ist print, SPD.
10. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press, http://www.deeplearningbook.org

| PC-CS-AIML-208A | Internet & Web technology | | | | | |
|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **75** | **25** | **100** | **3** |
| **Purpose** | To gain a broad understanding of the discipline of Web engineering and its application to the development and management of Web Applications. | | | | | |
| **Course Outcomes** | | | | | | |
| **CO1** | Learn the basic concepts of information and web architecture. | | | | | |
| **CO2** | Learn about the skills that will enable to design and build high level web enabled applications. | | | | | |
| **CO3** | Understand the applicability of Java Script as per current software industry standards. | | | | | |
| **CO4** | Acquaint the latest programming language for the implementation of object based and procedure based applications using Python. | | | | | |

**Unit-I**

**Information Architecture**: The role of Information Architect, Collaboration and communication, Organizing information, organizational challenges, Organizing web sites and Intranets, Creating cohesive organization systems, designing navigation systems, types of navigation systems, Integrated navigation elements, designing elegant navigation systems, Searching systems, Searching your web site, designing the search interface, Indexing the right stuff, To search or not to search grouping content, conceptual design, High level Architecture Blueprint. Architectural Page Mockups, Design Sketches.

**Unit-II**

**Introduction to XHTML and HTML5**: Origins and Evolution of HTML and XHTML, Basic Syntax, Standard XHTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, HTML5, Syntactic Differences between HTML and XHTML.

**Cascading Style Sheets**: Introduction, Levels of Style Sheets, Style Specification Formats, Selector Forms, Property Value Forms, Font Properties, List Properties, Color, Alignment of Text, Box Model, Background Images, Conflict Resolution.

**Unit -III**

**Java Script**: Overview of JavaScript, Object Orientation and JavaScript, General Syntactic Characteristics, Primitives, Operations, and Expressions, Screen Output and Keyboard Input, Control Statements, Object Creation and Modification, Arrays, Functions, Constructors, Pattern Matching Using Regular Expressions, Errors in Scripts

**Unit -IV**

**Python**: Introduction to Python, Data Types and Expressions, Control Statements, Strings and Text Files, Lists and Dictionaries, Design with Functions, Design with Classes

**Suggested Books:**

1. By Peter Morville, Louis Rosenfeld, “Information Architecture on the World Wide Web”, O'Reilly Media, 2006.
2. Robert W. Sebesta, “Programming The World Wide Web”, Eight Edition, Pearson India, 2015.
3. Kenneth A. Lambert, “The Fundamentals of Python: First Programs”, 2011, Cengage Learning.
4. Thomas A Powell, “HTML The Complete Reference”, Tata McGraw Hill Publications.

| PC-CS-AIML- 210A | Operating System | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | To familiarize the students with the basics of Operating Systems. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | To understand the structure and functions of Operating system. | | | | | | |
| **CO2** | To learn about processes, threads and scheduling algorithms. | | | | | | |
| **CO3** | To understand the principle of concurrency and the concept of deadlocks. | | | | | | |
| **CO4** | To understand various memory management scheme and to study I/O management and file systems. | | | | | | |

## Unit-I

**Introduction:** Introduction to OS. Operating system functions, Different types of O.S.: batch process, multi-programmed, time-sharing, real-time, distributed, parallel.

**System Structure:** Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, system calls.

## Unit-II

**CPU scheduling:** scheduling criteria, preemptive and non-preemptive scheduling, scheduling algorithms, algorithm evaluation, multi-processor scheduling.

**Threads:** overview, benefits of threads, user and kernel threads.

**Process Management:** Concept of processes, process states, process control, co-operating processes, inter-process communication.

**Process Synchronization:** background, critical section problem, critical region, synchronization hardware, Classical problems of synchronization, semaphores.

## Unit-III

**Deadlocks:** Concept of deadlock, deadlock characterization, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

**Memory Management:** background, logical vs. physical address space, contiguous memory allocation, paging, segmentation, segmentation with paging. Concept of fragmentation.

**Virtual Memory:** background, demand paging, concept of page replacement, page replacement algorithms, allocation of frames, thrashing.

## Unit-IV

**File Systems:** file concept, file organization and access methods, allocation methods, directory structure, free-space management

**I/O Management:** I/O hardware, polling, interrupts, DMA, kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation)

**Disk Management:** disk structure, disk scheduling (FCFS, SSTF, SCAN,C-SCAN) , disk reliability, disk Performance parameters

**Protection and Security:**

Goals of protection and security, security attacks, authentication, program threats, system threats, threat monitoring.

**Case studies:** UNIX file system, Windows file system

**Suggested Books:**


- Operating System Concepts", Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, Wiley
- Operating systems: a concept based approach", Dhananjay M. Dhamdhere, McGraw Hill .
- Operating Systems : Internals and Design Principles, William Stallings, Pearson
- Operating Systems Design and Implementation" ,(Prentice Hall Software Series) Andrew S Tanenbaum and Albert S Woodhull.
- Taub and Schilling, Principles of Communication Systems, TMH.
- Mithal G K, Radio Engineering, Khanna Pub.
- Sirnon Haykin, Communication Systems, John Wiley.


**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| PC-CS-AIML-212A | Software Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | To gain a broad understanding of the discipline of software engineering and its application to the development and management of software process. | | | | | | |
| **Course Outcomes(CO)** | | | | | | | |
| **CO1** | To understand the basic concepts of Software Engineering. | | | | | | |
| **CO2** | To understand the fundamental concept of requirements engineering and Analysis Modelling. | | | | | | |
| **CO3** | To understand the different design techniques and their implementation. | | | | | | |
| **CO4** | To learn about software testing and maintenance measures. | | | | | | |

## Unit-I

**Introduction**: Introduction to Software Engineering, Software Characteristics, Software Crisis, The Evolving role of Software, Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models, RAD, V Model.

## Unit-II

**Software Requirement Specification**: Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Data Flow Diagrams, Decision Tables, SRS Document, IEEE Standard for SRS.

**Software Quality:** Software Quality, Concept of Software Quality Assurance (SQA), SEI-CMM Model.
Introduction to Software Risk Management and Software Configuration Management

## Unit-III

**Software Design**: Basic Concept of Software Design, Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion.

**Design Strategies:** Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design.

**Software Measurement and Metrics:** Various Size Oriented Measures: Halstead's Software Science, Function Point (FP) Based Measures, COCOMO, Cyclomatic Complexity Measures: Control Flow Graphs.

## Unit-IV

**Software Construction:** Software construction fundamentals, minimizing complexity, Top-Down and Bottom –Up programming, structured programming, Compliance with Design and Coding Standards.

**Testing:** Testing Objectives, Unit Testing, Integration Testing, system testing, Acceptance Testing, Regression Testing, Structural Testing, Functional Testing, debugging.

**Maintenance**: key issues, Types of software Maintenance, Cost of Maintenance, Software Re-Engineering.

**Suggested Books:**

1. R. S. Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
2. K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.\
3. Pankaj Jalote, Software Engineering, Wiley India.
4. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.
5. Ian Sommerville, Software Engineering, Addison Wesley.

| PC-CS-AIML-216A | Database Management Systems Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credit** | **Practical** | **Minor Test** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **60** | **40** | **100** | **2** |
| **Purpose** | **To implement practically the various concepts of DBMS** | | | | | | |
| | **Course Outcomes** | | | | | | |
| **CO1** | To understand& Implement basic DDL commands. | | | | | | |
| **CO2** | To learn & Implement DML and DCL commands. | | | | | | |
| **CO3** | To understand the SQL queries using SQL operators. | | | | | | |
| **CO4** | To understand the concept of relational algebra and implement using examples. | | | | | | |

## LIST OF PRACTCALS

**1.** Create a database and write the programs to carry out the following operation:

- Add , Delete and modify a record in the database
- Generate queries
- Data operations
- List all the records of database in ascending order.

**2.** To perform various integrity constraints on relational database.

**3.** Create a database and perform the following operations:-

1. Arithmetic and Relational operations
2. Group by & having clauses
3. Like predicate for pattern matching in database

**4.** Create a view to display details of employees working on more than one project.

**5.** Create a view to display details of employees not working on any project.

**6.** Using two tables create a view which shall perform natural join, equi join, outer joins.

**7.** Write a procedure to give incentive to employees working on all projects. If no such employee found give app. Message.

**8.** Write a procedure for computing amount telephone bill on the basic of following conditions.
1. telephone rent Rs. 205 including first 105 free units.
2. if extra units>0 but <500 then rate is 80 paise per unit.
3. if extra units>500 then rate is Rs. 1.20 per unit.
For this purpose create a table with name, Phone No., No. of units consumed, bill amount of a customer.

**9.** Write a procedure for computing income tax of employee on the basic of following conditions:-
1. if gross pay<=40,000 then I.T rate is 0%.
2. if gross pay>40,000 but <60000 then I.T rate is 10%.
3. if gross pay>60,000 but <1,00,0000 then I.T rate is 20%.
4. if gross pay>1,00,0000 then I.T rate is 30%.
For this purpose create a table with name, ssn, gross salary and income tax of the employee.

**10.** Write trigger for before and after insertion, deletion and updation process.

**NOTE:** A student has to perform at least ten experiments.Seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

| PC-CS-AIML- 218A | **Internet and Web Technology Lab** | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credit** | **Practical** | **Minor Test** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **60** | **40** | **100** | **2** |
| **Purpose** | To introduce the concepts of HTML5, JavaScript and Python. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Design webpages using HTML, JavaScript and CSS. | | | | | | |
| **CO2** | Design and test simple function/program to implement Searching and sorting techniques using Python. | | | | | | |
| **CO3** | Develop program in Java Script for pattern matching using regular expressions and errors in scripts. | | | | | | |
| **CO4** | Design client-server based web applications. | | | | | | |

**LIST OF PRACTCALS**

1. Create your own page with your favorite hobbies using HTML, JavaScript and CSS.
2. Create a frameset in HTML that is divided into three sections. The frameset should have three zones.
   a. The Topmost section of the frameset should take up about just 15% of the browser window. Name this frame title.
   b. The middle section should be 75% of the browser window. Name this frame title.
   c. The lower section should be 10% of the browser window. Name this frame menu.
3. Create pages for each section. For the lowermost section, create page that loads the content into the middle section. The topmost section should contain a page describing the web page itself.
4. Create a web page, which displays the map of your country Link, each city /state on the image map, such that the respective HTML page of the city/state is displayed when the user selects an area.
5. Add the tickertape applet to your page by customizing it for the following settings:
   a. Increase the count by one.
   b. Accordingly update the message count.
   c. Change the text color to (237,192,171)
   d. Experiment with changing the scrolling speed.
   e. Customize the message text as per your page requirement.
6. Incorporate a quest book into the Diary Food Webpage and use Java Script to build validations into the form.
7. Use Cascading Style sheets (CSS) to modify the following:
   a. Change background.
   b. Change font type, face and color.
   c. Align Text.
   d. Remove underlines from hyperlinks.
8. Write the program for using JavaScript by using for – loops (through a block of code a number of times), for/in - loops (through the properties of an object), while - loops (through a block of code while a specified condition is true), do/while - loops (through a block of code while a specified condition is true).
9. Write a program in Java Script for the following:
   a. Copying, passing, and comparing by value
   b. Copying, passing, and comparing by reference
   c. References themselves are passed by value

10. Write program in Java Script for pattern matching using regular expressions and errors in scripts.
11. Write a Python function/program that accepts the lengths of three sides of a triangle as inputs. The program output should indicate whether or not the triangle is an equilateral triangle.
12. Write the Python functions for linear search, binary search, selection sort, Bubble Sort, Insertion Sort and converting Fibonacci to a linear algorithm.
13. Write program in Python using Lists and dictionaries, Control statements and Strings and text files.

| PC-CS-AIML-220A | Python Lab-II | | | | | |
|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **40** | **60** | **100** | **2** |
| **Purpose** | To gain a broad understanding of the discipline of machine Learning and its implementation using different libraries. | | | | | |
| **Course Outcomes** | | | | | | |
| **CO1** | To understand the basic concepts of Python libraries | | | | | |
| **CO2** | To learn and apply concepts of data manipulation in machine Learning . | | | | | |
| **CO3** | To learn and apply descriptive analysis concepts. | | | | | |
| **CO4** | To understand the fundamentals of knowledge representation. | | | | | |
| **CO5** | To learn and apply concepts of distribution and hypothesis. | | | | | |
| **CO6** | To understand and implement various data visualization concepts. | | | | | |

**LIST OF PRACTICALS:**

1. Write a program to implement of Basic Python Libraries-numpy, scipy.
2. Write a program to implement of Basic Python Libraries-matplotlib, pandas, Scikitlearn.
3. Write a program to create samples from population.
4. Write a program to evaluate Mean, Median, Mode of dataset.
5. Write a program to implement Central Limit Theorem in dataset.
6. Write a program to implement Measure of Spread in datset.
7. Write a program to implement program to differentiate between descriptive and inferential statistics.
8. Write a program to implement pmf, pdf and cdf.
9. Write a program to implement different visualization techniques on sample dataset.
10. Write a program to implement different hypothesis test on sample dataset.

NOTE: A student has to perform at least ten experiments. Seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

| MC-901A | Environmental Sciences | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **0** | **75** | **25** | **100** | **3** |
| **Purpose** | To learn the multidisciplinary nature, scope and importance of Environmental sciences. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | The students will be able to learn the importance of natural resources. | | | | | | |
| **CO2** | To learn the theoretical and practical aspects of eco system. | | | | | | |
| **CO3** | Will be able to learn the basic concepts of conservation of biodiversity. | | | | | | |
| **CO4** | The students will be able to understand the basic concept of sustainable development. | | | | | | |

**Unit-I**

The multidisciplinary nature of environmental studies, Definition, Scope and Importance, Need for public awareness, Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems.

(a) Forest Resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
(b) Water Resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
(c) Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
(d) Food Resources: World Food Problems, changes caused by agriculture and overgazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
(e) Energy Resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
(f) Land Resources: Land as a resource, land, degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyle.

**Unit-II**

**Ecosystem-Concept of an ecosystem**: Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological Succession, Food Chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: (a) Forest Ecosystem, (b) Grassland Ecosystem, (c) Desert Ecosystem and (d) Aquatic Ecosystems (ponds, streams, lakes, rivers, oceans, esturaries

Field Work: Visit to a local area to document Environment assets-river/forest/grassland/hill/mountain, Visit to a local polluted site-Urban /Rural Industrial/Agricultural, Study of common plants, insects and birds, Study of simple ecosystems-pond, river, hill, slopes etc. (Field work equal to 5 lecture hours).

**Unit-III**

**Biodiversity and its conservation:** Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity of global, National and local levels. India as a mega-diversity nation Hot spot of Biodiversity, Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts, Endangered and endemic species of India, Conservation of Biodiversity- In situ and Ex-Situ conservation of biodiversity.

**Environmental Pollution Definition:** Cause, effects and control measures of (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution (e) Noise Pollution (f) Thermal Pollution (g) Nuclear Hazards

Solid waste management- cause, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides

**Unit-IV**

**Social Issues and the Environment**: From unsustainable to sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people: Its problems and concerns, Case Studies: Environmental ethics-issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies: Wasteland Reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public

Awareness, Human population and the Environment, Population growth, variation among nations, Population explosion-Family Welfare Programme, Environment and human health. Human rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human Health, Case Studies, Drugs and their effects; Useful and harmful drugs, Use and abuse of drugs, Stimulant and depression drugs, Concept of drug de-addiction, Legal position on drugs and laws related to drugs.

**SUGGESTED BOOKS:**

- Environmental Studies- Deswal and Deswal. Dhanpat Rai and Co.
- Environmental Science and Engineering Anandan, P. and Kumaravelan, R. 2009. Scitech Publications (India) Pvt. Ltd., India
- Environmental Studies. Daniels Ranjit R. J. and Krishnaswamy. 2013. Wiley India.
- Environmental Science- Botkin and Keller. 2012. Wiley , India

**Note: The Examiner will be given the question paper template to set the question paper.**

**B.Tech Computer Science and Engineering (Cyber Security)**
**Credit Based Scheme of Studies/Examination**
**Semester III**

| S. N. | Course No. | Subject | L:T:P | Hours/Week | Credits | Examination Schedule (Marks) | | | | Duration of Exam (Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Major Test | Minor Test | Practical | Total | |
| 1 | PC-CS-CYS-201A | Introduction to Cyber Security | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | PC-CS-CYS-203A | Data Structure | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 3 | PC-CS-CYS-205A | Computational Thinking with Python | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 4 | PC-CS-CYS-207A | Software Engineering | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 5 | PC-CS-CYS-209A | Principles of Programming Languages | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 6 | ES-CS-CYS-211A | Computer Organization and Architecture | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 7 | PC-CS-CYS-213LA | Data Structure Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 8 | PC-CS-CYS-215LA | Python Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 9 | PC-CS-CYS-217LA | Software Engineering Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| | | **Total** | | **24** | **21** | **450** | **270** | **180** | **900** | |
| 10 | SIM-201A* | Seminar on Summer Internship | 2:0:0 | 2 | 0 | 0 | 50 | 0 | 50 | |

***Note: SIM-201A* is a mandatory credit-less course in which the students will be evaluated for the Summer Internship (training) undergone after 2$^{nd}$semester and students will be required to get passing marks to qualify.**

| PC-CS-CYS-201A | **Introduction to Cyber Security** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3.0** | **75** | **25** | **100** | **3 Hours** |
| **Purpose** | To gain a broad understanding in order to get predictive ways out related to cyber security. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | To facilitate the basic knowledge of cyber security. | | | | | | |
| **CO2** | To explore and sort issues related to different types of activities in cyber crime. | | | | | | |
| **CO3** | To get enable to fix the various cyber attacks. | | | | | | |
| **CO4** | To deal with the digital forensics and related scenarios of cyber crimes. | | | | | | |

**Unit-I**

**Introduction:** Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime: crime against individual, Crime against property, Cyber extortion, Drug trafficking, cyber terrorism. Need for Information security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis.

**Unit-II**

**Cyber Crime Issues**: Unauthorized Access to Computers, Computer Intrusions, Viruses and Malicious Code, Internet Hacking and Cracking, Virus and worms, Software Piracy, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Password Cracking, Steganography, Key loggers and Spyware, Trojan and backdoors, phishing, DOS and DDOS attack, SQL injection, Buffer Overflow.

**Unit-III**

**Introduction to cyber attacks:** passive attacks, active attacks, Cyber crime prevention methods, Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control, Hardware protection mechanisms, OS Security

**Unit-IV**

**Digital Forensics:** Introduction to Digital Forensics, historical background of digital forensics, Forensic Software and Hardware, need for computer forensics science, special tools and techniques digital forensic life cycle, challenges in digital forensic.

**Law Perspective**: Introduction to the Legal Perspectives of Cybercrimes and Cyber security, Cybercrime and the Legal Landscape around the World, Why Do We Need Cyber laws, The Indian IT Act, Cybercrime Scenario in India, Digital Signatures and the Indian IT Act, Cybercrime and Punishment.

**Suggested Books:**

1. Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.
2. Robert M Slade," Software Forensics", Tata McGraw - Hill, New Delhi, 2005.
3. Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt. Ltd.

| PC-CS-CYS-203A | Data Structure | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3.0** | **75** | **25** | **100** | **3 Hours** |
| **Purpose** | To introduce the principles and paradigms of Data Structures for design and implement the software systems logically and physically. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO 1** | To introduce the basic concepts of data structure , basic data types ,searching and sorting based on array data types. | | | | | | |
| **CO 2** | To introduce the structured data types like Stacks and Queue and its basic operations' implementation. | | | | | | |
| **CO 3** | To introduce dynamic implementation of linked list. | | | | | | |
| **CO 4** | To introduce the concepts of Tree and graph and implementation of traversal algorithms. | | | | | | |

**Unit-1**

**Introduction to Data Structures**, Data Types, Built in and User Defined Data Structures, Applications of Data Structure, Algorithm Analysis, Worst, Best and Average Case Analysis, Notations of Space and Time Complexity, Basics of Recursion.

**Arrays**, One Dimensional Arrays, Two Dimensional Arrays and Multi-Dimensional Arrays, Sparse Matrices, Searching from array using Linear and Binary Searching Algorithm, Sorting of array using Selection, Insertion, Bubble, Radix Algorithm

**Unit-2**

**Stacks**: Definition, Implementation of Stacks and Its Operations, Evaluation of Infix, prefix and Postfix Expression, Inter-conversion of Infix, Prefix and Post-Fix Expression, Implementation of Merge Sort and Quick Sort Algorithm.

**Queues**: Definition, Sequential Implementation of Linear Queues and Its Operations, Circular Queue and Its Implementation, Priority Queues and Its Implementation, Applications of queues.

**Unit-3**

**Linked Lists**: Need of Dynamic Data Structures, Single Link List and Its Dynamic Implementation, Traversing, Insertion, Deletion Operations on Single Link Lists. Comparison between Static and Dynamic, Implementation of Linked List. Circular Link Lists and Doubly Link List, Dynamic Implementation of Primitive Operations on Doubly Linked Lists and Circular Link List. Dynamic Implementation of Stacks and Queues.

**Unit-4**

**Trees**: Definition, Basic Terminology, Binary Tree, External and Internal Nodes, Static and Dynamic Implementation of a Binary Tree, Primitive Operations on Binary Trees, Binary Tree Traversals: Pre-Order, In-Order and Post-Order Traversals. Representation of Infix, Post-Fix and Prefix Expressions using Trees.

**Introduction to Binary Search Trees:** B+ trees, AVL Trees, Threaded Binary trees, Balanced Multi-way search trees, Implementation of Heap Sort Algorithm.

**Graphs**: Basic Terminology, Definition of Undirected and Directed Graphs, Memory Representation of Graphs, Minimum-Spanning Trees, Warshal Algorithm, Graph Traversals Algorithms: Breadth First and Depth First.

**Suggested Books:**

- Theory and Problems of Data Structures by Jr. Symour Lipschetz, Schaum's outline, TMH.
- Data Structures and Algorithms by PAI, TMH.
- Fundamentals of Data structures by Ellis Horowitz and Sartaj Sahni, Pub, 1983, AW.
- Data Structures and Algorithms by A.V. Aho, J.E. Hopcroft and T.D. Ullman, Original edition, Addison-Wesley, 1999, Low Priced Edition.
- Data Structures and Program Design in C by Robert Kruse, PHI,
- Shukla, Data Structures using C++, Wiley India
- Introduction to Computers Science -An Algorithms Approach, Jean Paul Tremblay, Richard B. Bunt, 2002, T.M.H.
- Data Structure and the Standard Template library – Willam J. Collins, 2003, T.M.H.

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| PC-CS-CYS-205A | **Computational Thinking with Python** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3.0** | **75** | **25** | **100** | **3 Hours** |
| **Purpose** | The purpose of this course is to introduce Python, a remarkably powerful dynamic programming language to write code for different operating systems along with application domain. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO 1** | To Learn python statements, comments and indentation, tokens, input and output methods using various example programs. | | | | | | |
| **CO 2** | To Learn the different methods involved in List, String, Tuples and Dictionary and Design solutions for complex programs using decision making and looping statements. | | | | | | |
| **CO 3** | To learn about different functions in python and Develop the function programs with all the concepts like lambda, decorators and generators. | | | | | | |
| **CO 4** | To learn about the exception handling functions, file concepts and CSV and JSON. | | | | | | |

**Unit-1**

**Introduction to python:** Advantages of python programming-Tokens-Variables-Input/output methods-Data types- Operators

**Unit-2**

**DATA STRUCTURES:** Strings-Lists-Tuples-Dictionaries-Sets.
**CONTROL STATEMENTS:** Flow Control-Selection control Structure-if-if-else-if-elseif-else-Nested if iterative control structures-while loop, for loop and range.

**Unit-3**

**FUNCTIONS:** Declaration-Types of Arguments-Fixed arguments, variable arguments, keyword arguments and keyword variable arguments-Recursions-Anonymous functions: lambda- Decorators and Generators.

**Unit-4**

**EXCEPTION HANDLING:** Exception Handling-Regular Expression-Calendars and clock files: File input/output operations-Dictionary operations-Reading and writing in structured files: CSV and JSON.

**Suggested Books:**


- Bill Lubanovic, "Introducing Python Modern Computing in Simple Packages", 1st Edition, O'Reilly Media, 2014.
- Programming With Python Book ‘Himalaya Publishing House Pvt Ltd
- “Dive Into Python” by Mark Pilgrim
- Mark Lutz, “Learning Python”, 6th Edition, O'Reilly Media, 2014.
- David Beazley, Brian K. Jones, "Python Cookbook", 3rd Edition, O'Reilly Media, 2015.
- Mark Lutz, “Python Pocket Reference”, 6th Edition, O'Reilly Media, 2015.


**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| PC-CS-CYS-207A | **Software Engineering** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3.0** | **75** | **25** | **100** | **3 Hours** |
| **Purpose** | To gain a broad understanding of the discipline of software engineering and its application to the development and management of software process. | | | | | | |
| **Course Outcomes(CO)** | | | | | | | |
| **CO1** | To understand the basic concepts of Software Engineering. | | | | | | |
| **CO2** | To understand the fundamental concept of requirements engineering and Analysis Modelling. | | | | | | |
| **CO3** | To understand the different design techniques and their implementation. | | | | | | |
| **CO4** | To learn about software testing and maintenance measures. | | | | | | |

**Unit-I**

**Introduction**: Introduction to Software Engineering, Software Characteristics, Software Crisis, The Evolving role of Software, Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models, RAD, V Model.

**Unit-II**

**Software Requirement Specification**: Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Data Flow Diagrams, Decision Tables, SRS Document, IEEE Standard for SRS.

**Software Quality:** Software Quality, Concept of Software Quality Assurance (SQA), SEI-CMM Model. Introduction to Software Risk Management and Software Configuration Management

**Unit-III**

**Software Design**: Basic Concept of Software Design, Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion.

**Design Strategies:** Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design.

**Software Measurement and Metrics:** Various Size Oriented Measures: Halstead's Software Science, Function Point (FP) Based Measures, COCOMO, Cyclomatic Complexity Measures: Control Flow Graphs.

**Unit-IV**

**Software Construction:** Software construction fundamentals, minimizing complexity, Top-Down and Bottom –Up programming, structured programming, Compliance with Design and Coding Standards.

**Testing:** Testing Objectives, Unit Testing, Integration Testing, system testing, Acceptance Testing, Regression Testing, Structural Testing, Functional Testing, debugging.

**Maintenance**: key issues, Types of software Maintenance, Cost of Maintenance, Software Re-Engineering.

**Suggested Books:**

1. R. S. Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
2. K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.
3. Pankaj Jalote, Software Engineering, Wiley India.
4. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.
5. Ian Sommerville, Software Engineering, Addison Wesley.

| PC-CS-CYS-209A | **Principles of Programming Languages** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3.0** | **75** | **25** | **100** | **3 Hours** |
| **Purpose** | To introduce the principles and paradigms of programming languages for design and implement the software intensive systems. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO 1** | To introduce the basic concepts of programming language, the general problems and methods related to syntax and semantics. | | | | | | |
| **CO 2** | To introduce the structured data objects, subprograms and programmer defined data types. | | | | | | |
| **CO 3** | To outline the sequence control and data control. | | | | | | |
| **CO 4** | To introduce the concepts of storage management using programming languages. | | | | | | |

### Unit-I: Introduction, Syntax and Semantics

**Introduction:** A brief history, Characteristics of a good programming language, Programming language translators- compiler and interpreters, Elementary data types – data objects, variable and constants, data types. Specification and implementation of elementary data types, Declarations, type checking and type conversions, Assignment and initialization, Numeric data types, enumerations, Booleans and characters.

**Syntax and Semantics:** Introduction, general problem of describing syntax, Formal method of describing Syntax, attribute grammar dynamic semantic.

### Unit-II: Structured data objects, Subprograms and Programmer Defined Data Types

**Structured data objects:** Structured data objects and data types, specification and implementation of structured data types, Declaration and type checking of data structure, vector and arrays, records Character strings, variable size data structures, Union, pointer and programmer defined data objects, sets, files.

**Subprograms and Programmer Defined Data Types:** Evolution of data type concept abstraction, encapsulation and information hiding, Subprograms, type definitions, abstract data types, over loaded subprograms, generic subprograms.

### Unit–III: Sequence Control and Data Control

**Sequence Control:** Implicit and explicit sequence control, sequence control within expressions, sequence control within statement, Subprogram sequence control: simple call return, recursive subprograms, Exception and exception handlers, co routines, sequence control. Concurrency – subprogram level concurrency, synchronization through semaphores, monitors and message passing

**Data Control:** Names and referencing environment, static and dynamic scope, block structure, Local data and local referencing environment, Shared data: dynamic and static scope, Parameter and parameter transmission schemes.

### Unit-IV: Storage Management and Programming Languages

**Storage Management:** Major run time elements requiring storage, programmer and system controlled storage management and phases, Static storage management, Stack based storage management, Heap storage management, variable and fixed size elements.

**Programming Languages:** Introduction to procedural, non-procedural, structured, logical, functional and object oriented programming language, Comparison of C and C++ programming languages.

**Suggested Books:**

- Terrence W. Pratt, Marvin V. Zelkowitz, Programming Languages Design and Implementation, Pearson.
- Allen Tucker and Robert Noonan, Programming Languages–Principles and Paradigms, Tata McGraw-Hill, 2009.
- Ellis Horowitz, Fundamentals of Programming Languages, Galgotia Publications, 2010.
- C. Ghezzi, Programming Languages Concepts, Wiley Publications, 2010.

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| ES-CS-CYS-211A | Computer Organization and Architecture | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3.0** | **75** | **25** | **100** | **3 Hours** |
| **Purpose** | Student will be able to understand the basic concepts of computer architecture and organization, and understand the key skills of constructing cost-effective computer systems. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Be familiar with the functional units of the processor such as the register file and arithmetic-logical unit, and with the basics of systems topics | | | | | | |
| **CO2** | Be familiar with the design trade-offs in designing and constructing a computer processor. | | | | | | |
| **CO3** | Be familiar with the CPU design including the RISC/CISC architectures. | | | | | | |
| **CO4** | Be familiar with the basic knowledge of I/O devices and interfacing of I/O devices with computer. | | | | | | |

**Unit- I**

**Data representation and Computer arithmetic**: Introduction to Computer Systems, Organization and architecture, evolution and computer generations; Fixed point representation of numbers, digital arithmetic algorithms for Addition, Subtraction, Multiplication using Booth's algorithm and Division using restoring and non restoring algorithms. Floating point representation with IEEE standards and its arithmetic operations.

**Unit-II**

**Basic Computer organization and Design**: Instruction codes, stored program organization, computer registers and common bus system, computer instructions, timing and control, instruction cycle: Fetch and Decode, Register reference instructions; Memory reference instructions. Input, output and Interrupt: configuration, instructions, Program interrupt, Interrupt cycle, Micro programmed Control organization, address sequencing, micro instruction format and microprogram sequencer.

**Unit-III**

**Central Processing Unit**: General register organization, stack organization, instruction formats, addressing modes, Data transfer and manipulation, Program control. CISC and RISC: features and comparison. Pipeline and vector Processing , Parallel Processing, Pipelining, Instruction Pipeline, Basics of vector processing and Array Processors.

**Unit-IV**

**Input-output organization:** I/O interface. I/O Bus and interface modules, I/O versus Memory Bus. Asynchronous data transfer: Strobe control, Handshaking, Asynchronous serial transfer. Modes of Transfer: Programmed I/O, Interrupt driven I/O, Priority interrupt; Daisy chaining, Parallel Priority interrupt. Direct memory Access, DMA controller and transfer. Input output Processor , CPU-IOP communication, I/O channel.

**Suggested Books:**


- William Stallings, "Computer Organization and Architecture – Designing for Performance", Sixth Edition, Pearson Education, 2003.
- Morris Mano, M., "Computer System Architecture," 3/e, Pearson Education, 2005.
- John P. Hayes, "Computer Architecture and Organization," 3/e, TMH, 1998.
- David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software interface", Third Edition, Elsevier, 2005.
- V.P. Heuring, H.F. Jordan, "Computer Systems Design and Architecture", Second Edition, Pearson Education, 2004.
- Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", Fifth Edition, Tata McGraw Hill, 2002.

| PC-CS-CYS-213LA | **Data Structure Lab** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **40** | **60** | **100** | **2 Hours** |
| **Purpose** | To introduce the principles and paradigms of Data Structures for design and implement the software systems logically and physically. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Implement linear and non linear data structures using linked list. | | | | | | |
| **CO2** | Apply various data structures such as stack, queue and tree to solve the problems. | | | | | | |
| **CO3** | Implement various searching and sorting techniques. | | | | | | |
| **CO4** | Choose appropriate data structure while designing the applications and analyze the complexity of the algorithms. | | | | | | |

*LIST OF PRACTICALS:*

1. Write a program for Binary search methods.
2. Write a program for insertion sort, selection sort and bubble sort.
3. Write a program to implement Stack and its operation.
4. Write a program for quick sort.
5. Write a program for merge sort.
6. Write a program to implement Queue and its operation.
7. Write a program to implement Circular Queue and its operation.
8. Write a program to implement singly linked list for the following operations: Create, Display, searching, traversing and deletion.
9. Write a program to implement doubly linked list for the following operations: Create, Display, inserting, counting, searching, traversing and deletion.
10 Write a program to implement circular linked list for the following operations: Create, Display, inserting, counting, searching, traversing and deletion.
11. Write a program to implement insertion, deletion and traversing in B tree

**NOTE:** A student has to perform at least ten experiments. Seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

| PC-CS-CYS-215LA | **Python Lab** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **40** | **60** | **100** | **2 Hours** |
| **Purpose** | The course is designed to provide Basic knowledge of Python | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO 1** | To study fundamentals of python programming and implement basic programs. | | | | | | |
| **CO 2** | To implement the searching technique using python. | | | | | | |
| **CO 3** | To implement sorting techniques using python. | | | | | | |
| **CO 4** | To implement matrix multiplication using python. | | | | | | |

*LIST OF PRACTICALS*

1. WAP to compute the GCD of two numbers.
2. WAP to find the square root of a number
3. WAP to find the Exponentiation (power of a number)
4. WAP to find the maximum of a list of numbers
5. WAP for Linear search and Binary search
6. WAP for Selection sort, Insertion sort
7. WAP for Merge sort
8. WAP to find first n prime numbers
9. WAP to multiply matrices
10. WAP that take command line arguments (word count)
11. WAP to find the most frequent words in a text read from a file
12. WAP to Simulate elliptical orbits in Pygame
13. WAP to Simulate bouncing ball using Pygame

**Note:** A student has to perform at least 10 experiments. At least seven experiments should be performed from the above list. Three experiments may be designed & set by the concerned institution as per the scope of the syllabus.

| PC-CS-CYS-217LA | Software Engineering Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **40** | **60** | **100** | **2 Hours** |
| **Purpose** | To gain a broad understanding of the discipline of software engineering implementation. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | To learn about the reasons for the software crisis. | | | | | | |
| **CO2** | To understand the software testing techniques. | | | | | | |
| **CO3** | To understand the software metrics. | | | | | | |
| **CO4** | To understand the different design techniques and their implementation. | | | | | | |

## LIST OF PRACTICALS

1. To identify the role of the software in today's world across a few significant domains related to day to day life.
2. To identify the problem related to software crisis for a given scenario.
3. To classify the requirement into functional and non-functional requirements.
4. To implement at least four software metrics.
5. Preparation of requirement document for standard application problems in standard format.(e.g Library Management System, Railway Reservation system, Hospital management System, University Admission system)
6. To prepare Project Schedule for standard application problems in standard format.
7. To implement the functional testing techniques.
8. To implement the structural testing techniques

**B.Tech Computer Science and Engineering (Cyber Security)**
**Scheme of Studies/Examination**
**Semester IV**

| **S. N.** | **Course No.** | **Subject** | **L:T:P** | **Hours/ Week** | **Credits** | **Examination Schedule** | | | | **Duration of Exam (Hrs.)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | **Major Test** | **Minor Test** | **Practical** | **Total** | |
| 1 | PC-CS-CYS-202A | Mathematics for Intelligent Systems | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | ES-CS-CYS-204A | Object-Oriented Programming System | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 3 | PC-CS-CYS-206A | Data Base Management Systems | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 4 | ES-CS-CYS-208A | Internet & Web technology | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 5 | PC-CS-CYS-210A | Operating System | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 6 | PC-CS-CYS-212A | Cryptographic Fundamentals | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 7 | PC-CS-CYS-214LA | Object Oriented Programming Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 8 | PC-CS-CYS-216LA | Data Base Management Systems Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 9 | ES-CS-CYS-218LA | Internet & Web Technology Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| | | **Total** | | **24** | **21** | **450** | **270** | **180** | **900** | |
| 10 | MC-901A | Environmental Sciences | 3:0:0 | 3 | | 0 | | 100 | 0 | 100 |

| PC-CS-CYS-202A | **Mathematics for Intelligent Systems** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3.0** | **75** | **25** | **100** | **3 Hours** |
| **Purpose** | To introduce the principles and paradigms of linear algebra, differential equation and probability theory for modeling electrical, mechanical and computational experiments.. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| CO1 | To develop an understanding of the basic concepts and techniques of linear algebra as applied to signal processing. | | | | | | |
| CO2 | To provide connection between the concepts of linear algebra, differential equation and probability theory. | | | | | | |
| CO3 | To enable the students to understand the use of calculus and Linear algebra in modelling electrical and mechanical elements. | | | | | | |
| CO4 | To equip the students to understand the role of probability theory in providing data sets for computational experiments in data science. | | | | | | |

**Unit 1**

Basics of Linear Algebra - Linear Dependence and independence of vectors - Gaussian Elimination - Rank of set of vectors forming a matrix - Vector space and Basis set for a Vector space - Dot product and Orthogonality - Rotation matrices - Eigenvalues and Eigenvectors and its interpretation - Projection matrix and Regression – Singular Value Decomposition.

**Unit 2**

Convolution sum, Convolution Integral, Ordinary Linear differential equations, formulation, analytical and Numerical solutions, Impulse Response Computations, formulating state space models of Physical systems.

**Unit 3**

Examples of ODE modelling in falling objects, satellite and planetary motion, Electrical and mechanical systems. Multivariate calculus, Taylor series, Introduction to Optimization.

**Unit 4**

Introduction to Probability Distributions and Monte Carlo Simulations.

**Suggested Books** :-


1. Gilbert Strang, Linear Algebra and Learning from Data, Wellesley, Cambridge press, 2019.
2. William Flannery, Mathematical Modelling and Computational Calculus, Vol-1, Berkeley Science Books, 2013.

| ES-CS-CYS-204A | **Object-Oriented Programming System** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3.0** | **75** | **25** | **100** | **3 Hours** |
| **Purpose** | To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | To introduce the basic concepts of object oriented programming language and the its representation. | | | | | | |
| **CO2** | To allocate dynamic memory, access private members of class and the behavior of inheritance and its implementation. | | | | | | |
| **CO3** | To introduce polymorphism, interface design and overloading of operator. | | | | | | |
| **CO4** | To handle backup system using file, general purpose template and handling of raised exception during programming. | | | | | | |

**Unit–1**

Introduction to C++, C++ Standard Library, Illustrative Simple C++ Programs. Header Files, Namespaces, Application of object oriented programming.

Object Oriented Concepts, Introduction to Objects and Object Oriented Programming, Encapsulation, Polymorphism, Overloading, Inheritance, Abstract Classes, Accessifier (public/ protected/ private), Class Scope and Accessing Class Members, Controlling Access Function, Constant, Class Member, Structure and Class

**Unit-2**

Friend Function and Friend Classes, This Pointer, Dynamic Memory Allocation and Deallocation (New and Delete), Static Class Members, Constructors, parameter Constructors and Copy Constructors, Deconstructors,

Introduction of inheritance, Types of Inheritance, Overriding Base Class Members in a Derived Class, Public, Protected and Private Inheritance, Effect of Constructors and Deconstructors of Base Class in Derived Classes.

**Unit-3**

Polymorphism, Pointer to Derived class, Virtual Functions, Pure Virtual Function, Abstract Base Classes, Static and Dynamic Binding, Virtual Deconstructors.

Fundamentals of Operator Overloading, Rules for Operators Overloading, Implementation of Operator Overloading Like <<,>> Unary Operators, Binary Operators.

**Unit-4**

Text Streams and binary stream, Sequential and Random Access File, Stream Input/ Output Classes, Stream Manipulators.

Basics of C++ Exception Handling, Try, Throw, Catch, multiple catch, Re-throwing an Exception, Exception specifications.

Templates: Function Templates, Overloading Template Functions, Class Template, Class Templates and Non- Type Template arguments.

**Suggested Books:**

- The complete reference C ++ by Herbert shieldt Tata McGraw Hill.
- Object Oriented Programming in Turbo C++ by Robert Lafore, 1994, The WAITE Group Press.
- Shukla, Object Oriented Programming in c++, Wiley India.
- C++ How to Program by H M Deitel and P J Deitel, 1998, Prentice Hall.
- Programming with C++ By D Ravichandran, 2003, T.M.H.

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| PC-CS-CYS-206A | **Data Base Management Systems** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3.0** | **75** | **25** | **100** | **3 Hours** |
| **Purpose** | **To familiarize the students with Data Base Management system** | | | | | | |
| | **Course Outcomes** | | | | | | |
| **CO1** | To provide introduction to relational model. | | | | | | |
| **CO2** | To learn about ER diagrams and SQL. | | | | | | |
| **CO3** | To understand about the concept of functional dependencies. | | | | | | |
| **CO4** | To understand about Query Processing and Transaction Processing. | | | | | | |

**Unit-1**

**Introduction:** Concept & Overview of DBMS, Advantages of DBMS over file processing system, Database Languages, Responsibilities of Database Administrator, Database Users, Three Schema architecture of DBMS & Data Independence, Data Models.

**Entity-Relationship Model:** Basic concepts, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features: Specialization and Generalization.

**Unit-2**

**The Relational Data Model & Algebra:** Relational Model: Structure of relational Databases, Relational Algebra & various operations (Set operation, select, project, joins, division), Relational Calculus: Domain, Tuple.

**Integrity Constraints & Introduction to SQL:-**

Domain Constraints, Referential Integrity Constraints, Basic Structure & Concept of DDL, DML, DCL, Aggregate Functions, Null Values, Introduction to views, creating, modifying and deleting views.

**Unit-3**

**Relational Database Design :** Functional Dependency, Different anomalies in designing a Database., Normalization – 1NF, 2NF, 3NF, Boyce-CODD Normal Form, Normalization using multi-valued dependencies, 4NF, 5NF.

**Unit-4**

**Transaction Processing Concept:** Introduction to transaction processing, transaction model properties, serializability:-Serial, non-serial and Serializable Schedules, Conflict Serializability.

**Concurrency Control: Need** of concurrency control, Different concurrency control Techniques: locking based, timestamps based technique. Deadlock handling and Recovery Techniques:- Deferred update/ immediate update, shadow paging.

**Suggested Books:**

- Elmasri and Navathe , "Fundamentals of Database Systems" , Addision-Wesley,
- Silberschatz, and Korth ,"Database System Concepts", McGraw-Hill
- Date , "An Introduction to Database Systems" ,Addison-Wesley,
- Bhattacharyya, "Database Management Systems" , Tata McGraw-Hill Publishing.

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| ES-CS-CYS-208A | **Internet & Web Technology** | | | | | |
|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **75** | **25** | **100** | **3 Hours** |
| **Purpose** | To gain a broad understanding of the discipline of Web engineering and its application to the development and management of Web Applications. | | | | | |
| **Course Outcomes** | | | | | | |
| **CO1** | Learn the basic concepts of information and web architecture. | | | | | |
| **CO2** | Learn about the skills that will enable to design and build high level web enabled applications. | | | | | |
| **CO3** | Understand the applicability of Java Script as per current software industry standards. | | | | | |
| **CO4** | Acquaint the latest programming language for the implementation of object based and procedure based applications using Python. | | | | | |

**Unit-1**

**Information Architecture**: The role of Information Architect, Collaboration and communication, Organizing information, organizational challenges, Organizing web sites and Intranets, Creating cohesive organization systems, designing navigation systems, types of navigation systems, Integrated navigation elements, designing elegant navigation systems, Searching systems, Searching your web site, designing the search interface, Indexing the right stuff, To search or not to search grouping content, conceptual design, High level Architecture Blueprint. Architectural Page Mockups, Design Sketches.

**Unit-2**

**Introduction to XHTML and HTML5**: Origins and Evolution of HTML and XHTML, Basic Syntax, Standard XHTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, HTML5, Syntactic Differences between HTML and XHTML.

**Cascading Style Sheets**: Introduction, Levels of Style Sheets, Style Specification Formats, Selector Forms, Property Value Forms, Font Properties, List Properties, Color, Alignment of Text, Box Model, Background Images, Conflict Resolution.

**Unit -3**

**Java Script**: Overview of JavaScript, Object Orientation and JavaScript, General Syntactic Characteristics, Primitives, Operations, and Expressions, Screen Output and Keyboard Input, Control Statements, Object Creation and Modification, Arrays, Functions, Constructors, Pattern Matching Using Regular Expressions, Errors in Scripts

**Unit -4**

**Python**: Introduction to Python, Data Types and Expressions, Control Statements, Strings and Text Files, Lists and Dictionaries, Design with Functions, Design with Classes

**Suggested Books:**


- By Peter Morville, Louis Rosenfeld, “Information Architecture on the World Wide Web”, O'Reilly Media, 2006.
- Robert W. Sebesta, “Programming The World Wide Web”, Eight Edition, Pearson India, 2015.
- Kenneth A. Lambert, “The Fundamentals of Python: First Programs”, 2011, Cengage Learning.

- Thomas A Powell, “HTML The Complete Reference”, Tata McGraw Hill Publications.

| PC-CS-CYS-210A | Operating System | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3.0** | **75** | **25** | **100** | **3 Hours** |
| **Purpose** | To familiarize the students with the basics of Operating Systems. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | To understand the structure and functions of operating system. | | | | | | |
| **CO2** | To learn about processes, threads and scheduling algorithms. | | | | | | |
| **CO3** | To understand the principle of concurrency and the concept of deadlocks. | | | | | | |
| **CO4** | To understand various memory management scheme and to study I/O management and file systems. | | | | | | |

**Unit-1**

**Introduction:** Introduction to OS. Operating system functions, Different types of O.S.: batch process, multi-programmed, time-sharing, real-time, distributed, parallel.

**System Structure:** Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, system calls.

**Unit-2**

**CPU scheduling:** scheduling criteria, preemptive and non-preemptive scheduling, scheduling algorithms, algorithm evaluation, multi-processor scheduling.

**Threads:** overview, benefits of threads, user and kernel threads.

**Process Management:** Concept of processes, process states, process control, co-operating processes, inter-process communication.

**Process Synchronization:** background, critical section problem, critical region, synchronization hardware, Classical problems of synchronization, semaphores.

**Unit-3**

**Deadlocks:** Concept of deadlock, deadlock characterization, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

**Memory Management:** background, logical vs. physical address space, contiguous memory allocation, paging, segmentation, segmentation with paging. Concept of fragmentation.

**Virtual Memory:** background, demand paging, concept of page replacement, page replacement algorithms, allocation of frames, thrashing.

**Unit-4**

File Systems: file concept, file organization and access methods, allocation methods, directory structure, free-space management I/O Management: I/O hardware, polling, interrupts, DMA, kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation) Disk Management: disk structure, disk scheduling (FCFS, SSTF, SCAN,C-SCAN) , disk reliability, diskPerformance parametersProtection and Security:Goals of protection and security, security attacks, authentication, program threats, system threats, threat monitoring.Case studies: UNIX file system, Windows file system

**Suggested Books:**

- Operating System Concepts", Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, Wiley
- Operating systems: a concept based approach", Dhananjay M. Dhamdhere, McGraw Hill .
- Operating Systems : Internals and Design Principles, William Stallings, Pearson
- Operating Systems Design and Implementation" ,(Prentice Hall Software Series) Andrew S Tanenbaum and Albert S Woodhull.
- Taub and Schilling, Principles of Communication Systems, TMH.
- Mithal G K, Radio Engineering, Khanna Pub.

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| PC-CS-CYS- 212A | **Cryptographic Fundamentals** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3.0** | **75** | **25** | **100** | **3 Hours** |
| **Purpose** | **To familiarize the students with fundamentals of cryptography.** | | | | | | |
| | **Course Outcomes** | | | | | | |
| **CO1** | To understand basics of Cryptography and Network Security. | | | | | | |
| **CO2** | To be able to secure a message over insecure channel by various means.. | | | | | | |
| **CO3** | To learn about how to maintain the Confidentiality, Integrity and Availability of a data | | | | | | |
| **CO4** | To understand various protocols for network security to protect against the threats in the networks. | | | | | | |

**Unit-1**

**Introduction to Cryptography and Block Ciphers**: Introduction to security attacks - services and mechanism - introduction to cryptography - Conventional Encryption: Conventional encryption model - classical encryption techniques - substitution ciphers and transposition ciphers – cryptanalysis – steganography - stream and block ciphers - Modern Block Ciphers: Block ciphers principals - Shannon’s theory of confusion and diffusion - fiestal structure - data encryption standard(DES) - strength of DES - differential and linearcrypt analysis of DES - block cipher modes of operations - triple DES – AES.

**Unit-2**

**Public key cryptography and Authentication requirements**: Principles of public key crypto systems - RSA algorithm - security of RSA - key management – Diffle-Hellman key exchange algorithm - introductory idea of Elliptic curve cryptography.

**Integrity checks and Authentication algorithms**: MD5 message digest algorithm - Secure hash algorithm (SHA) Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS) - proof of digital signature algorithm - Authentication Applications: Kerberos and X.509 - directory authentication service - electronic mail security-pretty good privacy (PGP) - S/MIME.

**Unit-3**

**Cryptography and Network Security:** Introduction to the Concept of Security, Cryptographic Techniques, Computer-based Symmetric and Asymmetric Key Cryptographic Algorithms, Public Key Infrastructure (PKI), Internet Security Protocols, Network Security.

**Database Security:** Data management technologies, Information security, Information Management Technologies, Security policies, Policy enforcement & related issues, Design principles, Multi-level relational data models, Security impact on database function.

**Unit-4**

**Intrusion detection:** Defining Intrusion Detection, Security concepts intrusion Detection concept, determining strategies for Intrusion Detection, Responses, Vulnerability Analysis, Credentialed approaches, Technical issues.

**Suggested Books:**


- NETWORK SECURITY AND MANAGEMENT BRIJENDRA SINGH, 2007
- Firewalls Complete Firewalls Complete Marcus Goncalves, 1998
- Information Security Architecture: An Integrated Approach to Security in the Organization Information Security Architecture: An Integrated Approach to Security in the Organization Jan Killmeyer, 2000
- Fundamentals of Network Security Fundamentals of Network Security John E. Canavan, 2001
- A Practical Introduction to Enterprise Network and Security Management A Practical Introduction to Enterprise Network and Security Management Bongsik Shin, 2017

| PC-CS-CYS-214LA | Object Oriented Programming Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **40** | **60** | **100** | **2 Hours** |
| **Purpose** | To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| CO1 | To familiarize with the class and objects | | | | | | |
| CO2 | To implement the concept of constructors | | | | | | |
| CO3 | To familiarize the concept of operator overloading | | | | | | |
| CO4 | To implement the concepts of Inheritance | | | | | | |

**LIST OF PRACTICALS**

**1**. Raising a number n to a power p is the same as multiplying n by itself p times. Write a function called power ( ) that takes a double value for n and an int value for p, and returns the result as double value. Use a default argument of 2 for p, so that if this argument is omitted, the number will be squared. Write a main ( ) function that gets values from the user to test this function.

**2**. A point on the two dimensional plane can be represented by two numbers: an X coordinate and a Y coordinate. For example, (4,5) represents a point 4 units to the right of the origin along the X axis and 5 units up the Y axis. The sum of two points can be defined as a new point whose X coordinate is the sum of the X coordinates of the points and whose Y coordinate is the sum of their Y coordinates. Write a program that uses a structure called point to model a point. Define three points, and have the user input values to two of them. Then set the third point equal to the sum of the other two, and display the value of the new point. Interaction with the program might look like this:

Enter coordinates for P1: 3 4
Enter coordinates for P2: 5 7
Coordinates of P1 + P2 are : 8, 11

**3**. Create the equivalent of a four function calculator. The program should request the user to enter a number, an operator, and another number. It should then carry out the specified arithmetical operation: adding, subtracting, multiplying, or dividing the two numbers. (It should use a switch statement to select the operation). Finally it should display the result. When it finishes the calculation, the program should ask if the user wants to do another calculation. The response can be 'Y' or 'N'. Some sample interaction with the program might look like this.

Enter first number, operator, and second number: 10/ 3
Answer = 3.333333
Do another (Y/ N)? Y
Enter first number, operator, second number 12 + 100
Answer = 112
Do another (Y/ N) ? N

**4**. A phone number, such as (212) 767-8900, can be thought of as having three parts: the area code (212), the exchange (767) and the number (8900). Write a program that uses a structure to store these three parts of a phone number separately. Call the structure phone. Create two structure variables of type phone. Initialize one, and have the user input a number for the other one. Then display both numbers. The interchange might look like this:

- Enter your area code, exchange, and number: 415 555 1212
- My number is (212) 767-8900
- Your number is (415) 555-1212

**5**. Create two classes DM and DB which store the value of distances. DM stores distances in metres and centimeters and DB in feet and inches. Write a program that can read values for the class objects and add one object of DM with another object of DB. Use a friend function to carry out the addition operation. The object that stores the results maybe a DM object or DB objects, depending on the units in which the results are required. The display should be in the format of feet and inches or metres and cenitmetres depending on the object on display.

**6**. Create a class rational which represents a numerical value by two double values- NUMERATOR and DENOMINATOR. Include the following public member Functions:

- constructor with no arguments (default).
- constructor with two arguments.
- void reduce( ) that reduces the rational number by eliminating the highest common factor between the numerator and denominator.
- Overload + operator to add two rational number.
- Overload >> operator to enable input through cin.
- Overload << operator to enable output through cout.

Write a main ( ) to test all the functions in the class.

**7**. Consider the following class definition

```
class father {
protected : int age;
public;
father (int x) {age = x;}
virtual void iam ( )
{ cout < < "I AM THE FATHER, my age is : "<< age<< end1:}
```

Derive the two classes son and daughter from the above class and for each, define iam ( ) to write our similar but appropriate messages. You should also define suitable constructors for these classes. Now, write a main ( ) that creates objects of the three classes and then calls iam ( ) for them. Declare pointer to father. Successively, assign addresses of objects of the two derived classes to this pointer and in each case, call iam ( ) through the pointer to demonstrate polymorphism in action.

**8**. Write a program that creates a binary file by reading the data for the students from the terminal. The data of each student consist of roll no., name ( a string of 30 or lesser no. of characters) and marks.

**9**. A hospital wants to create a database regarding its indoor patients. The information to store include

a) Name of the patient
b) Date of admission
c) Disease
d) Date of discharge

Create a structure to store the date (year, month and date as its members). Create a base class to store the above information. The member function should include functions to enter information and display a list of all the patients in the database. Create a derived class to store the age of the patients. List the information about all the to store the age of the patients. List the information about all the pediatric patients (less than twelve years in age).

**10**. Make a class **Employee** with a name and salary. Make a class **Manager** inherit from **Employee**. Add an instance variable, named department, of type string. Supply a method to **to String** that prints the manager's name, department and salary. Make a class **Executive** inherits from **Manager**. Supply a method **to String** that prints the string **"Executive"** followed by the information stored in the **Manager** superclass object. Supply a test program that tests these classes and methods.

**11**. Imagine a tollbooth with a class called toll Booth. The two data items are a type unsigned int to hold the total number of cars, and a type double to hold the total amount of money collected. A constructor initializes both these to 0. A member function called payingCar ( ) increments the car total and adds 0.50 to the cash total. Another function, called nopayCar ( ), increments the car total but adds nothing to the cash total. Finally, a member function called displays the two totals. Include a program to test this class. This program should allow the user to push one key to count a paying car, and another to count a nonpaying car. Pushing the ESC kay should cause the program to print out the total cars and total cash and then exit.

**12**. Write a function called reversit ( ) that reverses a string (an array of char). Use a for loop that swaps the first and last characters, then the second and next to last characters and so on. The string should be passed to reversit ( ) as an argument. Write a program to exercise reversit ( ). The program should get a string from the user, call reversit ( ), and print out the result. Use an input method that allows embedded blanks. Test the program with Napoleon's famous phrase, "Able was I ere I saw Elba)".

**13**. Create some objects of the string class, and put them in a Deque-some at the head of the Deque and some at the tail. Display the contents of the Deque using the forEach ( ) function and a user written display function. Then search the Deque for a particular string, using the first That ( ) function and display any strings that match. Finally remove all the items from the Deque using the getLeft ( ) function and display each item. Notice the order in which the items are displayed: Using getLeft ( ), those inserted on the left (head) of the Deque are removed in "last in first out" order while those put on the right side are removed in "first in first out" order. The opposite would be true if getRight ( ) were used.

**14**. Assume that a bank maintains two kinds of accounts for customers, one called as savings account and the other as current account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides cheque book facility but no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed.

Create a class account that stores customer name, account number and type of account. From this derive the classes cur_acct and sav_acct to make them more specific to their requirements. Include necessary member functions in order to achieve the following tasks:

a) Accept deposit from a customer and update the balance.
b) Display the balance.
c) Compute and deposit interest.
d) Permit withdrawal and update the balance.
e) Check for the minimum balance, impose penalty, necessary and update the balance.
f) Do not use any constructors. Use member functions to initialize the class members.

**15**. Create a base class called shape. Use this class to store two double type values that could be used to compute the area of figures. Derive two specific classes called triangle and rectangle from the base shape. Add to the base class, a member function get_data( ) to initialize baseclass data members and another member function display_area( ) to compute and display the area of figures. Make display_area ( ) as a virtual function and redefine this function in the derived classes to suit their requirements. Using these three classes, design a program that will accept dimensions of a triangle or a rectangle interactively and display the area.
Remember the two values given as input will be treated as lengths of two sides in the case of rectangles and as base and height in the case of triangles and used as follows:
Area of rectangle = x * y
Area of triangle = ½ * x * y

**NOTE:** A student has to perform at least ten experiments. Seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

| PC-CS-CYS-216LA | Database Management Systems Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **40** | **60** | **100** | **2 Hours** |
| **Purpose** | **To implement practically the various concepts of DBMS** | | | | | | |
| | **Course Outcomes** | | | | | | |
| **CO1** | To understand& Implement basic DDL commands. | | | | | | |
| **CO2** | To learn & Implement DML and DCL commands. | | | | | | |
| **CO3** | To understand the SQL queries using SQL operators. | | | | | | |
| **CO4** | To understand the concept of relational algebra and implement using examples. | | | | | | |

**LIST OF PRACTCALS**

**1.** Create a database and write the programs to carry out the following operation:
- Add , Delete and modify a record in the database
- Generate queries
- Data operations
- List all the records of database in ascending order.

**2.** To perform various integrity constraints on relational database.

**3.** Create a database and perform the following operations:-
1. Arithmetic and Relational operations
2. Group by & having clauses
3. Like predicate for pattern matching in database

**4.** Create a view to display details of employees working on more than one project.

**5.** Create a view to display details of employees not working on any project.

**6.** Using two tables create a view which shall perform natural join, equi join, outer joins.

**7.** Write a procedure to give incentive to employees working on all projects. If no such employee found give app. Message.

**8.** Write a procedure for computing amount telephone bill on the basic of following conditions.
1. telephone rent Rs. 205 including first 105 free units.
2. if extra units>0 but <500 then rate is 80 paise per unit.
3. if extra units>500 then rate is Rs. 1.20 per unit.

For this purpose create a table with name, Phone No., No. of units consumed, bill amount of a customer.

**9.** Write a procedure for computing income tax of employee on the basic of following conditions:-
1. if gross pay<=40,000 then I.T rate is 0%.
2. if gross pay>40,000 but <60000 then I.T rate is 10%.
3. if gross pay>60,000 but <1,00,0000 then I.T rate is 20%.
4. if gross pay>1,00,0000 then I.T rate is 30%.

For this purpose create a table with name, ssn, gross salary and income tax of the employee.

**10.** Write trigger for before and after insertion, deletion and updation process.

**NOTE:** A student has to perform at least ten experiments.Seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus

| ES-CS-CYS-218LA | Internet & Web Technology Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **40** | **60** | **100** | **2 Hours** |
| **Purpose** | To introduce the concepts of HTML5, JavaScript and Python. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Design webpages using HTML, JavaScript and CSS. | | | | | | |
| **CO2** | Design and test simple function/program to implement Searching and sorting techniques using Python. | | | | | | |
| **CO3** | Develop program in Java Script for pattern matching using regular expressions and errors in scripts. | | | | | | |
| **CO4** | Design client-server based web applications. | | | | | | |

**LIST OF PRACTCALS**

1. Create your own page with your favorite hobbies using HTML, JavaScript and CSS.
2. Create a frameset in HTML that is divided into three sections. The frameset should have three zones.
    a. The Topmost section of the frameset should take up about just 15% of the browser window. Name this frame title.
    b. The middle section should be 75% of the browser window. Name this frame title.
    c. The lower section should be 10% of the browser window. Name this frame menu.
3. Create pages for each section. For the lowermost section, create page that loads the content into the middle section. The topmost section should contain a page describing the web page itself.
4. Create a web page, which displays the map of your country Link, each city /state on the image map, such that the respective HTML page of the city/state is displayed when the user selects an area.
5. Add the tickertape applet to your page by customizing it for the following settings:
    a. Increase the count by one.
    b. Accordingly update the message count.
    c. Change the text color to (237,192,171)
    d. Experiment with changing the scrolling speed.
    e. Customize the message text as per your page requirement.
6. Incorporate a quest book into the Diary Food Webpage and use Java Script to build validations into the form.
7. Use Cascading Style sheets (CSS) to modify the following:
    a. Change background.
    b. Change font type, face and color.
    c. Align Text.
    d. Remove underlines from hyperlinks.
8. Write the program for using JavaScript by using for – loops (through a block of code a number of times), for/in - loops (through the properties of an object), while - loops (through a block of code while a specified condition is true), do/while - loops (through a block of code while a specified condition is true).
9. Write a program in Java Script for the following:
    a. Copying, passing, and comparing by value
    b. Copying, passing, and comparing by reference
    c. References themselves are passed by value
10. Write program in Java Script for pattern matching using regular expressions and errors in scripts.
11. Write a Python function/program that accepts the lengths of three sides of a triangle as inputs. The program output should indicate whether or not the triangle is an equilateral triangle.
12. Write the Python functions for linear search, binary search, selection sort, Bubble Sort, Insertion Sort and converting Fibonacci to a linear algorithm.
13. Write program in Python using Lists and dictionaries, Control statements and Strings and text files.

| MC-901A | Environmental Sciences | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **0** | **75** | **25** | **100** | **3 Hours** |
| **Purpose** | To learn the multidisciplinary nature, scope and importance of Environmental sciences. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | The students will be able to learn the importance of natural resources. | | | | | | |
| **CO2** | To learn the theoretical and practical aspects of eco system. | | | | | | |
| **CO3** | Will be able to learn the basic concepts of conservation of biodiversity. | | | | | | |
| **CO4** | The students will be able to understand the basic concept of sustainable development. | | | | | | |

**Unit-1**

The multidisciplinary nature of environmental studies, Definition, Scope and Importance, Need for public awareness, Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems.

(g) Forest Resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
(h) Water Resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
(i) Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
(j) Food Resources: World Food Problems, changes caused by agriculture and overgazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
(k) Energy Resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
(l) Land Resources: Land as a resource, land, degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyle.

**Unit-2**

**Ecosystem-Concept of an ecosystem**: Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological Succession, Food Chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: (a) Forest Ecosystem, (b) Grassland Ecosystem, (c) Desert Ecosystem and (d) Aquatic Ecosystems (ponds, streams, lakes, rivers, oceans, esturaries

Field Work: Visit to a local area to document Environment assets-river/forest/grassland/hill/mountain, Visit to a local polluted site-Urban /Rural Industrial/Agricultural, Study of common plants, insects and birds, Study of simple ecosystems-pond, river, hill, slopes etc. (Field work equal to 5 lecture hours).

**Unit-3**

**Biodiversity and its conservation:** Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity of global, National and local levels. India as a mega-diversity nation Hot spot of Biodiversity, Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts, Endangered and endemic species of India, Conservation of Biodiversity- In situ and Ex-Situ conservation of biodiversity.

**Environmental Pollution Definition:** Cause, effects and control measures of (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution (e) Noise Pollution (f) Thermal Pollution (g) Nuclear Hazards

Solid waste management- cause, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides

**Unit-4**

**Social Issues and the Environment**: From unsustainable to sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people: Its problems and concerns, Case Studies: Environmental ethics-issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies: Wasteland Reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public Awareness, Human population and the Environment, Population growth, variation among nations, Population explosion-Family Welfare Programme, Environment and human health. Human rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human Health, Case Studies, Drugs and their effects; Useful and harmful drugs, Use and abuse of drugs, Stimulant and depression drugs, Concept of drug de-addiction, Legal position on drugs and laws related to drugs.

**Suggested Books:**

- Environmental Studies- Deswal and Deswal. Dhanpat Rai and Co.
- Environmental Science and Engineering Anandan, P. and Kumaravelan, R. 2009. Scitech Publications (India) Pvt. Ltd., India
- Environmental Studies. Daniels Ranjit R. J. and Krishnaswamy. 2013. Wiley India.
- Environmental Science- Botkin and Keller. 2012. Wiley , India

**Note: The Examiner will be given the question paper template to set the question paper.**

**B. Tech Computer Science and Engineering (Artificial Intelligence and Data Science)**
**Scheme of Studies/Examination**
**Semester III**

| S. No. | Course No. | Subject | L:T:P | Hours / Week | Credits | Examination Schedule | | | | Duration of Exam (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | **Major Test** | **Minor Test** | **Practical** | **Total** | |
| 1 | BS-CS-AIDS-201A | Mathematics for Big Data & Optimization | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | PC-CS-AIDS- 203A | Object Oriented Programming | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 3 | PC-CS-AIDS- 205A | Data Structures & Algorithms | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 4 | PC-CS-AIDS- 207A | Introduction to Artificial Intelligence | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 5 | PC-CS-AIDS- 209A | Programming Language | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 6 | HM-902 | Business Intelligence and Entrepreneurship | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 7 | PC-CS-AIDS-213LA | Data Structures & Algorithms Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 8 | PC-CS-AIDS-215LA | Artificial Intelligence Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 9 | PC-CS-AIDS-217LA | Object Oriented Programming Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| | | **Total** | | **24** | **21** | **450** | **270** | **180** | **900** | |
| 11 | SIM-201A* | Seminar on Summer Internship | 2:0:0 | 2 | 0 | 0 | 50 | 0 | 50 | |

***Note: SIM-201A* is a mandatory credit-less course in which the students will be evaluated for the Summer Internship (training) undergone after 2nd semester and students will be required to get passing marks to qualify.**

| BS-CS-AIDS-201A | **Mathematics for Big Data & Optimization** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hour** |
| **Purpose** | To introduce the concepts of mathematics in Data Science. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Demonstrate understanding of basic mathematical concepts in data science, relating to linear algebra, probability, and calculus | | | | | | |
| **CO2** | Employ methods related to these concepts in a variety of data science applications | | | | | | |
| **CO3** | Apply logical thinking to problem-solving in context. | | | | | | |
| **CO4** | Use appropriate technology to aid problem-solving and data analysis | | | | | | |

**UNIT**-I

**Fourier series:** Introduction, Fourier-Euler Formula, Dirichlet's conditions, Change of intervals, Fourier series for even and odd functions, Half range sine and cosine series.

**Fourier Transform:** Fourier Integral theorem, Fourier sine and cosine transforms and its properties, Convolution, Parseval's identity for fourier transforms, Fourier Transform of derivative of a function.

**UNIT-II**

**First order ordinary differential equations:** Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

**Differential equations of higher orders:**Second order linear differential equations with constant coefficients, method of variation of parameters, Cauchy and Legendre's linear differential equations.

**UNIT-III**

**Solution of polynomial and transcendental equations:** Bisection method, Newton-Raphson method and Regula-Falsi method, Finite differences, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Lagrange's formulae. Numerical differentiation using forward and backward difference.
**Numerical Integration:**Trapezoidal rule and Simpson's 1/3rd and 3/8 rules, Ordinary differential equations: Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first order equations.

**UNIT-IV**

**Introduction** – Formulation and classification of optimization problems, overview of analytical solution of unconstrained optimization problems, constrained optimization, convex set, convex functions, convex optimization problem, Kuhn Tucker condition, Search methods: overview og single variable search methods, search methods for multivariable unconstrained problems: optimality criteria, unidirectional search-direct search methods-evolutionary search methods.

**Suggested Books:**

- Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
- P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
- S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

- Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
- Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
- N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
- B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
- W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
- E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
- E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
- G.F. Simmons and S.G. Krantz, Differential Equations, Tata McGraw Hill, 2007.
- Optimization Methods for Engineers, N.V.S. Raju, PHI Learning Pvt. Ltd.

| PC-CS-AIDS- 203A | **Object-Oriented Programming** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hour** |
| **Purpose** | To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | To introduce the basic concepts of object oriented programming language and the its representation. | | | | | | |
| **CO2** | To allocate dynamic memory, access private members of class and the behavior of inheritance and its implementation. | | | | | | |
| **CO3** | To introduce polymorphism, interface design and overloading of operator. | | | | | | |
| **CO4** | To handle backup system using file, general purpose template and handling of raised exception during programming. | | | | | | |

**UNIT – I**

Introduction to C++, C++ Standard Library, Illustrative Simple C++ Programs. Header Files, Namespaces, Application of object oriented programming.

Object Oriented Concepts, Introduction to Objects and Object Oriented Programming, Encapsulation, Polymorphism, Overloading, Inheritance, Abstract Classes, Accessifier (public/ protected/ private), Class Scope and Accessing Class Members, Controlling Access Function, Constant, Class Member, Structure and Class

**UNIT – II**

Friend Function and Friend Classes, This Pointer, Dynamic Memory Allocation and Deallocation (New and Delete), Static Class Members, Constructors, parameter Constructors and Copy Constructors, Deconstructors, Introduction of inheritance, Types of Inheritance, Overriding Base Class Members in a Derived Class, Public, Protected and Private Inheritance, Effect of Constructors and Deconstructors of Base Class in Derived Classes.

**UNIT – III**

Polymorphism, Pointer to Derived class, Virtual Functions, Pure Virtual Function, Abstract Base Classes, Static and Dynamic Binding, Virtual Deconstructors.

Fundamentals of Operator Overloading, Rules for Operators Overloading, Implementation of Operator Overloading Like <<,>> Unary Operators, Binary Operators.

**UNIT – IV**

Text Streams and binary stream, Sequential and Random Access File, Stream Input/ Output Classes, Stream Manipulators.

Basics of C++ Exception Handling, Try, Throw, Catch, multiple catch, Re-throwing an Exception, Exception specifications.

Templates: Function Templates, Overloading Template Functions, Class Template, Class Templates and Non- Type Template arguments.

**Suggested Books:**

- The complete reference C ++ by Herbert shieldt Tata McGraw Hill.
- Object Oriented Programming in Turbo C++ by Robert Lafore, 1994, The WAITE Group Press.
- Shukla, Object Oriented Programming in c++, Wiley India.
- C++ How to Program by H M Deitel and P J Deitel, 1998, Prentice Hall.
- Programming with C++ By D Ravichandran, 2003, T.M.H.

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| PC-CS-AIDS-205A | **Data Structures & Algorithms** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hour** |
| **Purpose** | To introduce the principles and paradigms of Data Structures for design and implement the software systems logically and physically. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO 1** | To introduce the basic concepts of Data structure , basic data types ,searching and sorting based on array data types. | | | | | | |
| **CO 2** | To introduce the structured data types like Stacks and Queue and its basic operations' implementation. | | | | | | |
| **CO 3** | To introduce dynamic implementation of linked list. | | | | | | |
| **CO 4** | To introduce the concepts of Tree and graph and implementation of traversal algorithms. | | | | | | |

**UNIT – I**

**Introduction to Data Structures**, Data Types, Built in and User Defined Data Structures, Applications of Data Structure, Algorithm Analysis, Worst, Best and Average Case Analysis, Notations of Space and Time Complexity, Basics of Recursion.

**Arrays**, One Dimensional Arrays, Two Dimensional Arrays and Multi-Dimensional Arrays, Sparse Matrices, Searching from array using Linear and Binary Searching Algorithm, Sorting of array using Selection, Insertion, Bubble, Radix Algorithm

**UNIT – II**

**Stacks**: Definition, Implementation of Stacks and Its Operations, Evaluation of Infix, prefix and Postfix Expression, Inter-conversion of Infix, Prefix and Post-Fix Expression, Implementation of Merge Sort and Quick Sort Algorithm.

**Queues**: Definition, Sequential Implementation of Linear Queues and Its Operations, Circular Queue and Its Implementation, Priority Queues and Its Implementation, Applications of queues.

**UNIT – III**

**Linked Lists**: Need of Dynamic Data Structures, Single Link List and Its Dynamic Implementation, Traversing, Insertion, Deletion Operations on Single Link Lists. Comparison between Static and Dynamic, Implementation of Linked List. Circular Link Lists and Doubly Link List, Dynamic Implementation of Primitive Operations on Doubly Linked Lists and Circular Link List. Dynamic Implementation of Stacks and Queues.

**UNIT – IV**

**Trees**: Definition, Basic Terminology, Binary Tree, External and Internal Nodes, Static and Dynamic Implementation of a Binary Tree, Primitive Operations on Binary Trees, Binary Tree Traversals: Pre-Order, In-Order and Post-Order Traversals. Representation of Infix, Post-Fix and Prefix Expressions using Trees.

**Introduction to Binary Search Trees:** B+ trees, AVL Trees, Threaded Binary trees, Balanced Multi-way search trees, Implementation of Heap Sort Algorithm.

**Graphs**: Basic Terminology, Definition of Undirected and Directed Graphs, Memory Representation of Graphs, Minimum-Spanning Trees, Warshal Algorithm, Graph Traversals Algorithms: Breadth First and Depth First.

**Suggested Books:**

- Theory and Problems of Data Structures by Jr. Symour Lipschetz, Schaum's outline, TMH.
- Data Structures and Algorithms by PAI, TMH.
- Fundamentals of Data structures by Ellis Horowitz and Sartaj Sahni, Pub, 1983, AW.
- Data Structures and Algorithms by A.V. Aho, J.E. Hopcroft and T.D. Ullman, Original edition, Addison-Wesley, 1999, Low Priced Edition.
- Data Structures and Program Design in C by Robert Kruse, PHI,
- Shukla, Data Structures using C++, Wiley India
- Introduction to Computers Science -An Algorithms Approach, Jean Paul Tremblay, Richard B. Bunt, 2002, T.M.H.
- Data Structure and the Standard Template library – Willam J. Collins, 2003, T.M.H.

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| PC-CS-AIDS-207A | **Introduction to Artificial Intelligence** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hour** |
| **Purpose** | To gain a broad understanding of the discipline of Artificial Intelligence and its scope in various emerging areas. | | | | | | |
| **Course Outcomes(CO)** | | | | | | | |
| **CO1** | Demonstrate fundamental understanding of Artificial Intelligence (AI) and its foundation | | | | | | |
| **CO2** | Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning | | | | | | |
| **CO3** | Demonstrate proficiency in applying scientific method to models of machine learning | | | | | | |
| **CO4** | Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications | | | | | | |

**UNIT – I**

**Scope of AI**: Games, theorem proving, natural language processing, vision and speech processing, robotics, expert systems, AI techniques-search knowledge, abstraction.

**Problem Solving (Blind):** State space search; production systems, search space control; depth first search , breadth-first search. Heuristic Based Search: Heuristic search, Hill climbing, best-first search, branch and bound, Problem Reduction, Constraint Satisfaction End, Means-End Analysis.

**UNIT – II**

**Game Playing:** Game Tree, Minimax Algorithm, Alpha Beta Cutoff, Modified Minimax Algorithm, Horizon Effect, Futility Cut-off.

**Knowledge Representation**: Predicate Logic: Unificatioin, Modus Ponens, Modus Tolens, Resolution in Predicate Logic, Conflict Resolution Forward Chaining, Backward Chaining, Declarative and Procedural Representation, Rule based Systems.

**Structured Knowledge Representation:** Semantic Nets: Slots, exceptions and default frames, conceptual dependency, scripts.

**UNIT – III**

**Knowledge Engineering:** First order logic, Syntax and semantics for first order logic, Inference in First order logic – prepositional versus first order logic, unification and lifting, forward chaining, backward chaining , Resolution, Knowledge representation

**Handling Uncertainty**: Non-Monotonic Reasoning, Probabilistic reasoning, use of certainty factors, fuzzy logic.

**Natural Language Processing:** Introduction, Syntactic Processing, Semantic Processing, Pragmatic Processing.

**UNIT – IV**

**LEARNING PRINCIPLES :** Learning from observations , forms of learning , Inductive learning , Learning decision trees, Ensemble learning, Knowledge in learning,Logical formulation of learning ,Explanation base learning,Learning using relevant information, Inductive logic programming,Statistical learning methods,Learning with complete data ,Learning with hidden variable**,** genetic algorithm, learning by inductions, neural networks.

**Expert Systems:** Need and justification for expert systems, knowledge acquisition, Case Studies: MYCIN, RI.

**Suggested Books:**

1. E. Rich and K. Knight, “Artificial Intelligence”, TMH, 2nd Ed., 1992.
2. N. J. Nilsson, “Principles of AI”, Narosa Publ. House, 1990.
3. M. N. Hoda, “Foundation Course in Artificial Intelligence”, Vikas Pub., 2004.
4. P. H. Winston, "Artificial Intelligence", Pearson Education, 3rd Edition, 2002. Artificial Intelligence.
5. D. W. Patterson, “Introduction to AI and Expert Systems”, PHI, 1992.
6. R. J. Schalkoff, “Artificial Intelligence – An Engineering Approach”, McGraw Hill Int. Ed. Singapore, 1992.
7. M. Sasikumar, S. Ramani, “Rule Based Expert Systems”, Narosa Publishing House, 1994. 5. Tim Johns, “Artificial Intelligence, Application Programming, Wiley Dreamtech, 2005.

| PC-CS-AIDS- 209A | Programming Languages | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hour** |
| **Purpose** | To introduce the principles and paradigms of programming languages for design and implement the software intensive systems. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO 1** | To introduce the basic concepts of programming language, the general problems and methods related to syntax and semantics. | | | | | | |
| **CO 2** | To introduce the structured data objects, subprograms and programmer defined data types. | | | | | | |
| **CO 3** | To outline the sequence control and data control. | | | | | | |
| **CO 4** | To introduce the concepts of storage management using programming languages. | | | | | | |

## UNIT – I

**Introduction:** A brief history, Characteristics of a good programming language, Programming language translators- compiler and interpreters, Elementary data types – data objects, variable and constants, data types. Specification and implementation of elementary data types, Declarations, type checking and type conversions, Assignment and initialization, Numeric data types, enumerations, Booleans and characters.

**Syntax and Semantics:** Introduction, general problem of describing syntax, Formal method of describing Syntax, attribute grammar dynamic semantic.

## UNIT – II

**Structured data objects:** Structured data objects and data types, specification and implementation of structured data types, Declaration and type checking of data structure, vector and arrays, records Character strings, variable size data structures, Union, pointer and programmer defined data objects, sets, files.

**Subprograms and Programmer Defined Data Types:** Evolution of data type concept abstraction, encapsulation and information hiding, Subprograms, type definitions, abstract data types, over loaded subprograms, generic subprograms.

## UNIT – III

**Sequence Control:** Implicit and explicit sequence control, sequence control within expressions, sequence control within statement, Subprogram sequence control: simple call return, recursive subprograms, Exception and exception handlers, co routines, sequence control. Concurrency – subprogram level concurrency, synchronization through semaphores, monitors and message passing

**Data Control:** Names and referencing environment, static and dynamic scope, block structure, Local data and local referencing environment, Shared data: dynamic and static scope, Parameter and parameter transmission schemes.

## UNIT – IV

**Storage Management:** Major run time elements requiring storage, programmer and system controlled storage management and phases, Static storage management, Stack based storage management, Heap storage management, variable and fixed size elements.

**Programming Languages:** Introduction to procedural, non-procedural, structured, logical, functional and object oriented programming language, Comparison of C and C++ programming languages.

**Suggested Books:**


- Terrence W. Pratt, Marvin V. Zelkowitz, Programming Languages Design and Implementation, Pearson.
- Allen Tucker and Robert Noonan, Programming Languages–Principles and Paradigms, Tata McGraw-Hill, 2009.
- Ellis Horowitz, Fundamentals of Programming Languages, Galgotia Publications, 2010.
- C. Ghezzi, Programming Languages Concepts, Wiley Publications, 2010.


**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| HM-902 | Business Intelligence and Entrepreneurship | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Purpose** | To make the students conversant with the basics concepts in management thereby leading to nurturing their managerial skills. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Students will be able understand who the entrepreneurs are and what competences needed to become an Entrepreneur. | | | | | | |
| **CO2** | Students will be able understand insights into the management, opportunity search, identification of a Product; market feasibility studies; project finalization etc. required for small business enterprises. | | | | | | |
| **CO3** | Students can be able to write a report and do oral presentation on the topics such as product identification, business idea, export marketing etc. | | | | | | |
| **CO4** | Students will be able to know the different financial and other assistance available for the small industrial units. | | | | | | |

**UNIT – I**

**Entrepreneurship :** Concept and Definitions; Entrepreneurship and Economic Development; Classification and Types of Entrepreneurs; Entrepreneurial Competencies; Factor Affecting Entrepreneurial Growth – Economic, Non-Economic Factors; EDP Programmes; Entrepreneurial Training; Traits/Qualities of an Entrepreneurs; Manager Vs. Entrepreneur, Entrepreneurial challenges.

**UNIT – II**

**Opportunity / Identification and Product Selection:** Entrepreneurial Opportunity Search and Identification; Criteria to Select a Product; Conducting Feasibility Studies; Sources of business ideas, Marketing Plan : Conducting of Marketing Research, Industry Analysis, Competitor analysis, market segmentation and positioning, building a marketing plan, marketing mix, launching a new product; export marketing, Methods of Project Appraisal, Project Report Preparation; Specimen of Project Report; Project Planning and Scheduling using Networking Techniques of PERT / CPM.

**UNIT – III**

**Small Enterprises and Enterprise Launching Formalities :** Definition of Small Scale; Rationale; Objective; Scope; SSI; Registration; NOC from Pollution Board; Machinery and Equipment Selection , Role of SSI in Economic Development of India; major problem faced by SSI,MSMEs – Definition and Significance in Indian Economy; MSME Schemes, Challenges and Difficulties in availing MSME Schemes.

**UNIT – IV**

**Role of Support Institutions and Management of Small Business :** DIC; SIDO; SIDBI; Small Industries Development Corporation (SIDC); SISI; NSIC; NISBUD; State Financial Corporation SIC; Venture Capital : Concept, venture capital financing schemes offered by various financial institutions in India.

**Special Issues for Entrepreneurs**: Legal issues – Forming business entity, requirements for formation of a Private/Public Limited Company, Entrepreneurship and Intellectual Property Rights: IPR and their importance. (Patent, Copy Right, Trademarks) , Case Studies-At least one in whole course.

**Note:**

• Case studies of Entrepreneurs – successful, failed, turnaround ventures should be discussed in the class.

• Exercises / activities should be conducted on ‘generating business ideas’ and identifying problems and opportunities.

• Interactive sessions with Entrepreneurs, authorities of financial institutions, Government officials should be organized

**Suggested Readings:**

1. "Entrepreneurship development small business enterprises", Pearson, Poornima M Charantimath,2013.
2. Roy Rajiv, "Entrepreneurship", Oxford University Press, 2011.
3. "Innovation and Entrepreneurship",Harper business- Drucker.F, Peter, 2006.
4. "Entrepreneurship", Tata Mc-graw Hill Publishing Co.ltd new Delhi- Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, 8th Edition, 2012
5. Enterpreneurship Development- S.Chand and Co.,Delhi- S.S.Khanka 1999
6. Small-Scale Industries and Entrepreneurship. Himalaya Publishing House, Delhi –Vasant Desai 2003.
7. Entrepreneurship Management -Cynthia, Kaulgud, Aruna, Vikas Publishing House, Delhi, 2003.

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| PC-CS-AIDS-213LA | **Data Structure & Algorithms Lab** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **40** | **60** | **100** | **3** |
| **Purpose** | To introduce the principles and paradigms of Data Structures for design and implement the software systems logically and physically. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Implement linear and non linear data structures using linked list. | | | | | | |
| **CO2** | Apply various data structures such as stack, queue and tree to solve the problems. | | | | | | |
| **CO3** | Implement various searching and sorting techniques. | | | | | | |
| **CO4** | Choose appropriate data structure while designing the applications and analyze the complexity of the algorithms. | | | | | | |

***LIST OF PRACTICALS***

1. Write a program for Binary search methods.
2. Write a program for insertion sort, selection sort and bubble sort.
3. Write a program to implement Stack and its operation.
4. Write a program for quick sort.
5. Write a program for merge sort.
6. Write a program to implement Queue and its operation.
7. Write a program to implement Circular Queue and its operation.
8. Write a program to implement singly linked list for the following operations: Create, Display, searching, traversing and deletion.
9. Write a program to implement doubly linked list for the following operations: Create, Display, inserting, counting, searching, traversing and deletion.

10 Write a program to implement circular linked list for the following operations: Create, Display, inserting, counting, searching, traversing and deletion.

11. Write a program to implement insertion, deletion and traversing in B tree

**NOTE:** A student has to perform at least ten experiments. Seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

| PC-CS-AIDS-215LA | **Artificial Intelligence Lab** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **40** | **60** | **100** | **3** |
| **Purpose** | To gain a broad understanding of the discipline of Artificial Intelligence | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | To understand the basic concepts of Artificial Intelligence. | | | | | | |
| **CO2** | To apply various AI Search algorithms. | | | | | | |
| **CO3** | To understand the fundamentals of knowledge representation and theorem proving using AI tools. | | | | | | |
| **CO4** | Ability to apply knowledge representation and machine learning techniques to real life problems. | | | | | | |

**LIST OF PRACTICALS:**

1. Introduction to PYTHON & study of basic commands.
2. Write a program to implement Factorial, Fibonacci of a given number.
3. Write a program to solve 8 queens problem.
4. Solve a problem using Depth First Search.
5. Solve a problem using Breadth First Search.
6. Solve 8 puzzle problem using Best First Search
7. Solve Robot Traversal Problem using Means End Analysis
8. Solve Travelling Salesman Problem.

**Suggested Books:**

1. Artificial Intelligence: A Modern Approach,. Russell & Norvig, Prentice Hall.
2. Artificial Intelligence, Elain Rich and Kevin Knight, TMH.
3. Artificial Intelligence-A modern approach, Staurt Russel and peter norvig, 1998, PHI.
4. Artificial intelligence, Patrick Henry Winston:, 1992, Addition Wesley 3 Ed.

| PC-CS-AIDS-217LA | **Object Oriented Programming Lab** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **40** | **60** | **100** | **3 Hour** |
| **Purpose** | To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Implement object oriented concepts such as objects,classes abstraction and message passing. | | | | | | |
| **CO2** | Implement the friend function ,function overloading and virtual function | | | | | | |
| **CO3** | Implement Operator overloading, Inheritance and method overriding. | | | | | | |
| **CO4** | Implement the various functions on String and apply I/O operation to handle file system | | | | | | |

## LIST OF PRACTICALS

**1**. Raising a number n to a power p is the same as multiplying n by itself p times. Write a function called power

( ) that takes a double value for n and an int value for p, and returns the result as double value. Use a default argument of 2 for p, so that if this argument is omitted, the number will be squared. Write a main ( ) function that gets values from the user to test this function.

**2**. A point on the two dimensional plane can be represented by two numbers: an X coordinate and a Y coordinate. For example, (4,5) represents a point 4 units to the right of the origin along the X axis and 5 units up the Y axis. The sum of two points can be defined as a new point whose X coordinate is the sum of the X coordinates of the points and whose Y coordinate is the sum of their Y coordinates. Write a program that uses a structure called point to model a point. Define three points, and have the user input values to two of them. Then set the third point equal to the sum of the other two, and display the value of the new point. Interaction with the program might look like this:

Enter coordinates for P1: 3 4

Enter coordinates for P2: 5 7

Coordinates of P1 + P2 are : 8, 11

**3**. Create the equivalent of a four function calculator. The program should request the user to enter a number, an operator, and another number. It should then carry out the specified arithmetical operation: adding, subtracting, multiplying, or dividing the two numbers. (It should use a switch statement to select the operation). Finally it should display the result. When it finishes the calculation, the program should ask if the user wants to do another calculation. The response can be 'Y' or 'N'. Some sample interaction with the program might look like this.

Enter first number, operator, and second number: 10/ 3

Answer = 3.333333

Do another (Y/ N)? Y

Enter first number, operator, second number 12 + 100

Answer = 112

Do another (Y/ N) ? N

**4**. A phone number, such as (212) 767-8900, can be thought of as having three parts: the area code (212), the exchange (767) and the number (8900). Write a program that uses a structure to store these three parts of a phone number separately. Call the structure phone. Create two structure variables of type phone. Initialize one, and have the user input a number for the other one. Then display both numbers. The interchange might look like this:

- Enter your area code, exchange, and number: 415 555 1212
- My number is (212) 767-8900
- Your number is (415) 555-1212

**5**. Create two classes DM and DB which store the value of distances. DM stores distances in metres and centimeters and DB in feet and inches. Write a program that can read values for the class objects and add one object of DM with another object of DB. Use a friend function to carry out the addition operation. The object that stores the results maybe a DM object or DB objects, depending on the units in which the results are required. The display should be in the format of feet and inches or metres and cenitmetres depending on the object on display.

**6**. Create a class rational which represents a numerical value by two double values- NUMERATOR and DENOMINATOR. Include the following public member Functions:

- constructor with no arguments (default).
- constructor with two arguments.
- void reduce( ) that reduces the rational number by eliminating the highest common factor between the numerator and denominator.
- Overload + operator to add two rational number.
- Overload >> operator to enable input through cin.
- Overload << operator to enable output through cout.

Write a main ( ) to test all the functions in the class.

**7**. Consider the following class definition

```
class father {

protected : int age;

public;

father (int x) {age = x;}

virtual void iam ( )

{ cout < < “I AM THE FATHER, my age is : ”<< age<< end1:}
```

Derive the two classes son and daughter from the above class and for each, define iam ( ) to write our similar but appropriate messages. You should also define suitable constructors for these classes. Now, write a main ( ) that creates objects of the three classes and then calls iam ( ) for them. Declare pointer to father. Successively, assign addresses of objects of the two derived classes to this pointer and in each case, call iam ( ) through the pointer to demonstrate polymorphism in action.

**8**. Write a program that creates a binary file by reading the data for the students from the terminal. The data of each student consist of roll no., name ( a string of 30 or lesser no. of characters) and marks.

**9**. A hospital wants to create a database regarding its indoor patients. The information to store include

a) Name of the patient

b) Date of admission

c) Disease

d) Date of discharge

Create a structure to store the date (year, month and date as its members). Create a base class to store the above information. The member function should include functions to enter information and display a list of all the patients in the database. Create a derived class to store the age of the patients. List the information about all the to store the age of the patients. List the information about all the pediatric patients (less than twelve years in age).

**10**. Make a class **Employee** with a name and salary. Make a class **Manager** inherit from **Employee**. Add an instance variable, named department, of type string. Supply a method to **to String** that prints the manager's name, department and salary. Make a class **Executive** inherits from **Manager**. Supply a method **to String** that prints the string **"Executive"** followed by the information stored in the **Manager** superclass object. Supply a test program that tests these classes and methods.

**11**. Imagine a tollbooth with a class called toll Booth. The two data items are a type unsigned int to hold the total number of cars, and a type double to hold the total amount of money collected. A constructor initializes both these to 0. A member function called payingCar ( ) increments the car total and adds 0.50 to the cash total. Another function, called nopayCar ( ), increments the car total but adds nothing to the cash total. Finally, a member function called displays the two totals. Include a program to test this class. This program should allow the user to push one key to count a paying car, and another to count a nonpaying car. Pushing the ESC kay should cause the program to print out the total cars and total cash and then exit.

**12**. Write a function called reversit ( ) that reverses a string (an array of char). Use a for loop that swaps the first and last characters, then the second and next to last characters and so on. The string should be passed to reversit ( ) as an argument. Write a program to exercise reversit ( ). The program should get a string from the user, call reversit ( ), and print out the result. Use an input method that allows embedded blanks. Test the program with Napoleon's famous phrase, "Able was I ere I saw Elba)".

**13**. Create some objects of the string class, and put them in a Deque-some at the head of the Deque and some at the tail. Display the contents of the Deque using the forEach ( ) function and a user written display function. Then search the Deque for a particular string, using the first That ( ) function and display any strings that match. Finally remove all the items from the Deque using the getLeft ( ) function and display each item. Notice the order in which the items are displayed: Using getLeft ( ), those inserted on the left (head) of the Deque are removed in "last in first out" order while those put on the right side are removed in "first in first out" order. The opposite would be true if getRight ( ) were used.

**14**. Assume that a bank maintains two kinds of accounts for customers, one called as savings account and the other as current account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides cheque book facility but no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed.

Create a class account that stores customer name, account number and type of account. From this derive the classes

cur_acct and sav_acct to make them more specific to their requirements. Include necessary member functions in order to achieve the following tasks:

a) Accept deposit from a customer and update the balance.

b) Display the balance.

c) Compute and deposit interest.

d) Permit withdrawal and update the balance.

e) Check for the minimum balance, impose penalty, necessary and update the balance.

f) Do not use any constructors. Use member functions to initialize the class members.

**15**. Create a base class called shape. Use this class to store two double type values that could be used to compute the area of figures. Derive two specific classes called triangle and rectangle from the base shape. Add to the base class, a member function get_data( ) to initialize baseclass data members and another member function display_area( ) to compute and display the area of figures. Make display_area ( ) as a virtual function and redefine this function in the derived classes to suit their requirements. Using these three classes, design a program that will accept dimensions of a triangle or a rectangle interactively and display the area.

Remember the two values given as input will be treated as lengths of two sides in the case of rectangles and as base and height in the case of triangles and used as follows:

Area of rectangle = x * y

Area of triangle = ½ * x * y

**NOTE:** A student has to perform at least ten experiments. Seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

**B. Tech Computer Science and Engineering (Artificial Intelligence and Data Science)**
**Scheme of Studies/Examination**
**Semester IV**

| S. No. | Course No. | Subject | L:T:P | Hours / Week | Credits | Examination Schedule | | | | Duration of Exam (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Major Test | Minor Test | Practical | Total | |
| 1 | BS-AIDS-202A | Bayesian Data Analysis | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | PC-CS-AIDS- 204A | Data Science with R Programming | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 3 | ES-CS-AIDS-206A | Intelligent Communication Systems | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 4 | PC-CS-AIDS-208A | Internet and web technology | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 5 | PC-CS-AIDS- 210A | Database Management System | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 6 | PC-CS-AIDS-212A | Operating system | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 7 | PC-CS-AIDS-214LA | R Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 8 | PC-CS-AIDS-216LA | Internet and web technology Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 9 | PC-CS-AIDS-218LA | Database Management System Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| | | **Total** | | **24** | **21** | **450** | **270** | **180** | **900** | |
| 10 | MC -901A | Environmental Sciences | 3:0:0 | 3 | 0 | 0 | 100 | 0 | 100 | 3 |

| BS-AIDS-202A | **Bayesian Data Analysis** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | Aim of this course is to equip students with the skills to perform and interpret Bayesian Data analysis | | | | | | |
| **Course Outcomes(CO)** | | | | | | | |
| **CO1** | Demonstrate fundamental understanding of Bayesian Inference and models | | | | | | |
| **CO2** | Understand and apply Bayesian statistics, posterior inference and decision analysis for making Bayesian models. | | | | | | |
| **CO3** | Demonstrate Computation , approximation and simulating from probability distributions in Bayesian analysis | | | | | | |
| **CO4** | Understand Bayesian forms of the standard statistical models | | | | | | |

## UNIT – I
## Fundamental of Bayesian Inference

**Probability & Inference** : The Bayesian Approach, Basic Probability, Bayes' Bayes' Law, Posterior Distribution, Bayesian Framework , The three steps of Bayesian Data Analysis, Statisitcal Infernece and Bayesian Infernece, Discrete Probability Examples:- genetics and spell checking, Bayesian Inference in Applied Science

**Models:** Single and multi-variate models, Bayesian networks, Second-order models (i.e., distributions over distribution parameters), Infinite models: Gaussian process, Dirichlet process, Hierarchical models, Non-parameteric models.

## UNIT – II
## Bayesian Data Analysis

Posterior predictive checking of model in applied Bayesian statistics, Graphical posterior predictive check, Measures of predictive accuracy, Information criteria and cross-validation Model comparison based on predictive performance , Model comparison using Bayes factors , Bayesian decision theory in different contexts ,Using regression predictions, Multistage decision making, Hierarchical decision analysis for radon measurement , Personal vs. institutional decision analysis.

## UNIT – III
## Computation & Approximations

Introduction Bayesian computation, Numerical integration, Distributional approximations , Markov chain simulation, Metropolis and Metropolis-Hastings algorithms , Using Gibbs and Metropolis as building blocks, Gibbs Sampling Examples in R and WinBUGS, Inference and assessing convergence, Hamiltonian Monte Carlo, Posterior modes Normal and related mixture approximations, Finding marginal posterior modes using EM, Approximating conditional and marginal posterior densities

## UNIT – IV
## Regression Models

Bayesian analysis of the classical regression model, Regression for causal inference: incumbency in congressional elections, Goals of regression analysis, Hierarchical Linear Model: - Regression coefficients, Interpreting a normal prior distribution, varying intercepts and slopes, Standard generalized linear model likelihoods, Working with generalized linear models 407 16.3 Weakly informative priors for logistic regression, Models for multivariate and multinomial responses 423 16.7 Loglinear models for multivariate discrete data,

**Nonlinear and Nonparametric Models:** Parametric nonlinear models, Gaussian process models, Finite mixture models, Dirichlet process models.

**Suggested Books:**


1. Bayesian Data Analysis, by Andrew Gelman, John Carlin, Hal Stern, David Dunson, Aki Vehtari, and Donald Rubin, Chapman and Hall/CRC
2. Data Analysis: A Bayesian Tutorial, D. S. Sivia, Clarendon Press, 1996
3. Doing Bayesian Data Analysis: A Tutorial Introduction with R, John Kruschke, Academic press.

| PC-CS-AIDS- 204A | Data Science and R Programming | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | **To Describe what Data Science is and the skill sets needed to be a data scientist..** | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Basics of Data Science, Explain basic Statistics. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data. | | | | | | |
| **CO2** | Using R to carry out basic statistical modeling and analysis.. | | | | | | |
| **CO3** | Explain the significance of exploratory data analysis (EDA) in data science. Apply basic tools (plots, graphs, summary statistics) to carry out EDA. | | | | | | |
| **CO4** | Describe the Data Science Process and how its components interact via machine learning models. | | | | | | |

## UNIT -I

What is Data Science, What does Data Science involve, Era of Data Science, Business Intelligence vs Data Science, Life cycle of Data Science, Tools of Data Science, Introduction to Big Data and Hadoop, Introduction to R, Introduction to Spark, Introduction to Machine Learning.

Statistics: Describing a Single Set of Data, Central Tendencies, Dispersion, Correlation, Simpson’s Paradox, Some Other Correlational Caveats, Correlation and Causation. Probability: Dependence and Independence, Conditional Probability, Bayes’s Theorem, Random Variables, Normal Distribution, Binary distribution.

## UNIT -II

R Programming, What is R, Installing R and RStudio, RStudio Overview, Working in the Console , Writing data, Reading from csv files, Data Types, Operators, Functions, Vectors, Data Frames, Factors, Sorting Numeric, Character, and Factor Vectors, Special Values, Installing and loading packages, Setting up your working directory, Downloading and importing data, Working with missing data , Extracting a subset of a data frame, Writing R scripts, Creating reports, Flow Control, while loops, for loops, If / else, Debugging tools, Data Analysis Pipeline, Data Extraction, Types of Data, Raw and Processed, Data Wrangling

## UNIT -III

Data Manipulation in R, List Management, Data Transformation, Merging Data Frames, Outlier Detection, Combining multiple vectors, Logical Regression, Hierarchical Clustering, PCA for Dimensionality Reduction, Data Import Techniques, Exploratory Data Analysis, Visualization of Data, Loading different types of dataset in R, Arranging the data, Plotting the graphs, Statistical graphs, Creating bar chart and dot plot, Creating histogram and box plot, Plotting with base graphics, Plotting and coloring in R

## UNIT -IV

Machine Learning using R: Modeling, Linear Regression, Logistic Regression, K-Means, K-Means++, Hierarchical Clustering – Agglomerative, CART, Random forest, Naïve Bayes, Implementing Support Vector Machine in R,

**Suggested Book**


1. R for Data Analysis in Easy Steps by Mike Mc Grath .
2. Beginning Data Science in R: Data Analysis, Visualization, and Modelling for the Data Scientist by Thomas Mailund.
3. The Elements of Statistical Learning, 2nd edition. — Springer, 2009. Hastie, T., Tibshirani, R., Friedman, J.
4. Statistical Analysis with R For Dummies by: Joseph Schmuller.
5. Machine Learning: A Probabilistic Perspective. Murphy, K. - MIT Press, 2012.
6. “Practical Data Science with R”. Nina Zumel, John Mount. Manning, 2014.
7. Advanced R: Data Programming and the Cloud by by: Matt Wiley,Joshua F. Wiley.
8. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython ,2nd edition, Wes McKinney,O’Reilly Media (2017)

| ES-CS-AIDS-206A | Intelligent Communication Systems | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To gain a broad understanding of intelligent communication system and its scope in various emerging areas. | | | | | | |
| **Course Outcomes(CO)** | | | | | | | |
| **CO1** | To be able to understand the theoretical basis of communication system process | | | | | | |
| **CO2** | Demonstrate the concept of Information theory and describe various sources available to transfer the information. | | | | | | |
| **CO3** | To have the in depth knowledge of the Communication Network Structure and study various protocols. | | | | | | |
| **CO4** | To deal with the practical aspect of intelligent communication system. | | | | | | |

## UNIT – I

**Communication System**: Elements of communication system, introduction to analog and digital communication systems, Nyquist, Sampling Theorem. Quantization, Pulse Code Modulation, Delta Modulation, Pass band Digital Transmission via Carrier Modulation: ASK, FSK, BPSK, and QPSK. Multiplexing technique: Time Division Multiplexing (TDM), Frequency Division Multiplexing (FDM).

## UNIT – II

**Information Theory:** Introduction to information theory, Information sources; average code word length; Huffman encoding; Channel capacity, discrete memory less channels and capacity, channel coding theorem; theory and practice of error-control coding: trellis diagram and the Viterbi algorithm, connection-type communication and connectionless-type communication, numbering plan.

## UNIT – III

**Communication Network Structure:** Telephone Network Architecture, Computer Network Architecture: Computer Network, Network Architecture, OSI Protocol, Specific Structure of the OSI Reference Model, Internet Network Architecture: TCP/IP Protocol, TCP/IP Subprotocol Structure.

**Advances in Communication Networks:** Integrated Services Digital Network, N-ISDN, B- ISDN, Session Initiation Protocol (SIP), Asynchronous Transfer Mode

## UNIT – IV

**Intelligent Communication Systems:** Concept of Intelligent Communication Systems, Functions of the Intelligent Processing Layer, Structure of the Knowledge-Base System, Design Methodology for Telecommunication Services: state-of-the-art design methodology, definition, graph theory, conflicts among telecommunication services, conflict of charge policy, high-level description of telecommunication.

**Basic Technology of the Intelligent Communication System:** Application of Production Rules to Telecommunications, Description of Telecommunication Services in a Semantic Network, Symbolic Logic, Predicate Logic: Definitions and Operations for Predicate Logic, Clausal Form, Herbrand Universe and the Herbrand Theorem, Proof of Tautology, Resolution Principle, Logical Consequence, Horn Set, Application to Telecommunication Service.

**Suggested Books**

1. **Communication Systems: Analog and Digital by R. P. Singh and B. D. Sapre, Tata- McGraw Hill**
2. **Intelligent Communication Systems- Nobuyoshi Terashima (2001)**

**Reference**

3. **B.P. Lathi and Z. Ding: Modern Digital and Analog Communication Systems, Fourth Edition, 2010, ISBN-13: 978-0-19-533145-5 (main text)**

| PC-CS-AIDS- 208A | **Internet & Web technology** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To gain a broad understanding of the discipline of Web engineering and its application to the development and management of Web Applications. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Learn the basic concepts of information and web architecture. | | | | | | |
| **CO2** | Learn about the skills that will enable to design and build high level web enabled applications. | | | | | | |
| **CO3** | Understand the applicability of Java Script as per current software industry standards. | | | | | | |
| **CO4** | Acquaint the latest programming language for the implementation of object based and procedure based applications using Python. | | | | | | |

**UNIT – I**

**Information Architecture**: The role of Information Architect, Collaboration and communication, Organizing information, organizational challenges, Organizing web sites and Intranets, Creating cohesive organization systems, designing navigation systems, types of navigation systems, Integrated navigation elements, designing elegant navigation systems, Searching systems, Searching your web site, designing the search interface, Indexing the right stuff, To search or not to search grouping content, conceptual design, High level Architecture Blueprint. Architectural Page Mockups, Design Sketches.

**UNIT – II**

**Introduction to XHTML and HTML5**: Origins and Evolution of HTML and XHTML, Basic Syntax, Standard XHTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, HTML5, Syntactic Differences between HTML and XHTML.

**Cascading Style Sheets**: Introduction, Levels of Style Sheets, Style Specification Formats, Selector Forms, Property Value Forms, Font Properties, List Properties, Color, Alignment of Text, Box Model, Background Images, Conflict Resolution.

**UNIT – III**

**Java Script**: Overview of JavaScript, Object Orientation and JavaScript, General Syntactic Characteristics, Primitives, Operations, and Expressions, Screen Output and Keyboard Input, Control Statements, Object Creation and Modification, Arrays, Functions, Constructors, Pattern Matching Using Regular Expressions, Errors in Scripts

**UNIT – IV**

**Python**: Introduction to Python, Data Types and Expressions, Control Statements, Strings and Text Files, Lists and Dictionaries, Design with Functions, Design with Classes

**Suggested Books:**


- By Peter Morville, Louis Rosenfeld, "Information Architecture on the World Wide Web", O'Reilly Media, 2006.
- Robert W. Sebesta, "Programming The World Wide Web", Eight Edition, Pearson India, 2015.
- Kenneth A. Lambert, "The Fundamentals of Python: First Programs", 2011, Cengage Learning.
- Thomas A Powell, "HTML The Complete Reference", Tata McGraw Hill Publications.

| PC-CS-AIDS- 210A | Data Base Management Systems | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Praqctical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To familiarize the students with Data Base Management system | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | To provide introduction to relational model. | | | | | | |
| **CO2** | To learn about ER diagrams and SQL. | | | | | | |
| **CO3** | To understand about the concept of functional dependencies. | | | | | | |
| **CO4** | To understand about Query Processing and Transaction Processing. | | | | | | |

## UNIT – I

**Introduction:** Concept & Overview of DBMS, Advantages of DBMS over file processing system, Database Languages, Responsibilities of Database Administrator, Database Users, Three Schema architecture of DBMS & Data Independence, Data Models.

**Entity-Relationship Model:** Basic concepts, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features: Specialization and Generalization.

## UNIT – II

**The Relational Data Model & Algebra:** Relational Model: Structure of relational Databases, Relational Algebra & various operations (Set operation, select, project, joins, division), Relational Calculus: Domain, Tuple.

**Integrity Constraints & Introduction to SQL:-**

Domain Constraints, Referential Integrity Constraints, Basic Structure & Concept of DDL, DML, DCL, Aggregate Functions, Null Values, Introduction to views, creating, modifying and deleting views.

## UNIT – III

**Relational Database Design :** Functional Dependency, Different anomalies in designing a Database., Normalization – 1NF, 2NF, 3NF, Boyce-CODD Normal Form, Normalization using multi-valued dependencies, 4NF, 5NF.

## UNIT – IV

**Transaction Processing Concept:** Introduction to transaction processing, transaction model properties, serializability:-Serial, non-serial and Serializable Schedules, Conflict Serializability.

**Concurrency Control: Need** of concurrency control, Different concurrency control Techniques: locking based, timestamps based technique. Deadlock handling and Recovery Techniques:- Deferred update/ immediate update, shadow paging.

**Suggested Books:**

- Elmasri and Navathe , “Fundamentals of Database Systems” , Addision-Wesley,
- Silberschatz, and Korth ,”Database System Concepts”, McGraw-Hill
- Date , “An Introduction to Database Systems” ,Addison-Wesley,
- Bhattacharyya, “Database Management Systems” , Tata McGraw-Hill Publishing.

| .PC-CS-AIDS-212A | OPERATING SYSTEMS | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To familiarize the students with the basics of Operating Systems. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | To understand the structure and functions of Operating system. | | | | | | |
| **CO2** | To learn about processes, threads and scheduling algorithms. | | | | | | |
| **CO3** | To understand the principle of concurrency. | | | | | | |
| **CO4** | To understand the concept of deadlocks. | | | | | | |
| CO5 | To learn various memory management schemes. | | | | | | |
| CO6 | To study I/O management and file systems. | | | | | | |
| CO7 | To study the concept of protection and security. | | | | | | |

## UNIT – I

**Introduction:** Introduction to OS. Operating system functions, Different types of O.S.: batch process, multi-programmed, time-sharing, real-time, distributed, parallel.
**System Structure:** Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, system calls.

## UNIT – II

**CPU scheduling:** scheduling criteria, preemptive and non-preemptive scheduling, scheduling algorithms, algorithm evaluation, multi-processor scheduling.
**Threads:** overview, benefits of threads, user and kernel threads.
**Process Management:** Concept of processes, process states, process control, co-operating processes, inter-process communication.
**Process Synchronization:** background, critical section problem, critical region, synchronization hardware, Classical problems of synchronization, semaphores.

## UNIT – III

**Deadlocks:** Concept of deadlock, deadlock characterization, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.
**Memory Management:** background, logical vs. physical address space, contiguous memory allocation, paging, segmentation, segmentation with paging. Concept of fragmentation.
**Virtual Memory:** background, demand paging, concept of page replacement, page replacement algorithms, allocation of frames, thrashing.

## Unit-IV

**File Systems:** file concept, file organization and access methods, allocation methods, directory structure, free-space management
**I/O Management:** I/O hardware, polling, interrupts, DMA, kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation)
**Disk Management:** disk structure, disk scheduling (FCFS, SSTF, SCAN,C-SCAN) , disk reliability, disk Performance parameters
**Protection and Security:**
Goals of protection and security, security attacks, authentication, program threats, system threats, threat monitoring.
**Case studies:** UNIX file system, Windows file system

**Suggested Books:**

- Operating System Concepts", Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, Wiley
- Operating systems: a concept based approach", Dhananjay M. Dhamdhere, McGraw Hill .
- Operating Systems : Internals and Design Principles, William Stallings, Pearson
- Operating Systems Design and Implementation" ,(Prentice Hall Software Series) Andrew S Tanenbaum and Albert S Woodhull.
- Taub and Schilling, Principles of Communication Systems, TMH.
- Mithal G K, Radio Engineering, Khanna Pub.
- Sirnon Haykin, Communication Systems, John Wiley.

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| PC-CS-AIDS-214LA | R Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **40** | **60** | **100** | **3 Hour** |
| **Purpose** | To Describe what Data Science is and the skill sets needed to be a data scientist | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Install and use R for simple programming tasks. Extend the functionality of R by using add-on packages. | | | | | | |
| **CO2** | Extract data from files and other sources and perform various data manipulation tasks on them. 4. Code statistical functions in R. | | | | | | |
| **CO3** | Use R Graphics and Tables to visualize results of various statistical operations on data . | | | | | | |
| **CO4** | Apply the knowledge of R gained to data Analytics for real life applications. | | | | | | |

## LIST OF PRACTICALS

1. Write an R script, to create R objects for calculator application and save in a specified location in disk.
2. Write an R script to find basic descriptive statistics using summary, str, quartile function on sample datasets.
3. Write an R script to find subset of dataset by using subset (), aggregate () functions on sample dataset.
4. Write an R script for Reading different types of data sets (.txt, .csv) from web and disk and writing in file in specific disk location.
5. Write an R script for Reading Excel data sheet and XML dataset.
6. Find the data distributions using box and scatter plot of sample dataset.
   a. Find the outliers using plot.
   b. Plot the histogram, bar chart and pie chart on same data.
7. How to find a corelation matrix and plot the correlation on sample data set.
   a. Plot the correlation plot on dataset and visualize giving an overview of relationships among data
   b. Analysis of covariance: variance (ANOVA), if data have categorical variables
8. Import a data from web storage. Name the dataset and now do Logistic Regression to find out relation between variables that are affecting the admission of a student in a institute based on his or her GRE score, GPA obtained and rank of the student. Also check the model is fit or not. require (foreign), require(MASS).
9. Apply multiple regressions, if data have a continuous independent variable. Apply on above dataset (in Que 8).
10. Apply regression Model techniques to predict the data on above dataset (in Que 8).

<table>
<tr><td>ES-CS-AIDS-216LA</td><td colspan="6">Internet & Web Technology Lab</td></tr>
<tr><td>Lecture</td><td>Tutorial</td><td>Practical</td><td>Minor Test</td><td>Practical</td><td>Total</td><td>Time</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td><td>3 Hrs.</td></tr>
<tr><td>Purpose</td><td colspan="6">To introduce the concepts of HTML5, JavaScript and Python.</td></tr>
<tr><td colspan="7">Course Outcomes (CO)</td></tr>
<tr><td>CO1</td><td colspan="6">Design webpages using HTML, JavaScript and CSS.</td></tr>
<tr><td>CO2</td><td colspan="6">Design and test simple function/program to implement Searching and sorting techniques using Python.</td></tr>
<tr><td>CO3</td><td colspan="6">Develop program in Java Script for pattern matching using regular expressions and errors in scripts.</td></tr>
<tr><td>CO4</td><td colspan="6">Design client-server based web applications.</td></tr>
</table>

**LIST OF PRACTCALS**

1. Create your own page with your favorite hobbies using HTML, JavaScript and CSS.
2. Create a frameset in HTML that is divided into three sections. The frameset should have three zones.
   a. The Topmost section of the frameset should take up about just 15% of the browser window. Name this frame title.
   b. The middle section should be 75% of the browser window. Name this frame title.
   c. The lower section should be 10% of the browser window. Name this frame menu.
3. Create pages for each section. For the lowermost section, create page that loads the content into the middle section. The topmost section should contain a page describing the web page itself.
4. Create a web page, which displays the map of your country Link, each city /state on the image map, such that the respective HTML page of the city/state is displayed when the user selects an area.
5. Add the tickertape applet to your page by customizing it for the following settings:
   a. Increase the count by one.
   b. Accordingly update the message count.
   c. Change the text color to (237,192,171)
   d. Experiment with changing the scrolling speed.
   e. Customize the message text as per your page requirement.
6. Incorporate a quest book into the Diary Food Webpage and use Java Script to build validations into the form.
7. Use Cascading Style sheets (CSS) to modify the following:
   a. Change background.
   b. Change font type, face and color.
   c. Align Text.
   d. Remove underlines from hyperlinks.
8. Write the program for using JavaScript by using for – loops (through a block of code a number of times), for/in - loops (through the properties of an object), while - loops (through a block of code while a specified condition is true), do/while - loops (through a block of code while a specified condition is true).
9. Write a program in Java Script for the following:
   a. Copying, passing, and comparing by value
   b. Copying, passing, and comparing by reference
   c. References themselves are passed by value
10. Write program in Java Script for pattern matching using regular expressions and errors in scripts.
11. Write a Python function/program that accepts the lengths of three sides of a triangle as inputs. The program output should indicate whether or not the triangle is an equilateral triangle.
12. Write the Python functions for linear search, binary search, selection sort, Bubble Sort, Insertion Sort and converting Fibonacci to a linear algorithm.
13. Write program in Python using Lists and dictionaries, Control statements and Strings and text files.

| PC-CS-AIDS-218LA | **Database Management Systems Lab** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Practical** | **Minor Test** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **60** | **40** | **100** | **3Hour** |
| **Purpose** | **To implement practically the various concepts of DBMS** | | | | | | |
| | **Course Outcomes** | | | | | | |
| **CO1** | To understand& Implement basic DDL commands. | | | | | | |
| **CO2** | To learn & Implement DML and DCL commands. | | | | | | |
| **CO3** | To understand the SQL queries using SQL operators. | | | | | | |
| **CO4** | To understand the concept of relational algebra and implement using examples. | | | | | | |

**LIST OF PRACTCALS**

**1.** Create a database and write the programs to carry out the following operation:
- Add , Delete and modify a record in the database
- Generate queries
- Data operations
- List all the records of database in ascending order.

**2.** To perform various integrity constraints on relational database.

**3.** Create a database and perform the following operations:-

4. Arithmetic and Relational operations
5. Group by & having clauses
6. Like predicate for pattern matching in database

**4.** Create a view to display details of employees working on more than one project.

**5.** Create a view to display details of employees not working on any project.

**6.** Using two tables create a view which shall perform natural join, equi join, outer joins.

**7.** Write a procedure to give incentive to employees working on all projects. If no such employee found give app. Message.

**8.** Write a procedure for computing amount telephone bill on the basic of following conditions.

1. telephone rent Rs. 205 including first 105 free units.
2. if extra units>0 but <500 then rate is 80 paise per unit.
3. if extra units>500 then rate is Rs. 1.20 per unit.

For this purpose create a table with name, Phone No., No. of units consumed, bill amount of a customer.

**9.** Write a procedure for computing income tax of employee on the basic of following conditions:-

1. if gross pay<=40,000 then I.T rate is 0%.
2. if gross pay>40,000 but <60000 then I.T rate is 10%.
3. if gross pay>60,000 but <1,00,0000 then I.T rate is 20%.
4. if gross pay>1,00,0000 then I.T rate is 30%.

For this purpose create a table with name, ssn, gross salary and income tax of the employee.

**10.** Write trigger for before and after insertion, deletion and updation process.

**NOTE:** A student has to perform at least ten experiments.Seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus

| MC-901A | Environmental Sciences | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **0** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To learn the multidisciplinary nature, scope and importance of Environmental sciences. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | The students will be able to learn the importance of natural resources. | | | | | | |
| **CO2** | To learn the theoretical and practical aspects of eco system. | | | | | | |
| **CO3** | Will be able to learn the basic concepts of conservation of biodiversity. | | | | | | |
| **CO4** | The students will be able to understand the basic concept of sustainable development. | | | | | | |

**UNIT – I**

The multidisciplinary nature of environmental studies, Definition, Scope and Importance, Need for public awareness, Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems.

(m) Forest Resources: Use and over-exploitation, deforestation, case studies. Timber eztraction, mining, dams and their effects on forests and tribal people.
(n) Water Resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
(o) Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
(p) Food Resources: World Food Problems, changes caused by agriculture and overgazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
(q) Energy Resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
(r) Land Resources: Land as a resource, land, degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyle.

**UNIT – II**

**Ecosystem-Concept of an ecosystem**: Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological Succession, Food Chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: (a) Forest Ecosystem, (b) Grassland Ecosystem, (c) Desert Ecosystem and (d) Aquatic Ecosystems (ponds, streams, lakes, rivers, oceans, esturaries

Field Work: Visit to a local area to document Environment assets-river/forest/grassland/hill/mountain, Visit to a local polluted site-Urban /Rural Industrial/Agricultural, Study of common plants, insects and birds, Study of simple ecosystems-pond, river, hill, slopes etc. (Field work equal to 5 lecture hours).

**UNIT – III**

**Biodiversity and its conservation:** Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity of global, National and local levels. India as a mega-diversity nation Hot spot of Biodiversity, Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts, Endangered and endemic species of India, Conservation of Biodiversity- In situ and Ex-Situ conservation of biodiversity.

**Environmental Pollution Definition:** Cause, effects and control measures of (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution (e) Noise Pollution (f) Thermal Pollution (g) Nuclear Hazards

Solid waste management- cause, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides

**UNIT – IV**

**Social Issues and the Environment**: From unsustainable to sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people: Its problems and concerns, Case Studies: Environmental ethics-issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies: Wasteland Reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public Awareness, Human population and the Environment, Population growth, variation among nations, Population explosion-Family Welfare Programme, Environment and human health. Human rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human Health, Case Studies, Drugs and their effects; Useful and harmful drugs, Use and abuse of drugs, Stimulant and depression drugs, Concept of drug de-addiction, Legal position on drugs and laws related to drugs.

**Suggested Books:**


- Environmental Studies- Deswal and Deswal. Dhanpat Rai and Co.
- Environmental Science and Engineering Anandan, P. and Kumaravelan, R. 2009. Scitech Publications (India) Pvt. Ltd., India
- Environmental Studies. Daniels Ranjit R. J. and Krishnaswamy. 2013. Wiley India.
- Environmental Science- Botkin and Keller. 2012. Wiley , India


**Note: The Examiner will be given the question paper template to set the question paper.**

**Bachelor of Technology (Electrical Engineering)**
**(Credit Based)**
**Modified Scheme of Studies/Examination Semester III**
**(Modified & w.e.f. Session 2021-22)**

| Sr. No. | Course No. | Subject | L:T:P | Hours/Week | Credits | Examination Schedule (Marks) | | | | Duration of Exam (Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Major Test | Minor Test | Practical | Total | |
| 1 | *EE-201A | Electric Circuit Theory | 3:1:0 | 4 | 4 | 75 | 25 | 0 | 100 | 3 |
| 2 | EE-203A | Analog Electronics | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 3 | *EE-205A | Electrical Machines - I | 3:1:0 | 4 | 4 | 75 | 25 | 0 | 100 | 3 |
| 4 | BS-207A | Applied and Computational Mathematics | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 5 | HTM-901A | Universal Human Values II : Understanding Harmony | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 6 | *EE-211A | Electrical Machines – I Lab | 0:0:2 | 2 | 1 | - | 40 | 60 | 100 | 3 |
| 7 | EE-207A | Analog Electronics Lab | 0:0:2 | 2 | 1 | - | 40 | 60 | 100 | 3 |
| 8 | **EE-209A | Industrial Training-I | 2:0:0 | 2 | - | - | 100 | 0 | 100 | 3 |
| 9 | ***MC-901A | Environmental Sciences | 3:0:0 | 3 | - | 75 | 25 | 0 | 100 | 3 |
| | | Total | | 26 | 19 | 375 | 205 | 120 | 700 | |

* Subjects Common with IIIrd Semester. B.Tech. [Electrical & Electronics Engg.] Scheme, K.U.K.

**EE-209Aisamandatorycredit-lesscourseinwhichthestudentswillbeevaluatedfortheindustrialtrainingundergoneafter2nd semesterandstudentswillberequiredto get passing marks toqualify.

***MC-901A is a mandatory credit-less course in which the students will be required to get passing marks in the major test.

| HTM-901A | Universal Human Values II: Understanding Harmony | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time |
| 3 | 0 | 0 | 3.0 | 75 | 25 | 100 | 3 Hours |
| Purpose | Purpose and motivation for the course, recapitulation from Universal Human Values-I | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| CO 1 | Development of a holistic perspective based on self-exploration about themselves (human being),family, society and nature/existence. | | | | | | |
| CO 2 | Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence. | | | | | | |
| CO 3 | Strengthening of self-reflection. | | | | | | |
| CO 4 | Development of commitment and courage to act. | | | | | | |

**Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for ValueEducation**

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' andExperiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment ofaspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at variouslevels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrarinessin choice based on liking-disliking

**Module 2: Understanding Harmony in the Human Being - Harmony in Myself!**

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

**Module 3: Understanding Harmony in the Family and Society- Harmony in**

**Human-HumanRelationship**

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the othersalient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- fromfamily to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

**Module 4: Understanding Harmony in the Nature and Existence - Whole existence asCoexistence**

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature-recyclability and self-regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" canbe used), pollution, depletion of resources and role of technology etc.

**Module 5: Implications of the above Holistic Understanding of Harmony on ProfessionalEthics**

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and

organizations

28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. todiscuss the conduct as an engineer or scientist etc.

**READINGS:**

**Text Book**

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010

**Reference Books**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J CKumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

**MODE OF CONDUCT**

Lecture hours are to be used for lecture/practice sessions.

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at handand motivating students to reflect, explore and verify them.

Practice hours are to be used for practice sessions.

While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elementsto help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions, the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration. Scenarios may be used to initiate discussion. The student is encouraged to take up" ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Practice experiments are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based onbasic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.
This course is to be taught by faculty from every teaching department, including HSS faculty. Teacher preparation with a minimum exposure to at least one 8-day FDP on Universal Human Values is deemed essential.

**ASSESSMENT:**
This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.
Example:
Assessment by
faculty mentor: 5 marks
Self-assessment: 5 marks
Assessment by peers: 5 marks
Socially relevant project/Group Activities/Assignments: 10 marks
Semester End Examination: 75 marks
The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

**KURUKSHETRA UNIVERSITYKURUKSHETRA**
**Bachelor of Technology (ElectricalEngineering)**
**Scheme of Studies/Examination SemesterVII**
**(w.e.f.session 2021-22)**

| SN | Course No. | Subject | L:T:P | H/Wk | Credits | Examination Schedule (Marks) | | | | Duration of Exam (Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Major Test | Minor Test | Practi cal | Total | |
| 1 | HSMC-401A | Principles of Management | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | -- | Program Elective-IV | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 3 | -- | Program Elective-V | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 4 | -- | Open Elective-III | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| | -- | Open Elective-IV | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 5 | EE-401LA | Project Stage-I | 0:0:6 | 6 | 3 | - | 40 | 60 | 100 | 3 |
| 6 | #EE-403A | Industrial Training-II | 2:0:0 | 2 | - | - | 100 | - | 100 | 3 |
| | | **Total** | | **23** | **18** | **375** | **165** | **60** | **600** | |

| | | |
|---|---|---|
| ****Program Elective-IV** | EEP-405A | HVDC Transmission System |
| | **EENP-401A | Industrial Electrical System |
| ****Program Elective- V** | **EENP-403A | Digital Control System |
| | **EENP-405A | High Voltage Engineering |
| ****Open Elective-III** | EEO-401A | Utilization of Electric Energy |
| | EEO-415A | Transducers and their Applications |
| ****Open Elective-IV** | EEO-419A | Biomedical Instrumentation |
| | EEO-421A | Fluid Machinery |

**Note: The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.**

**#** EE-403A is a mandatory credit-less course in which the students will be evaluated for the industrial training undergone after 6th semester and students will be required to get passing marks to qualify.

****: Subject common with B.Tech. Electrical& Electronics Engg .7th Sem.**

| KURUKSHETRA UNIVERSITY KURUKSHETRA<br>BachelorofTechnology ( Electrical Engineering) Scheme of Studies/Examination Semester VIII (w.e.f.Session 2021-22) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| S. No. | Course No. | Subject | L:T:P | Hours/ Week | Credits | Examination Schedule (Marks) | | | | Duration of Exam. (Hrs.) |
| | | | | | | Major Test | Minor Test | Practical | Total | |
| 1 | -- | Program Elective-VI | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 3 | -- | Open Elective-V | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 4 | -- | Open Elective-VI | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 5 | EE-402LA | Project Stage-II | 0:0:12 | 12 | 6 | - | 40 | 60 | 100 | 3 |
| | | **Total** | | **21** | **15** | **225** | **115** | **60** | **400** | |
| | | | | | | | | | | |

| | | |
|---|---|---|
| **Program Elective-VI** | EEP-402A | Electrical & Hybrid Vehicles |
| | **EENP-402A | Power Quality & FACTS |
| | **EENP-404A | Control System Design |
| | EEP-408A | Wind and Solar Energy System |
| **Open Elective-V** | EEO-410A | Power Plant Engineering |
| | EEO-412A | PLC and their application |
| **Open Elective-VI** | **EENO-406A | Embedded System |
| | **EENO-412A | Automobile Engineering |
| | EEO-418A | Biomedical Signal & Image Processing |

**Note: The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.**
****Subject common with B.Tech. 8th sem Electrical & Electronics Engg.**

**Total Credits = 160**

| HSMC-401A | Principles of Management | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time(Hrs)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Program Objective (PO)** | To make students aware about the fundamentals and various technique used in signal and image processing | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **After completion of course students will be able to** | | | | | | | |
| **CO1** | To develop ability to critically analyze and evaluate a variety of management practices in the contemporary context | | | | | | |
| **CO2** | To understand and apply a variety of management and organizational theories in practice | | | | | | |
| **CO3** | To develop ability to critically analyze and evaluate a variety of management practices in the contemporary context | | | | | | |
| **CO4** | To be able to mirror existing practices or to generate their own innovative management competencies, required for today's complex and global workplace | | | | | | |

UNIT-1

**Introduction**: Definition, roles and functions of a manager, management and its science and art perspectives, management challenges and the concepts like, competitive advantage, entrepreneurship and innovation. Early contributors and their contributions to the field of management. Corporate Social Responsibility. Planning, Organizing, Staffing and HRD functions, Leading and Controlling. Decision making under certainty, uncertainty and risk, creative process and innovation involved in decision making.

UNIT-2

**Early Contributions and Ethics in Management**: Scientific Management- contributions of Taylor, Gilbreths, Human Relations approach-contributions of Mayo, McGregor's Theory, Ouchi's Theory Z (3 Hrs.) Systems Approach, the Contingency Approach, the Mckinsey 7-S Framework Corporate Social responsibility- Managerial Ethics. (3 Hrs)

UNIT-3

**Organizing for decision making:** Nature of organizing, organization levels and span of control in management Organizational design and structure –departmentation, line and staff concepts (3 Hrs.) Limitations of decision making Evaluation and selecting from alternatives- programmed and non-programmed decisions - decision under certainty, uncertainty and risk-creative process and innovation (3 Hrs.)

UNIT-4

**Staffing and related HRD Functions:** definition, Empowerment, staff – delegation, decentralization and recentralization of authority – Effective Organizing and culture-responsive organizations –Global and entrepreneurial organizing (3 Hrs.) Manager inventory chart-matching person with the job-system approach to selection (3 Hrs.) Job design skills and personal characteristics needed in managers selection process, techniques and Instruments (3 Hrs.)

Text Books


1. Harold Koontz and Heinz Weihrich, *Essentials of Management*, Mc Graw Hil Companies , 10th edition, 2014
2. Draft, *New Era Managment*, Pearson Education , 11th edition, Cengage Learning
3. Ptere F. Drucker, *The Practice of Management*, Mc Graw Hill, New York.
4. Robbins and Coulter, Management, 13th Edition, Pearson Education , 2016.

| EEP-405A | HVDC Transmission Systems | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time(Hrs)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Program Objective (PO)** | To make students aware about the fundamentals and various techniques of HVDC transmission system | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **After completion of course students will be able to** | | | | | | | |
| **CO1** | Understand the advantages of dc transmission over ac transmission. | | | | | | |
| **CO2** | Understand the operation of Line Commutated Converters and Voltage Source | | | | | | |
| **CO3** | Understand the control strategies used in HVDC transmission system | | | | | | |
| **CO4** | Understand the improvement of power system stability using an HVDC system | | | | | | |

### UNIT 1

Comparison of AC and dc Transmission (Economics, Technical Performance and Reliability). Application of DC Transmission. Description of DC transmission system; planning for HVDC transmission; modern trends in DC transmission.

### UNIT 2

Thyristor Valve & Analysis of HVDC Converters: Introduction; thryistor device; thyristor value; value tests; recent trends; pulse number; choice of converter configuration;simplified analysis of Graetz circuit; converter bridge characteristics; characteristics of twelve pulse converter; detailed analysis of converters.

### UNIT 3

Converter and Hvdc System Control: General; principles of DC link control; converter control characteristics; system control hierarchy; firing angle control; current and extinction angle control; starting and stopping of dc link; power control; higher level controllers; telecommunication requirements.

### UNIT 4

Smoothing Reactors, Reactive Power Sources and Filters in LCC HVdc systems DC line: Corona Effects. Insulators, Transient Over-voltages. dc line faults in LCC systems. dc line faults in VSC systems. dc breakers. Monopolar Operation. Ground Electrodes.

**Suggested Books:**

1. Padiyar, K.R., “HVDC Power Transmissions Systems”, New Age International, 2001
2. Rao,S., “EHV-AC, HVDC Transmission & Distribution Engineering”, Khanna Publishers, 1999
3. Tagare, D.M., “Reactive Power Management”, Tata McGraw Hill, 1996
4. Dubey, G.K., “Power Semi-conductor Controlled Drives”, Prentice Hall, 1999.
5. Arrillaga, J., “High Voltage D.C.Transmission”, Peter Peregrinus Ltd, 1996

| EENP-401A | Industrial Electrical System | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time(Hrs)** |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| **Program Objective (PO)** | To provide knowledge about various concepts of industrial electrical systems and their automation | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **After completion of course students will be able to** | | | | | | | |
| **CO1** | Understand residential and commercial electrical systems | | | | | | |
| **CO2** | Understand various types of illumination systems and lighting schemes used for a residential and commercial premises | | | | | | |
| **CO3** | Understand various concepts of industrial electrical systems | | | | | | |
| **CO4** | Understand the concept related to industrial electrical system automation | | | | | | |

## UNIT- I

**Residential and Commercial Electrical Systems:** Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components

## UNIT- II

**Illumination Systems:** Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting

## UNIT- III

**Industrial Electrical Systems I :** HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

## UNIT IV

**Industrial Electrical Systems II:** DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks

**Industrial Electrical System Automation:** Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation

**Text Books/References**:

1. S. L. Uppal and G. C. Garg, "Electrical Wiring, Estimating &Costing", Khanna publishers, 2008.

2. K. B. Raina, "Electrical Design, Estimating & Costing", New age International, 2007.

3. S. Singh and R. D. Singh, "Electrical estimating and costing", Dhanpat Rai and Co., 1997. Web site for IS Standards.

4. H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008

| EENP-403A | Digital Control System | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | To enable students to design and analyze discrete time (digital) control system | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Represent discrete time systems under the form of z-domain transfer functions and state-space models. Also able to obtain the model of discrete-time systems by pulse transfer function | | | | | | |
| CO2 | Analyze stability, transient response and steady state behaviour of linear discrete time systems, analytically and numerically using tools such as MATLAB and Simulink | | | | | | |
| CO3 | Design sampled data control systems. | | | | | | |
| CO4 | Describe Discrete state space model and test controllability and observability of systems | | | | | | |

### UNIT- I

**Introduction to digital control**: Introduction, Discrete time system representation, Mathematical modelling of sampling process, Data reconstruction.

**Modelling discrete-time systems by pulse transfer function**

Revisiting Z-transform, Mapping of s-plane to z-plane, Pulse transfer function, Pulse transfer function of closed loop system, Sampled signal flow graph

### UNIT- II

**Stability analysis of discrete time systems**: Jury stability test, Stability analysis using bi-linear transformation, Time response of discrete systems, Transient and steady state responses, Time response parameters of a prototype second order system.

### UNIT- III

**Design of sampled data control systems:** Root locus method, Controller design using root locus, Root locus-based controller design using MATLAB, Nyquist stability criteria, bode plot, Lead compensator design using Bode plot, Lag compensator design using Bode plot, Lag-lead compensator design in frequency domain.

### UNIT IV

**Discrete state space model:** Introduction to state variable model, Various canonical forms, Characteristic equation, state transition matrix, Solution to discrete state equation. Controllability, observability and stability of discrete state space models: Controllability and observability, Stability, Lyapunov stability theorem.

**Text Books/References**:


1. B. C.Kuo, Digital Control Systems, Oxford University Press, 2nd Edition, Indian Edition, 2007.
2. K. Ogata, Discrete Time Control Systems,Prentice Hall, 2ne Edition, 1995.
3. M. Gopal, Digital Control and State Variable Methods, McGraw Hill, 2/e, 2003.
4. G. F. Franklin, J. D.Powell and M. L. Workman, Digital Control of Dynamic Systems, Addison Wesley, 1998, Pearson Education, 3rd Edition.
5. K. J.Astroms and B. Wittenmark, Computer Controlled Systems - Theory and Design, Prentice Hall, 3rd Edition, 1997.

| EENP-405A | High Voltage Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time(Hrs)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Program Objective (PO)** | To enable students to understand important concepts of high voltage engineering | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **After completion of course students will be able to** | | | | | | | |
| **CO1** | Understand the concept of electrostatic field and effect of high electrostatic field over Gases, Liquid and solid dielectric | | | | | | |
| **CO2** | Understand the concept of generation of high voltages and currents in the system | | | | | | |
| **CO3** | Measure high voltages and currents in the system | | | | | | |
| **CO4** | Perform Non-destructive and high voltage testing on various components of power system | | | | | | |

### .UNIT I

**Electrostatic Field and Field Stress Control:** Electric field stresses, Numerical methods for Electric field computation, Finite Element Method, Charge simulation method.

**Conduction and Break Down in Gases:** Ionization processes, Townsend's criterion, breakdown in electronegative gases, time lags for breakdown, streamer theory, Paschen's law, break down in non-uniform field, and corona discharge

**Break Down in Liquid Dielectrics:** Conduction and breakdown in pure liquid and commercial liquid.

**Break Down in Solid Dielectrics:** Intrinsic breakdown, electromechanical breakdown breakdown of solid, dielectric and composite dielectrics.

### UNIT II

**Generation of High Voltages and Currents:** Generation of high direct current voltages, generation of high alternating voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators..

### UNIT III

**Measurement of High Voltages and Currents:** Measurement of high direct current voltages, measurement of high alternating and impulse Voltages measurement of high direct, alternating and impulse currents, Cathode Ray Oscillographs for impulse voltage and current measurements.

**Insulation Coordination in Electric Power Systems:** Principle of Isolation Coordination in High-Voltage & Extra-High Voltage Power System.

### UNIT IV

**Non-Destructive Testing:** Measurement of direct current resistively, measurement of dielectric constant and loss factor, partial discharge measurements

**High Voltage Testing:** Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, testing of transformers, testing of surge arresters, radio interference measurements.

**Text Books/References** :


1. M. S. Naidu and V. Kamaraju, "High Voltage Engineering, Tata Mc-Graw Hill.
2. C. L. Wadhwa, "High Voltage Engineering", Wiley Eastern Ltd.
3. E. Kuffel and W. S. Zacngal, High Voltage Engineering", Pergamon Press.
4. M. P. Chaurasia , "High Voltage Engineering", Khanna Publishers
5. R. S. Jha, "High Voltage Engineering", DhanpatRai& sons
6. M. Khalifa,' High Voltage Engineering Theory and Practice,' Marcel Dekker.
7. Subir Ray,' An Introduction to High Voltage Engineering' Prentice Hall of India

| EEO-401A | UTILAZTION OF ELECTRICAL ENERGY | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | To make students aware about the fundamentals and various techniques used in Utiization of Electrical Energy | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Understand the different terms of illumination and various lamps | | | | | | |
| CO2 | Analyze the different methods of Electrical heating and electrical welding | | | | | | |
| CO3 | Understand the laws of Electrolysis. | | | | | | |
| CO4 | Understand the basics of traction motors. | | | | | | |

## UNIT 1

**Illumination:** Term used in illumination, Laws of illumination, sources of Light, arc lamp incandescent lamp, discharge lamp, sodium vapour, mercury vapour lamp, fluorescent tubes, lightening schemes, method of lightning calculation.

## UNIT II

**Electrical Heating:** Advantages of Electrical Heating, various types of Electrical heating, Power frequency and High frequency heating, Degree of heating element, Equivalent circuit of arc furnace, Resistance heating, Arc heating, Induction heating, dielectric heating etc.

**Electric Welding:** All types of electrical welding, resistance welding, arc welding, electrical winding equipment, Comparison between AC & DC welding, types of electrodes, advantages of coated electrodes.

## UNIT III

**Electroplating:** Basic principle, faraday's law of electrostatics, terms used, Application of electrolysis, factors governing electro deposition, power supply.

**Refrigeration & Air Conditioning:** Basic principle, various compression cycle & system its application, electric circuit of refrigerator, air conditioner.

## UNIT IV

**Traction Motors :** Different system of electric traction, comparison between AC & DC system, block diagram of traction system ,Starting-Speed control and braking- Speed control and braking –Speed time curves,-Mechanics of Train movement-Tractive effort for acceleration – Power and energy output from driving axles -Specific energy output and consumption-Train resistance.

**Suggested Books:**

1. Dr.S.L.Uppal, Electrical Power ,Khanna Publishers, New Delhi,1980.
2. M.L.Soni,P.V.Gupta,U.S.Bhatnagar,A.Chakrabarti,A Text Book On Power System Engineering, Dhanpat Rai & Co,New Delhi1997-98
3. H.Pratap, Art and Science of Utilization of Electric Energy, Dhanpat Rai & Sons, New Delhi,1980.
5. G.C.Garg, Utilization of Electric Power and Electric Traction, Khanna publishers, New Delhi,1995.

| EEO-415A | Transducer & Their Applications | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | To make students aware about the fundamentals of transducers and their applications. | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Understand the different types of transducers | | | | | | |
| CO2 | Analyze the different methods of measurements of displacement | | | | | | |
| CO3 | Understand the different methods of measurements of pressure | | | | | | |
| CO4 | Understand the basics concepts of measurements of temperature | | | | | | |

### UNIT - I

Definition of transducer. Advantages of an electrical signal as out-put. Basic requirements of transducers, Primary and Secondary Transducer, Analog or digital types of transducers. Resistive, inductive, capacitive, piezoelectric, photoelectric and Hall effect transducers.

### UNIT-II

Measurement of Displacement - Potentiometric resistance type transducers, inductive type transducers, differential transformer (L.V.D.T), capacitive transducers, Hall effect devices, strain gage transducers. Measurement of Velocity - variable reluctance pick up, electromagnetic tachometers, photoelectric tachometer, toothed rotor tachometer generator.

Measurement of Flow: Venturi meter, orifice meter, nozzle meter, Pitot-static tube, rotameter, turbine flow meter, ultrasonic flow meter, electromagnetic flow meter, hot wire anemometer.

### UNIT - III

Measurement of Pressure - Manometers, Force summing devices and electrical transducers Measurement of Force - Strain-gage load cells, pneumatic load cell, L VDT type force transducer.

Measurement of Torque - Torque meter, torsion meter, absorption dynamometers, inductive torque transducer, digital methods

### UNIT - IV

Measurement of Temperature - Metallic resistance thermometers, semi conductor resistance sensors (Thermistors), thermo-electric sensors, pyrometers.

Measurement of Liquid Level: Resistive Method, Inductive method, capacitive method Sound Measurement: Microphone, Types of Microphones.

Measurement of Humidity: Resistive, capacitive, aluminium oxide & crystal hygrometers.

**Suggested Books:**


1. B.C. Nakra, K.K. Chaudhry, "Instrumentation Measurement and Analysis," . Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Thomas G. Beckwith etc. all, "Mechanical Measurements (International Student Edition), Addison-Wesley Longman, Inc. England.
3. A.K. Sawhney, " A Course in Electrical and Electronic Measurements and Instrumentation," Dhanpat Rai & Sons, Delhi-6.

| EEO-419A | BIOMEDICAL INSTRUMENTATION | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | To make students aware about the fundamentals and various technique used in biomedical instrumentation. | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Understand the basic concepts of bio potential. | | | | | | |
| CO2 | Analyze the different types of meters. | | | | | | |
| CO3 | Understand the different medical imaging technique. | | | | | | |
| CO4 | Understand the basics concepts of Electrode-electrolyte interface | | | | | | |

**Unit 1**

Cell resting potential and action potentials - Origin of bio potentials - characteristics – Frequency and amplitude ranges - ECG – Einthoven's triangle – 3 lead ECG system - EEG – 10- 20 electrode system - Origin and characteristics of EMG – EOG - ERG electrodes and transducers.

**Unit 2**

Diagnostic and Therapeutic Equipments: Blood pressure monitors – Electro-cardio scope - Pulse Oximeter - pH meter - Auto analyzer – Pacemakers – Defibrillator - Heart lung machine - Nerve and muscle stimulators - Dialysis machines - Surgical diathermy equipments – Nebulizer; inhalator - Aspirator – Humidifier - Ventilator and spirometry.

**Unit 3**

Medical imaging techniques: Basics of diagnostic radiology – Production - Nature and properties of X rays - X-ray machine - Block diagram - Digital radiography – CT - Basic Principle - Block diagram – Radioisotopes in medical diagnosis – Physics of radioactivity – Gamma Camera. Block diagram – SPECT Scanner – PET Scanner - Principles of NMR Imaging systems - Block diagram of NMR Imaging System .

**Unit 4**

Electrode-electrolyte interface – Electrode – skin interface - Half cell potential – Impedance - Polarization effects of electrode – Non-polarizable electrodes. Types of electrodes - Surface; needle and micro electrodes – ECG – EMG - EEG Electrodes. Physics of Ultrasound waves – Doppler effect – Medical Ultrasound Electrical safety: Physiological effects of electricity.

TEXT BOOKS:-

1. John G Webster, "Medical Instrumentation - Application and Design", 4th ed., John Wiley and Sons, 2007.
2. Leslie Cromwell, Fred. J. Weibell, Erich. A. Pfeiffer, "Biomedical Instrumentation & Measurements, 2nd ed., Pearson Education., 2001.
3. R S Khandpur, "Handbook of Biomedical Instrumentation", 1st ed., Tata McGraw Hill Publishing Company Limited, 2004.

| EEO-421A | Fluid Machinery | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time(Hrs)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Program Objective (PO)** | To make students aware about the fundamentals and various pumps and machinery used in hydraulic system. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **After completion of course students will be able to** | | | | | | | |
| **CO1** | Discuss the characteristics of centrifugal pump and reciprocating pumps. | | | | | | |
| **CO2** | Calculate forces and work done by a jet on fixed or moving plate and curved plates. | | | | | | |
| **CO3** | Know the working of turbines and select the type of turbine for an application | | | | | | |
| **CO4** | Do the analysis of air compressors and select the suitable one for a specific application | | | | | | |

UNIT-1

Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat and curve),– Series of vanes - work done and efficiency Hydraulic Turbines : Impulse and Reaction Turbines – Degree of reaction – Pelton Wheel – Constructional features - Velocity triangles – Euler's equation – Speed ratio, jet ratio and work done , losses and efficiencies, design of Pelton wheel – Inward and outward flow reaction turbines- Francis Turbine – Constructional features – Velocity triangles, work done and efficiencies.

UNIT-2

Axial flow turbine (Kaplan) Constructional features – Velocity triangles- work done and efficiencies – Characteristic curves of turbines – theory of draft tubes – surge tanks – Cavitation in turbines – Governing of turbines – Specific speed of turbine , Type Number– Characteristic curves, scale Laws – Unit speed – Unit discharge and unit power.

UNIT-3

Rotary motion of liquids – free, forced and spiral vortex flows Rotodynamic pumps- centrifugal pump impeller types,-velocity triangles-manometric head- work, efficiency and losses, H-Q characteristic, typical flow system characteristics, operating point of a pump. Cavitation in centrifugal pumps- NPSH required and availableType number-Pumps in series and parallel operations.

UNIT-4

Positive displacement pumps- reciprocating pump – Single acting and double acting- slip, negative slip and work required and efficiencyindicator diagram- acceleration head - effect of acceleration and friction on indicator diagram – speed calculation- Air vessels and their purposes, saving in work done to air vessels multi cylinder pumps.

**Text Books**: 1. Som, Introduction to Fluid Mechanics and Fluid Machines ,McGraw Hill Education India 2011
2. Bansal R. K., A Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications,2005.
3. Cengel Y. A. and J. M. Cimbala, Fluid Mechanics, Tata McGraw Hill, 2013
4. Yahya S. M, Fans, Blower and Compressor, Tata McGraw Hill, 2005.

| EEP-402A | Electrical & Hybrid Vehicles | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time(Hrs)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Program Objective (PO)** | To provide knowledge of Electrical and hybrid vehicles to the students. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **After completion of course students will be able to** | | | | | | | |
| **CO1** | To learn about Electrical and Hybrid Vehicles. | | | | | | |
| **CO2** | Understand about types of machinery used in Electric propulsion unit | | | | | | |
| **CO3** | Understand about various methods of energy storage in Electric and hybrid vehicles | | | | | | |
| **CO4** | Learn about sizing methodology of drive system and energy management strategies used in electric and hybrid vehicles | | | | | | |

**UNIT 1**

**Introduction to Hybrid Electric Vehicles:** History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles.

**Hybrid Electric Drive-trains:** Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

**Electric Drive-trains:** Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

**UNIT 2**

**Electric Propulsion unit:** Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

**UNIT 3**

**Energy Storage:** Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

**UNIT 4**

**Sizing the drive system:** Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems.

**Energy Management Strategies:** Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

**Text / Reference Books:**

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003
3. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004

| EENP-402A | Power Quality and FACTS | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time(Hrs)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Program Objective (PO)** | To enable students to understand the Power Quality related issues, their solutions and details of FACTS devices. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **After completion of course students will be able to** | | | | | | | |
| **CO1** | Understand the characteristics of ac transmission and the effect of shunt and series reactive compensation. | | | | | | |
| **CO2** | Understand the working principles of FACTS devices and their operating Characteristics. | | | | | | |
| **CO3** | Understand the basic concepts of power quality. | | | | | | |
| **CO4** | Understand the working principles of devices to improve power quality. | | | | | | |

**UNIT 1**

**Power Quality Problems & Monitoring:** Overview and Definitions of power quality, sources of pollution, international power quality standards, and regulations.

**UNIT 2**

**Power Quality Problems :** Surges, voltage sag and swell, over voltage under voltage, outage voltage, and phase angle imbalance, electric noise, harmonics, frequency deviation monitoring,

**UNIT 3**

**Power System Harmonics**: Harmonic analysis, harmonic sources – the static converters, transformer magnetization and non-linear machines, are furnaces, fluorescent lighting. Harmonic effect within the power system, interference with communication harmonic measurements, Harmonic Mitigation Techniques

**UNIT 4**

**FACT Systems:** Introduction – Terms & definition, Fact Controllers, Type of FACT devices i.e. SSC, SVC, TSC, SSS, TCSC, UPFC, Basic relationship for power flow control.

**Introduction to Custom Power Devices**-Network Reconfiguration devices; Load compensation and voltage regulation using DSTATCOM; protecting sensitive loads using DVR; Unified power Quality Conditioner. (UPQC), uninterruptible power suppliers

**Text/References**

1. N. G. Hingorani and L. Gyugyi, “Understanding FACTS: Concepts and Technology of FACTS Systems”, Wiley-IEEE Press, 1999.
2. K. R. Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age International (P) Ltd. 2007.
3. T. J. E. Miller, “Reactive Power Control in Electric Systems”, John Wiley and Sons, New York, 1983.
4. R. C. Dugan, “Electrical Power Systems Quality”, McGraw Hill Education, 2012.

| EENP-404A | Control System Design | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | The course is useful for the students to get an idea of ideal practices in the field of control systems design. Students will get in touch with recent trends in the field of modern control engineering. Here importance of designing the control systems is emphasized. | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Define fundamental control system design specifications and basic principles of controller design | | | | | | |
| CO2 | Design modern controllers based on the state space techniques and recognize the importance of observability and controllability for system design. | | | | | | |
| CO3 | Understand concept of optimal control and robust control techniques. | | | | | | |
| CO4 | Understand concept of Lyapunov's stability Criteria and optimal control | | | | | | |

## UNIT 1

**Design of Feedback Control Systems :** Introduction, Approaches to System Design, Cascade Compensation Networks, Phase-Lead Design Using the Bode Diagram, Phase-Lead Design Using the Root Locus, System Design Using Integration Networks, Phase-Lag Design Using the Root Locus, Phase-Lag Design Using the Bode Diagram, Design on the Bode Diagram Using Analytical Methods, Systems with a Pre-filter, Design for Deadbeat Response; Design Examples.

## UNIT 2

**Design of State Variable Feedback Systems:** Introduction, State space representation of physical systems, State space models of some common systems like R-L-C networks, DC motor, inverted pendulum etc., Controllable Canonical Form, Observable Canonical Form, Diagonal Canonical Form, State transition matrix, Solution of state equations, Controllability and Observability, Full-State Feedback Control Design; Observer Design; Integrated Full-State Feedback and Observer; Tracking Reference Inputs; Internal Model Design; Design Examples

## UNIT 3

**Introduction to Robust Control and optimal control :** Robust control system and system sensitivities to parameter perturbations, analysis of robustness, systems with uncertain parameters, considerations in design of robust control system, robust PID controller.

## UNIT 4

**Lyapunov's stability and optimal control:** Positive/negative definite, positive/negative semi-definite functions, Lyapunav stability criteria, introduction to optimal control, Riccatti Equation, Linear Quadratic Regulator, Design Examples.

**Text books / References:**

1. Modern Control Engineering by K. Ogata, PHI.
2. Discrete Time Control Systems by K. Ogata, PHI.
3. Automatic Control Systems by B C Kuo, PHI.
4. Control Systems, Principles and Design by M. Gopal, MC Graw Hill, 2012.

| EEP-408A | Wind and Solar Energy | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time(Hrs)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Program Objective (PO)** | The main objective of the course is to impart the students with the detailed knowledge of working of solar and wind power plants. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **After completion of course students will be able to** | | | | | | | |
| **CO1** | Understand the current energy scenario across the country and the world .Students will also be able to get knowledge about various types of energy resources available. | | | | | | |
| **CO2** | Get knowledge about various types of Solar energy systems. | | | | | | |
| **CO3** | Understand the concepts related to wind energy generation. | | | | | | |
| **CO4** | Design hybrid energy systems. | | | | | | |

**UNIT 1**

**Introduction:** Energy demand of world and country and gap analysis, Fossil fuel based systems, Impact of fossil fuel based systems, Non conventional energy – seasonal variations and availability, Renewable energy – sources and features, Hybrid energy systems. Distributed energy systems and dispersed generation (DG).

**UNIT 2**

**Solar thermal systems:** Solar radiation spectrum, Radiation measurement, Technologies, Applications, Heating, Cooling, Drying, Distillation, Power generation; Costing: Life cycle costing (LCC), Solar thermal system.

**Solar Photovoltaic systems** : Operating principle, Photovoltaic cell concepts ,Cell, module, array, Series and parallel connections, Maximum power point tracking, Applications ,Battery charging, Pumping , Lighting,Peltier cooling , Costing: Life cycle costing ,Solar PV system

**UNIT 3**

**Wind Energy:** Wind power and its sources, Wind patterns and wind data, Site selection, criterion, momentum theory, Types of wind mills, Characteristics of wind generators, performance and limitations of energy conversion systems, Load matching, Life cycle costing - Wind system LCC

**UNIT4**

**Hybrid Energy Systems**: Need for Hybrid Systems, Range and type of Hybrid systems, Case studies of Diesel-PV, Wind-PV, Microhydel-PV, electric and hybrid electric vehicles.

**Text Books / References:**

1. Ashok V Desai, Non-Conventional Energy, Wiley Eastern Ltd, New Delhi
2. Mittal K M, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, New Delhi
3. Ramesh R & Kumar K U, Renewable Energy Technologies, Narosa Publishing House, New Delhi
4. Wakil MM, Power Plant Technology, Mc Graw Hill Book Co, New Delhi

| EEO-410A | Power Plant Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | To enable students to understand the power plant engineering. | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | To provide an overview of power plants and the associated | | | | | | |
| CO2 | Understand the energy conversion issues | | | | | | |
| CO3 | Understand the principles of operation for different power plants | | | | | | |
| CO4 | Understand the principles power plant economics. | | | | | | |

**Unit-1**

Coal based thermal power plants, basic Rankine cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, turbines, condensers, steam and heating rates, subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment.

**Unit-2**

Gas turbine and combined cycle power plants, Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants.

**Unit-3**

Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants.

**Unit-4**

Hydroelectric power plants, classification, typical layout and components, principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems.

**Text Books:**

1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.
2. El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.
3. Elliot T.C., Chen K and Swane kamp R.C., Power Plant Engineering, 2nd ed., McGraw Hill, 1998.

| EEO-412A | PLC and Their Application | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| Program Objective (PO) | To enable students to understand the power plant engineering. | | | | | | |
| Course Outcomes (CO) | | | | | | | |
| After completion of course students will be able to | | | | | | | |
| CO1 | Understand the Programmable Logic Controllers | | | | | | |
| CO2 | Explore the basic functions of PLC Programming | | | | | | |
| CO3 | Recognize the intermediate functions of PLC | | | | | | |
| CO4 | Identify the various advanced functions in PC Programming | | | | | | |

**Paper Setter Note:** 8questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections

UNIT 1

Introduction to PLC:- Definition: Evolution, Advantages/Disadvantages: system description; Internal operation of CPU and I/C modules, installation & testing.

Programs & Software:- General programming procedures, registers and Addresses, Relation of Digital Gate Logic to contact logic.

UNIT 2

Basic PC Functions:- Programming, On-Off inputs to produce on – off outputs: Timers, Counters: Auxiliary Commands &functions.

UNIT 3

Intermediate Functions:- Arithmetic functions, Number Comparison functions, The skip & master control relay functions, Data move systems.

Functions involving individual register bits:- Utilizing digital bits, the sequences functions, Matrix functions.

UNIT 4

Advanced Functions:- Controlling a robot with a PC; Analog PC operator , Immediate update, select continuously, ascending sort, transmit print, FIFO, LIFO,& Loop Control.

**Suggested Books:**


1. Webb: Programmable Controllers: Principles & Applications, Merril Publishing Co.Columbus, Ohio, 1988.
2. Simpson: Programmable Logic Controllers, Prentice Hall, Englewood Cliffs, 1994.
3. T.A.Hughes, Programmable Controllers, 3rd Edition, ISA Press.
4. Gary Danning, Introduction to Programmable Logic Controllers, Delmar Thomson Learning
5. Bela.G.Liptak, Instrument Engineer's Handbook, Vol:II-Process Control, 3rd Edition, ISA Press, 1995

| EENO-406A | Embedded System | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| **Program Objective (PO)** | To introduce the students to concepts of embedded systems. To offer them a level of confidence in microcontroller based system design. To introduce them to the concepts of ARM architectures and RTOS. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **After completion of course students will be able to** | | | | | | | |
| CO1 | Understand various concepts of embedded system | | | | | | |
| CO2 | Learn about 8051 Microcontroller | | | | | | |
| CO3 | Understand the operating system of Embedded system and also learn about higher embedded system | | | | | | |
| CO4 | Learn about communication basics and interfacing of various devices to the microcontroller | | | | | | |

### *UNIT 1*

**Introduction to embedded system:** Embedded System, Embedded versus external memory devices, CISC and RISC processors, Harvard and Von Neumann Architecture, Application of Embedded System, Embedded operating system, Design Parameters of embedded and its Significance, Design life cycle, Hardware fundamentals, Digital circuit parameter, O.C and Tristate outputs, I/O sink and Source, Custom single purpose processor Optimization, FSMD, data path & FSM , General purpose Processor and ASIP'S

### UNIT 2

**8051 Microcontrollers:** 8051 microcontrollers-Assembly language, Architecture of 8051, Registers, Addressing Modes, Instruction Set, I/O ports, memory organization, Programs showing use of I/O Pins, Interrupts, Interrupt Programming, Timer and counters, Serial Communication, Programming of serial communication.

### UNIT 3

**Introduction to operating system and basics of higher embedded system:** Introduction to RTOS, Tasks, Data, Semaphores and shared data, Operating system services, Message queues, Mailboxes, Advanced processor (Only architecture), 80386, 80486, Introduction to ARM, features, architecture, instruction set

### UNIT 4

**Communication basics and interfacing of various devices the microcontroller:** Microprocessor interfacing I/O addressing, direct memory access (DMA), Arbitration, multilevel bus architecture, serial protocol, parallel protocols and wireless protocol, Real world interfacing: LCD, Stepping motor, ADC, DAC, LED, Pushbuttons, Keyboard, Latch connection, PPI

**Text / Reference Books:**


1. Embedded system Design-Frank Vahid/ Tony Givargis. John Willey
2. Microcontroller (Theory and applications) Ajay V Deshmukh, Tata , McGraw-Hill
3. An Embedded Software Primer-David E.Simon, Pearson Education
4. The 8051 Microcontroller and embedded systems-Muhammad Ali Mazidi and Janice Gillispie.
5. Microcontrollers (Architecture, Implementation & Programming) Kenneth Hinz, Daniel Tabak, Tata McGraw-Hill
6. 8051 Microcontrollers & Embedded Systems 2nd edition Sampath Kr. Katson books

| EENO-412A | Automobile Engineering | | | | | | |
|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Credit | Major Test | Minor Test | Total | Time(Hrs) |
| 3 | 0 | 0 | 3 | 75 | 25 | 100 | 3 |
| **Program Objective (PO)** | To make aware the students with the study of engineering which teaches manufacturing and mechanical-mechanisms as well operations of automobiles. It is an introduction to vehicle engineering which deals with motorcycles, cars, buses trucks etc. It includes branch study of mechanical, electronic, and safety elements. Some of the engineering attributes and disciplines that are of importance to the automotive engineer. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **After completion of course students will be able to** | | | | | | | |
| **CO1** | Students will be able to Develop a strong base for understanding future developments in the automobile industry | | | | | | |
| **CO2** | Students will be able to Explain the working of various parts like engine, transmission, gear box etc. | | | | | | |
| **CO3** | Students will be able to Describe how the brakes and the suspension systems operate | | | | | | |
| **CO4** | Students will be able to Understand the steering geometry and emission control system. | | | | | | |

## UNIT I

**Introduction:** Brief history of automobiles, Main components of an automobile, Brief description of each component. Brief description of constructional details and working of a four stroke I.C. Engine (S.I. Engines and C.I. Engines) including lately developed overhead cam shaft, Multi-cylinder engines, Introduction to recent developments in I.C. Engines- Direct injection systems, Multi-point fuel injection systems, Introduction, Brief description of different components of Transmission System.

**Clutch**: Introduction to Clutch and its different types, Principle of Friction Clutch, Clutch Lining and friction materials used in Friction Clutches, Torque transmitted, Brief description of Cone Clutch, Single Plate and Multiplate Clutches, Dry and wet clutches, Automatic clutch action, Centrifugal clutches, Electromagnetic clutches, Fluid Flywheel.

## UNIT II

**Gear Box:** Gear Box Air resistance, gradient resistance and rolling resistance coming across a moving automobile, Tractive effort, Variation of tractive effort with speed, Performance curves (object and need of a gear box), Sliding mesh gear box, Control mechanism, Sliding type selector mechanism, Ball type selector mechanism, Steering column gear shift control, Constant mesh gear box, Synchromesh device, Automatic transmission in general, AP automatic gear box, Torque converter, Torque converter with direct drive, Lubrication of Gear Box.

**Propeller Shaft:** Functions and requirements of a propeller shaft, Universal joints, Constructional forms of universal joints, Flexible-ring joints, Rubber-bushed flexible joints. Constant-velocity joints. Differential : Principle of operation, Constructional details of a typical Differential unit, Traction control differentials, Multi-plate clutch type traction control device.

## UNIT III

**Brakes:** Functions and methods of operation, Brake efficiency. Elementary theory of shoe brake, brake shoe adjustments, A modern rear-wheel brake, Disc brakes, Brake linkages, Leverage and adjustment of the brake linkage, Servo- and power operated brakes, Vacuum brake operation,' Hydraulic Brakes-constructional details and working, Direct action vacuum servos, Power-operated brakes, A dual power air brake system,

**Suspension system**: Suspension principles, Road irregularities and human susceptibility, Suspension system, Damping, Double tube damper, Single tube damper, Lever arm type damper, Springs-Leaf springs, Coil and torsion springs, variable rate springs, Composite leaf springs, Rubber springs, Air springs, Adjustable and self-adjusting suspensions, Interconnected suspension system, Interconnected air and liquid suspensions, Independent suspension system, Different independent suspension layouts, McPherson strut type, Rear suspension-live axle, McPherson strut rear suspension.

## UNIT IV

**Steering Geometry**: Castor, Camber, Kingpin inclination, Combined angle, Toe-in, Steering system-basic aims, Ackerman linkage, Steering linkages for independent suspension, Center point steering, Costarring or trailing action, Cornering power, Self-righting torque, Steering characteristics-over steer and under steer, Axle beam, Stub-axle construction, Steering column, Reversible and irreversible steering, Rack-and-pinion steering mechanism, Effect of toe-in on steering, Power steering, Vickers System. Recent trends in automobile engineering Multi fuel automobiles, Automobiles running on alternate sources of energy, Emission control through catalytic converter, Double catalytic converter, Aspects of pollution control in Automobiles.

**Reference and Text Books:**

1. The Motor Vehicle - By Newton, Steeds and Garretle Basic
2. Automobile Engineering - By Kirpal Singh
3. Automobile Engineering *' -By K.M. Gupta, Umesh Publications

| EEO-418A | Biomedical Signal & Image Processing | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time(Hrs)** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3** |
| **Program Objective (PO)** | To make students aware about the fundamentals and various techniques of biomedical image processing and to develop the algorithms for image analysis and diagnosis in medical imaging | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **After completion of course students will be able to** | | | | | | | |
| **CO1** | To understand image fundamentals and acquisition techniques | | | | | | |
| **CO2** | To learn Image Enhancement in Spatial and Frequency domain | | | | | | |
| **CO3** | To learn Morphological Image Processing and Image Segmentation. | | | | | | |
| **CO4** | To learn image compression and representation. | | | | | | |

## UNIT-I

Fundamentals of Digital Image: Image formation, visual perception, CCD & CMOS Image sensor, Image sampling: Two dimensional Sampling theory, Nonrectangular grid and Hexagonal sampling, optimal sampling, Image quantization, Non uniform Quantization, Image formats. Types of pixel Operations, Types of neighborhoods, adjacency, connectivity, boundaries, regions, 2D- convolution, Color models.

## UNIT-II

Image Enhancement in Spatial and Frequency domain: Basic gray level transformations, histogram processing, Smoothing operations, Edge Detection-derivative based operation, filtering in frequency domain, 2D-DFT, Smoothing frequency domain filters, Sharpening frequency domain filters, Homomorphic filtering.

## UNIT-III

Morphological Image Processing: Dilation and Erosion, Opening and Closing, Hit-or-Miss transformation, Boundary Extraction, Region filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening, Skeletons, Pruning.

Image Segmentation: Detection of discontinuities, Point-line- edge detection, Linear and Circular Hough Transform, Basic Global and Adaptive Thresholding, Region Based segmentation, K-Means Clustering

## UNIT-IV

Image Compression: Fundamentals of Image compression models, Lossless compression: variable length coding, LZW coding, Arithmetic coding, Lossy compression: Wavelet and DCT coding, Predictive coding.

Representation and Description: Image features, Feature extraction, Chain code, Moments

Text Books:

1. Digital Image Processing, Gonzalez and Woods- Pearson Education
2. Digital Image Processing, S. Sridhar – Oxford University Press.
3. Fundamentals of Digital Image Processing, A.K. Jain .P.H.I.
4. Digital Image Processing, William Pratt- John Wiley.
5. Feature Extraction and Image Processing, Mark S. Nixon and Alberto S. Aguado.
6. Digital Image Processing and Analysis, Chanda Majumder- Printice Hall India.
7. Medical image processing, Geoff Dougherty editor, springer.

| Bachelor of Technology (Information Technology ) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Credit-Based Scheme of Studies/Examination(Modified)** | | | | | | | | | | |
| **Semester IV (w.e.f. session 2021-2022 )** | | | | | | | | | | |
| **S. No.** | **Course Code** | **Subject** | **L:T:P** | **Hours/Week** | **Credits** | **Examination Schedule (Marks)** | | | | **Duration of Exam (Hrs)** |
| | | | | | | **Major Test** | **Minor Test** | **Practical** | **Total** | |
| 1 | ES-IT-202A | Basics of Communication | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | PC-IT-204A | Discrete Mathematics | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 3 | PC-IT-206A | Operating System | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 4 | PC-IT-208A | Microprocessor Interfacing and Application | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 5 | PC-IT-210A | Database Management Systems | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 6 | HTM-901A | Universal Human Values II : Understanding Harmony | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 7 | PC-IT-212LA | Microprocessor Interfacing and Application Lab | 0:0:3 | 3 | 1.5 | 0 | 40 | 60 | 100 | 3 |
| 8 | PC-IT-214LA | Operating Systems Lab | 0:0:3 | 3 | 1.5 | 0 | 40 | 60 | 100 | 3 |
| 9 | PC-IT-216LA | Database Management Systems Lab | 0:0:3 | 3 | 1.5 | 0 | 40 | 60 | 100 | 3 |
| **Total** | | | | **27** | **22.5** | **450** | **270** | **180** | **900** | |
| 10 | MC-901A* | Environmental Sciences | 3:0:0 | 3 | 0 | 75 | 25 | 0 | 100 | 3 |

***MC-901A** is a mandatory credit less course in which the student will be required to get passing marks in the major test.
**Note: Students be encouraged to go to 6-8 weeks summer internships mandatory during the summer break after the completion of fourth semester exams.**

| HTM-901A | Universal Human Values II: Understanding Harmony | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3.0** | **75** | **25** | **100** | **3 Hours** |
| **Purpose** | Purpose and motivation for the course, recapitulation from Universal Human Values-I | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO 1** | Development of a holistic perspective based on self-exploration about themselves (human being),family, society and nature/existence. | | | | | | |
| **CO 2** | Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence. | | | | | | |
| **CO 3** | Strengthening of self-reflection. | | | | | | |
| **CO 4** | Development of commitment and courage to act. | | | | | | |

**Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' andExperiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment ofaspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at variouslevels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrarinessin choice based on liking-disliking

**Module 2: Understanding Harmony in the Human Being - Harmony in Myself!**

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

**Module 3: Understanding Harmony in the Family and Society- Harmony in**

**Human-HumanRelationship**

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as thefoundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the othersalient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- fromfamily to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value inrelationships. Discuss with scenarios. Elicit examples from students' lives

**Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" canbe used), pollution, depletion of resources and role of technology etc.

**Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics**

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and

organizations

28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. todiscuss the conduct as an engineer or scientist etc.

**READINGS:**

**Text Book**


1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010


**Reference Books**


1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J CKumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)


**MODE OF CONDUCT**

Lecture hours are to be used for lecture/practice sessions.

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at handand motivating students to reflect, explore and verify them.

Practice hours are to be used for practice sessions.

While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elementsto help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions, the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration. Scenarios may be used to initiate discussion. The student is encouraged to take up" ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Practice experiments are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based onbasic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.

This course is to be taught by faculty from every teaching department, including HSS faculty. Teacher preparation with a minimum exposure to at least one 8-day FDP on Universal Human Values is deemed essential.

**ASSESSMENT:**

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.

Example:

Assessment by

faculty mentor: 5 marks

Self-assessment: 5 marks

Assessment by peers: 5 marks

Socially relevant project/Group Activities/Assignments: 10 marks

Semester End Examination: 75 marks

The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

| Bachelor of Technology (Information Technology ) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Credit-Based Scheme of Studies/Examination** | | | | | | | | | | |
| **Semester VII(w.e.f. session 2021-2022 )** | | | | | | | | | | |
| **S. No.** | **Course Code** | **Subject** | **L:T:P** | **Hours /Week** | **Credits** | **Examination Schedule (Marks)** | | | | **Duration of Exam (Hrs)** |
| | | | | | | **Major Test** | **Minor Test** | **Practical** | **Total** | |
| 1 | PE | Elective-IV | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | PE | Elective-V | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 3 | OE | Open Elective-II | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 4 | PROJ-IT-401A | Project-II | 0:0:12 | 12 | 6 | 0 | 40 | 60 | 100 | 3 |
| 5 | PE-IT-D415A | Server side programming Lab | 0:0:3 | 3 | 1.5 | 0 | 40 | 60 | 100 | 3 |
| 6 | PE-IT-D417A | Python Programming Lab | 0:0:3 | 3 | 1.5 | 0 | 40 | 60 | 100 | 3 |
| **Total** | | | | **27** | **18** | **225** | **195** | **180** | **600** | |
| 7 | SIM-401A* | Seminar on Summer Internship | 2:0:0 | 2 | 0 | 0 | 50 | 0 | 50 | |

| **PE Elective-IV** | **PE Elective-V** |
|---|---|
| Advanced Computer Networks: PE-IT-D401A | Software Testing: PE-IT-D407A |
| Parallel Computing: PE-IT-D403A | Software Project management:PE-IT-D409A |
| Complier Design: PE-IT-D405A | Distributed Operating System: PE-IT-D411A |
| **OE Elective-II** | Natural Language Processing: PE-IT-D413A |
| Cyber Law and Ethics: OE-IT-401A | |
| Signal and System: OE-IT-403A | |
| Neural Networks and Deep Learning: OE-IT-405A | |
| Digital Signal Processing: OE-IT-407A | |

**The course of both PE & OE will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.**

| PE-IT-D401A | Advanced Computer Networks | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credit** | **Major Test** | **MinorTest** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hr.** |
| **Purpose** | **To familiarize different protocols & applications of computer networks.** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | To study MAC protocols for High speed networks. | | | | | | |
| **CO 2** | To study IPv6 addressing schemes. | | | | | | |
| **CO 3** | To study wireless application protocol for communication. | | | | | | |
| **CO 4** | To study the concepts to manage networks. | | | | | | |

***UNIT – 1***

Introduction: Overview of computer networks, seven-layer architecture, TCP/IP suite of protocols, etc. MAC protocols for high-speed LANS, MANs, and wireless LANs. (For example, FDDI, DQDB, HIPPI, Gigabit Ethernet, Wireless Ethernet, etc.)

***UNIT-2***

Fast access technologies (For example, ADSL, Cable Modem, etc.).

Overview of IPv6, IPv6 & TCP/IP stack,IPv6 protocol architecture, IPv6 address basics, address notation, unicast address, multicast address , IPv6 headers, Routing table problem, static & automatic address configuration, neighbor discovery, stateless address auto configuration, Interoperation concepts ofIPv4/IPv6.

***UNIT-3***

Mobility in networks, Mobile IP. Security related issues in mobile IP. IP Multicasting. Multicast protocols, address assignments, session discovery, etc.

Network security at various layers. Secure-HTTP, SSL, ESP, Authentication header, Key, distribution protocols.Digital signatures, digital certificates.

***UNIT-4***

The Wireless Applications Protocols, applications environment, wireless application protocol client software, wireless application protocol gateways, implementing enterprise wireless application protocol strategy and Security Issues in Wireless LAN. Wireless network management, GPRS, and VOIP services.

Network Management: Introduction, LAN, SNMP, and CMIP. Issues in the management of large networks. Multicast: IGMP, PIM, DVMRP

***Text Books:***


1. W.R. Stevens. TCP/IP Illustrated, Volume 1: The protocols, Addison Wesley,1994.
2. G.R. Wright. TCP/IP Illustrated, Volume 2: The Implementation, Addison Wesley,1995.


***References Books:***


1. W.R. Stevens. TCP/IP Illustrated, Volume 3: TCP for Transactions, HTTP, NNTP, and the Unix Domain Protocols, Addison Wesley,1996.
2. R. Handel, M.N. Huber, and S. Schroeder. ATM Networks. Concepts, protocols, Applications, Addison Wesley,1998.
3. William Stalling, Wireless Communications and Networks. Prentice Hall2002.

| PE-IT-D403A | Parallel Computing | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **75** | **25** | **100** | **3Hr** |

| | |
|---|---|
| **Purpose** | **To enable students to compare various architectural taxonomies and design paradigms of parallel computers and computational models, parallelism approaches, performance metrics and techniques to parallelize and schedule loops and their programming constructs.** |
| | **Course Outcomes** |
| **CO 1** | Classify various synchronous and asynchronous paradigms of parallel computing as well as identify some of the taxonomies for architectural classification of parallel |
| **CO 2** | Compare various parallel computation models and approaches and describe different performance metrics in parallel computers. |
| **CO 3** | Distinguish shared memory and distributed memory multiprocessors and explain various parallel programming models and relative advantages and disadvantages of interconnection networks based on network parameters for reliable connections and achieving efficient speed. |
| **CO 4** | Examine various techniques of parallelizing loops and sequential programs and scheduling. |

**Unit-I**

Introduction: The state of computing, system attributes to performance, Paradigms of parallel computing: Synchronous – Vector/ Array, SIMD, systolic, Asynchronous- MIMD, reduction paradigm. Hardware Taxonomy: Flynn’s classification, Feng’s classification, handler’s classification. Software taxonomy: Kung’s taxonomy.

**Unit-II**

Abstract parallel computational models: combinational circuits, sorting network, PRAM models, VLSI complexity model, Interconnections RAMs, Parallelism approaches- data parallelism, control parallelism, Conditions of parallelism: Data, control and resource dependencies, Hardware and software parallelism. Performance metrics: Laws governing performance measurements, Metrics- speedups, efficiency, utilization, communication overheads, single/ multiple program performances.

**Unit-III**

Parallel processors: taxonomy and topology: shared memory multi processors, distributed memory multicomputer, static and dynamic interconnections. Parallel programming: shared memory programming, distributed memory programming, object oriented programming, data parallel programming, functional and data flow programming.

**Unit-IV**

Scheduling and parallelization: Loop parallelization and pipelining-Loop transformation theory, parallelization and wave fronting, tiling and localization, software pipelining, Scheduling parallel programs, program partitioning and scheduling: Grain size, latency, grain packing and scheduling, loop scheduling, Parallelization of sequential programs.

**Text Books**

1. Kai Hwang and NareshJotwani, Advanced Computer Architecture, Second Edition,McGraw Hill, New Delhi, India, 2012.
2. M.J. Quinn, Parallel Computing: Theory and Practice, Second Edition, McGraw Hill,New Delhi, India, 2008.
3. D.Sima, T.Fountain, P.Kasuk, Advanced Computer Architecture-A Design spaceApproach, Pearson Education,India, 2009.

**Reference Books**

1. J. L. Hennessy and D. A. Patterson, Computer Architecture: A Quantitative approach, 5th Edition, Morgan Kaufmann/Elsevier-India.
2. T.G.Lewis, Parallel Programming: A machine Independent approach, IEEE Computer Society Press,Los Alamitos, 1994.
3. T.G.Lewis and H. EI-Rewini, Introduction to parallel computing, Prentice Hall, New Jersey,2019.

| PE-IT-D405A | Compiler Design | | | | | | |
|---|---|---|---|---|---|---|---|
| L | T | P | Credit | Major Test | MinorTest | Total | Time |
| 3 | - | - | 3 | 75 | 25 | 100 | 3Hr |
| Purpose | To familiarize the students to design and implement a compiler. | | | | | | |
| Course Outcomes | | | | | | | |
| CO 1 | To understand, design and implement a lexical analyzer. | | | | | | |
| CO 2 | To understand, design and implement a parser. | | | | | | |
| CO 3 | To understand, design code generation schemes. | | | | | | |
| CO 4 | To understand optimization of codes and runtime environment. | | | | | | |

**UNIT I**

**Introduction to Compiling**

Analysis of the source program, Phases of a compiler, Grouping of Phases, Compiler construction tools. Lexical Analysis –Regular Expression, Introduction to Finite Automata and Regular Expression, Conversion of Regular Expression to NFA, Role of Lexical Analyzer, Input Buffering, Specification of Tokens.

**UNIT II**

**Syntax Analysis**

Role of the Parser, Writing Grammars, Symbol Table, Context-Free Grammars, Shift-reduce Parser, Operator Precedence Parsing, Top Down Parsing ,Predictive Parsers, LR Parsers: SLR Parser, Canonical LR Parser, LALR Parser, Implementation of LR Parsing Tables.

**UNIT III**

**Intermediate Code Generation and Code**

Intermediate languages, Declarations, Assignment Statements, Boolean Expressions, Case Statements, DAG representation of Basic Blocks, A simple Code generator from DAG, Issues in the design of code generator , The target machine , Runtime Storage management, Error Handling-Type checking,

**UNIT IV**

**Code Optimization and Run Time Environments**

Principal Sources of Optimization, Optimization of Basic Blocks, Peephole Optimization, Introduction to Global Data Flow Analysis, Source Language issues, Storage Organization, Static Storage Management, Heap Storage management, Access to non-Local Names, Parameter Passing.

**Text books**

1. Alfred Aho, Ravi Sethi, Jeffrey D Ullman, “Compilers Principles, Techniques and Tools”,Pearson Education Asia,2003.
2. Kenneth C. Louden, “Compiler Construction: Principles and Practice”, Thompson Learning,2003

**Reference books**

1. Allen I. Holub“Compiler Design in C”, Prentice Hall of India,2003.
2. C. N. Fischer and R. J. LeBlanc, “Crafting a compiler with C”, Benjamin Cummings,2003.
3. J.P. Bennet, “Introduction to Compiler Techniques”, Second Edition, Tata McGraw-Hill,2003.
4. HenkAlblas and Albert Nymeyer, “Practice and Principles of Compiler Building with C”,PHI, 2001.

| OE-IT-401A | Cyber Law and Ethics | | | | | | |
|---|---|---|---|---|---|---|---|
| L | T | P | Credits | Major Test | Minor Test | Total | Time |
| 3 | - | - | 3 | 75 | 25 | 100 | 3Hr |
| Purpose | **This course explores technical, legal, and social issues related to cybercrimes, Laws Cyber Ethics. Cybercrime and laws is a broad term that includes offences where a computer may be the target, crimes where a computer may be a tool used in the commission of an existing offence, and crimes where a computer may play a subsidiary role such as offering evidence for the commission of an offence. It is also required to have knowledge of Cyber Ethics and its role and significance.** | | | | | | |
| **Course Outcomes** | | | | | | | |
| CO 1 | Understand Cyber laws. | | | | | | |
| CO 2 | Describe Information Technology act and Related Legislation. | | | | | | |
| CO 3 | Demonstrate Electronic business and legal issues. | | | | | | |
| CO 4 | To study the concept of cyber ethics. | | | | | | |

**Unit-1: Introduction to Cyber Law**

Evolution of computer technology, emergence of cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.

**Unit-2: Information Technology Act**

Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.

**Unit-3: Cyber Law and Related Legislation**

Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution , Online Dispute Resolution (ODR).

**Unit-4: Electronic Business and Legal Issues**

Evolution and development in E-commerce, paper vs paper less contracts E-Commerce models-B2B, B2C, E security. Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends.

**Cyber Ethics**

The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.

**Text Books**:

1. Cyber Laws: Intellectual property & E Commerce, Security- Kumar K, dominant Publisher

2. Cyber Ethics 4.0, ChristophStuckelberger, PavanDuggal, by Globethic

3. Information Security policy & Implementation Issues, NIIT, PHI

**Reference Books:**

1. Computers, Internet and New Technology Laws, Karnika Seth, Lexis NexisButterworthsWadhwa Nagpur. 5. Legal Dimensions of Cyber Space, Verma S, K, Mittal Raman, Indian Law Institute, New Delhi,

2. Cyber Law, JonthanRosenoer, Springer, New York, (1997).

3. The Information Technology Act, 2005: A Handbook, OUP SudhirNaib,, New York, (2011)

4. Information Technology Act, 2000, S. R. Bhansali,, University Book House Pvt. Ltd., Jaipur (2003).

5. Cyber Crimes and Law Enforcement, Vasu Deva, Commonwealth Publishers, New Delhi, (2003)

| OE-IT-403A | **Signal & System** | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credit** | **Major Test** | **MinorTest** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **75** | **25** | **100** | **3Hr** |
| **Purpose** | **To familiarize the students with the basic concepts of signals and systems, Random variables, discretisation of analog signals, fourier series, fourier transform and laplace transform.** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | Introduce and classify signals and systems based on their properties. | | | | | | |
| **CO 2** | To understand the basic concepts of random variables and Linear time invariant systems. | | | | | | |
| **CO 3** | Familiarization with the sampling process and spectral analysis of signals using fourier series. | | | | | | |
| **CO 4** | Apply transform techniques to analyze continuous-time and discrete-time signals and systems | | | | | | |

**Unit-I** Introduction to Signals: Continuous and discrete time signals, deterministic and stochastic signals, periodic and a periodic signals, even and odd signals, energy and power signals, exponential and sinusoidal signals and singular functions. Signal representation in terms of singular functions, orthogonal functions and their use in signal representation Introduction to Systems: Linear and non-linear systems, time invariant and time varying systems, lumped and distributed systems, deterministic and stochastic systems, casual and non-causal systems, analog and discrete/digital memory and memory less systems.

**Unit-II** Random Variables: Introduction to Random Variables, pdf, cdf, moments, distributions, correlation functions. Linear Time Invariant Systems: Introduction to linear time invariant (LTI) systems, properties of LTI systems, convolution integral, convolution sum, causal LTI systems described by differential and difference equations. Concept of impulse response

**Unit-III** Discretisation of Analog Signals: Introduction to sampling, sampling theorem and its proof. Effect of under sampling, reconstruction of a signal from sampled signal. Fourier Series : Continuous time fourier series (CTFS), Properties of CTFS, Convergence of fourier series, Discrete time Fourier Series (DTFS), Properties of DTFS , Fourier series and LTI system, Filtering.

**Unit-IV** Fourier Transform: Continuous Time Fourier Transform (CTFT), Properties of CTFT, Systems characterized by linear constant- coefficient differential equations. Discrete time fourier transform (DTFT), Properties of DTFT, Duality, Systems characterized by Linear constant coefficient difference equations. Laplace Transform: Introduction to Laplace transform, Region of convergence for laplace transform, Inverse laplace transform, Properties of laplace transform, Analysis and characterization of LTI systems using laplace transform, System function algebra and block diagram representations, Unilateral laplace transform.

**Text Books:**


1. Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, Signals and Systems, Prentice Hall India, 2nd Edition, 2009 Reference Books: 1. Simon Haykins – “Signal & Systems”, Wiley Eastern

2. Tarun Kumar Rawat , Signals and Systems , Oxford University Press.

| OE-IT-405A | Neural Networks and Deep Learning | | | | | | |
|---|---|---|---|---|---|---|---|
| L | T | P | Credit | Major Test | MinorTest | Total | Time |
| 3 | - | - | 3 | 75 | 25 | 100 | 3 Hr. |
| **Purpose** | **To provide knowledge of various artificial neural networks, fuzzy logic techniques and Genetic Engineering approach for optimization** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | To learn the basics of artificial neural networks concepts. | | | | | | |
| **CO 2** | Expose detailed explanation of various neural networks architecture. | | | | | | |
| **CO 3** | To explore knowledge of special types of Artificial neural networks. | | | | | | |
| **CO 4** | To explore fuzzy logic techniques and genetic algorithms in neural networks. | | | | | | |

**Unit I: Fundamentals of Artificial Neural Networks**

Introduction: Concepts of neural networks, Characteristics of Neural Networks, Applications of Neural Networks. Fundamentals of Neural Networks: The biological prototype, Neuron concept, Single layer Neural Networks, Multi-Layer Neural Networks, terminology, Notation and representation of Neural Networks, Training of Artificial Neural Networks. Representation of perceptron, perceptron learning and training, Classification, linear Separability

**Unit II: Neural Networks**

Hopfield nets: Structure, training, and applications, Back Propagation: Concept, Applications and Back Propagation Training Algorithms. Counter Propagation Networks: Kohonan Network, Grossberg Layer & Training, applications of counter propagation, Image classification. Bi-directional Associative Memories: Structure, retrieving a stored association, encoding associations.

**Unit III: Special Neural Networks**

ART: ART architecture, ART classification operation, ART implementation and characteristics of ART. Image Compression Using ART, Optical Neural Networks: Vector Matrix Multipliers, Hop field net using Electro optical matrix multipliers, Holographic correlator, Optical Hopfield net using Volume Holograms, Cognitrons and Neocognitrons: structure and training.

**Unit IV: Deep learning and Fuzzy Logic**

Deep learning neural networks : Deep learning neural networks, forward propagation in a deep network, need of deep representations, Building blocks of deep neural networks, forward and backward propagation Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation, Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations  Genetic Algorithms: genetic algorithm implementation in problem solving and working of genetic algorithms evolving neural networks

**Text Books:**

1. Li Min Fu, “Neural Networks in Computer Intelligence”, McGraw-Hill, Inc. 2012.

2. S N Sivanandam, “Neural Networks using MATLAB 6.0”, TMH, 4th. Reprint 2015.

3. S N Sivanandam, “Principles of Soft Computing”, 2nd. Edition, Wiley, Reprint 2014.

**Reference Books**:

1. Simon Haykin, “Neural Networks: A Comprehensive Foundations”, Prentice-Hall International, New Jersey, 2013.

2. Freeman J.A. & D.M. Skapura, “Neural Networks: Algorithms, Applications and Programming Techniques”, Addison Wesley, Reading, Mass, 2014.

| OE-IT-407A | Digital Signal Processing | | | | | | |
|---|---|---|---|---|---|---|---|
| L | T | P | Credit | Major Test | MinorTest | Total | Time |
| 3 | - | - | 3 | 75 | 25 | 100 | 3 Hr. |
| Purpose | To make students aware about the digital signal processing in FIR & IIR filter | | | | | | |
| Course Outcomes | | | | | | | |
| CO 1 | This section provides the detail about the analysis of LTI system in Z transform | | | | | | |
| CO 2 | This section describe how we implement discrete time system in FIR & IIR systems | | | | | | |
| CO 3 | This section describe how we design FIR filters by frequency sampling method | | | | | | |
| CO 4 | This section describe how we design IIR filters using various method | | | | | | |

**UNIT-I**

Z – Transform Analysis of LTI System:- Transform its properties, System Function of a linear Time- Invariant system. Inversion of the Z Transform, the one-sided Z-transform, Solution of difference equations. Analysis of LTI system in Z- domain, transient and steady- state response.Causality and stability.Pole- Zero Cancellations.

DFT and FFT: DFT and its properties, Circular Convolution and fast linear convolution, Linear filtering using DFT. Direct Computation of DFT, FFT algorithms, Radix-2 and Radix-4 algorithms.

**UNIT-II**

Implementation of Discrete-Time Systems: Structure for the Realization of Discrete-Time Systems, Structure for FIR Systems: Direct-Form Structure, Cascade-Form Structures, Frequency-Sampling Structures; Structure for IIR Systems: Direct-Form Structures, Signal Flow Graphs and Transposed Structures, Cascade-Form Structures, Parallel-Form Structures, Lattice and Lattice-Ladder Structures for IIR Systems.

**UNIT-III**

Design of FIR Filters: Characteristics of practical frequency selective filters. Filters design specifications peak and pass band ripple, minimum stop band attenuation. Design of FIR filters using windows functions( Kaiser window, rectangular, Hamming and Blackman window) method comparison of design methods for FIR filters, Gibbs phenomenon, design of FIR filters by frequency sampling method.

**UNIT-IV**

Design of IIR Filters: Design of IIR filters from analog filters, Design by approximation of derivatives, Impulse invariance method, bilinear transformation method, characteristics of Butterworth, Chebyshev, and Elliptical analog filters and design of IIR filters.

**Text Books:**

1. Digital Signal Processing by J.G. Proakis and D.G. Manalakis-PHI
2. Digital Signal Processing by: A.V. Oppenheim and R.W. Schafer-PHI

**References Books:**

1. Element of Digital Signal Processing by N. SarkarKhanna Publishers.
2. Digital Signal Processing by S. K. Mitra –TMH.
3. Digital Signal Processing by Rabinar, Gold-PHI

| PE-IT-D407A | Software Testing | | | | | | |
|---|---|---|---|---|---|---|---|
| L | T | P | Credit | Major Test | MinorTest | Total | Time |
| 3 | - | - | 3 | 75 | 25 | 100 | 3 Hr. |
| **Purpose** | **To provide an understanding of concepts and techniques for testing software and assuring its quality.** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | Expose the criteria and parameters for the generation of test cases. | | | | | | |
| **CO 2** | Learn the design of test cases and generating test cases. | | | | | | |
| **CO 3** | Be familiar with test management and software testing activities. | | | | | | |
| **CO 4** | Be exposed to the significance of software testing in web and Object orient techniques | | | | | | |

**UNIT 1**

**Introduction**: Overview of software evolution, SDLC, Testing Process, Terminologies in Testing: Error, Fault, Failure, Verification, Validation, Difference between Verification and Validation, What is software testing and why it is so hard? Test Cases, Test Oracles, Testing Process, Limitations of Testing.

**UNIT 2**

**Functional Testing**: Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique. Structural Testing: Path testing, DD-Paths, Cyclomatic Complexity, Graph Metrics, Data Flow Testing, Mutation testing

**UNIT 3**

**Reducing the number of test cases**: Prioritization guidelines, Priority category, Scheme, Risk Analysis, Regression Testing, and Slice based testing Testing Activities: Unit Testing, Levels of Testing, Integration Testing, System Testing, Debugging, Domain Testing.

**UNIT 4**

**Object oriented Testing**: Definition, Issues, Class Testing, Object Oriented Integration and System Testing. Testing Web Applications: What is Web testing?, User interface Testing, Usability Testing, Security Testing, Performance Testing, Database testing, Post Deployment Testing.

**TEXT BOOKS:**


1. NareshChauhan "Software Testing Principles and Practices" Oxford Publications,2012.
2. Louise Tamres, "Software Testing", Pearson Education Asia,2002.
3. Robert V. Binder, "Testing Object-Oriented Systems-Models, Patterns and Tools", Addison Wesley,1999.
4. William Perry, "Effective Methods for Software Testing", John Wiley & Sons, New York,1995.


**REFERENCE BOOKS:**


1. CemKaner, Jack Falk, Nguyen Quoc, "Testing Computer Software", Second Edition, Van Nostrand Reinhold, New York, 1993.
2. K.K. Aggarwal&Yogesh Singh, "Software Engineering", 2nd Ed., New Age International Publishers, New Delhi, 2005.
3. Boris Beizer, "Software Testing Techniques", Second Volume, Second Edition, Van Nostrand Reinhold, New York,1990.
4. Boris Beizer, "Black-Box Testing –Techniques for Functional Testing of Software and Systems", John Wiley & Sons Inc.,New York,1995.

| PE-IT-D409A | Software Project Management | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **-** | **--** | **3** | **75** | **25** | **100** | **3Hr.** |
| **Purpose** | **The purpose of this course is to introduce students the basics of Software Project Management** | | | | | | |
| **CO 1** | To study software economics evolution. | | | | | | |
| **CO 2** | To study software management process & its framework. | | | | | | |
| **CO 3** | To study software management planning, responsibilities. | | | | | | |
| **CO 4** | To familiarize students about Project Management And Control | | | | | | |

## Unit-1

**Conventional Software Management:** Evolution of software economics, Improving software economics: reducing product size, software processes, team effectiveness, automation through, Software environments, Principles of modem software management.

## Unit-2

**Software Management Process:** Framework: Life cycle phases- inception, elaboration, construction and training phase. Artifacts of the process- the artifact sets, management artifacts, engineering artifacts, and pragmatics artifacts, Model based software architectures, Workflows of the process, Checkpoints of the process.

## Unit-3

**Software Management Disciplines:** Iterative process planning, Project organizations and responsibilities, Process automation, Project control and process instrumentation core metrics, management indicators, life cycle expectations, Process discriminates.

## Unit-4

**Project Management And Control:** framework for Management and control – Collection of data Project termination – Visualizing progress – Cost monitoring – Earned Value Analysis- Project tracking– Change control- Software Configuration Management – Managing contracts – Contract Management.

## TEXT BOOKS:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition,Tata McGraw Hill, New Delhi, 2012.
2. Software Project Management, Walker Royee, Addison Wesley,1998

## REFERENCE BOOKS :

1 Project management 2/e, Maylor.

2. Managing the Software Process, Humphrey.
3. Managing Global Software Projects. Ramesh, TMfH, 2001

| PE-IT-D411A | Distributed Operating System | | | | | | |
|---|---|---|---|---|---|---|---|
| L | T | P | Credit | Major Test | MinorTest | Total | Time |
| 3 | - | - | 3 | 75 | 2 | 100 | 3 Hr. |
| Purpose | Elucidate the foundations and issues of distributed systems | | | | | | |
| Course Outcomes | | | | | | | |
| CO 1 | Understand foundations of Distributed Systems. | | | | | | |
| CO 2 | Introduce the idea of peer to peer services and file system. | | | | | | |
| CO 3 | Understand in detail the system level and support required for distributed system. | | | | | | |
| CO 4 | Understand the issues involved in studying process and resource management. | | | | | | |

**Unit-1:**

Introduction: Distributed Computing Systems, Distributed Computing System Models, Advantages of Distributed Systems, Distributed Operating Systems, Issues in Designing Distributed Operating Systems, Distributed Computing Environment.

Message Passing: Introduction, Features of Message Passing, Issues in IPC by Message Passing, Synchronization, Buffering, Process Addressing, Failure Handling, Group Communication.

**Unit-2:**

Remote Procedure Calls: The RPC Model, Transparency of RPC, Implementation of RPC Mechanism, STUB Generation, RPC Messages, Marshaling Arguments and Results, Server Management, Parameter Passing, Call Semantics, Communication Protocol for RPCs, Complicated RPC, Client-Server Binding, Security.

**Unit-3:**

Distributed Shared Memory: Distributed Shared Memory Systems (DSM), DSM – Design and Implementation Issues, Granularity – Block Size, Structure of Shared Memory Space in a DSM System, Memory Coherence (Consistency) Models, Memory Consistency models, Implementing Sequential Consistency, Centralized – Server Algorithm, Fixed Distributed – Server Algorithm, Dynamic Distributed Server Algorithm, Implementing under RNMBs Strategy, Thrashing.

**Unit-4:**

Synchronization: Introduction, Clock Synchronization, Clock Synchronization Algorithms, Distributed Algorithms, Event Ordering, Mutual Exclusion, Deadlock, Election Algorithms.

Process Management: Introduction, Process Migration, Threads.

Security in Distributed Systems: Potential attacks to Computer Systems, Cryptography, Authentication, Access Control, Digital Signatures, Design Principles.

**REFERENCE BOOKS :**


1. Pradeep K Sinha, “Distributed Operating Systems: Concepts and Design”, Prentice Hall of India, 2007.
2. Tanenbaum A.S., Van Steen M., “Distributed Systems: Principles and Paradigms”, Pearson Education, 2007.

3. Liu M.L., “Distributed Computing, Principles and Applications”, Pearson Education, 2004.
4. Nancy A Lynch, “Distributed Algorithms”, Morgan Kaufman Publishers, USA, 2003.

| PE-IT-D413A | Natural Language Processing | | | | | | |
|---|---|---|---|---|---|---|---|
| L | T | P | Credit | Major Test | MinorTest | Total | Time |
| 3 | - | - | 3 | 75 | 25 | 100 | 3 Hr. |
| Purpose | To provide knowledge of various NLP techniques. | | | | | | |
| Course Outcomes | | | | | | | |
| CO 1 | Understand approaches to syntax, semantics, dialogue and summarization in NLP. | | | | | | |
| CO 2 | Understand current methods for statistical approaches to machine translation. | | | | | | |
| CO 3 | Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars and clustering | | | | | | |
| CO 4 | Understand the mathematical and linguistic foundations in the area of NLP. | | | | | | |

**Unit 1**

**Introduction and Overview:** What and why of Natural language Processing, Ambiguity and Uncertainty in language, Theturing test. Regular Expressions: Chomski Hierarchy, Regular Languages and their limitations, Finite-state automata. Practical regular expressions for finding and counting language phenomena.

**String Edit Distance and Alignment:** Key algorithmic tool: dynamic programming, a simple example, then its use in optimal alignment of sequences. String edit operations, edit distance, and examples of use in spelling correction

**Unit II**

**Context Free Grammers**: Constituency, CFG definition, use and limitations. Chomsky Normal Form. Top-down parsing, bottom-up parsing, and the problems with each. The desirability of combining evidence from both directions, Non-probabilisitc Parsing: Efficient CFG parsing with CYK, dynamic programming algorithm

**Information Theory**: What is information, Measuring it in bits. The "noisy channel model." The "Shannon game",Entropy, cross-entropy, information gain. Its application to some language phenomena.

**Unit III**

**Language modelling and Naive Bayes**: Probabilistic language modelling and its applications. Markov models.N-grams. Estimating the probability of a word, and smoothing. Generative models of language. Their applications to building an automatically-trained email spam filter, and automatically determining the language.

**Part of Speech Tagging and Hidden Markov Models**: The concept of parts-of-speech, examples, usage. The Penn Treebank and Brown Corpus. Probabilistic (weighted) finite state automata. Hidden Markov models (HMMs), definition and use. Viterbi Algorithm for Finding Most Likely HMM Path: Dynamic programming with Hidden Markov Models, and its use for part-of-speech tagging, Chinese word segmentation, prosody, information extraction

**Unit IV**

**Probabilistic Context Free Grammars**: Weighted context free grammars. Weighted CYK. Pruning and beam search. Parsing with PCFGs: treebank ,The probabilistic version of CYK. Experiments with eye-tracking. Modern parsers.

**Maximum Entropy Classifiers**: The maximum entropy principle, and its relation to maximum likelihood. The need in NLP to integrate many pieces of weak evidence.Maximum entropy classifiers and their application to document classification, sentence segmentation, and other language tasks.

**Text and Reference Books**:

1. Daniel Jurafsky and James H. Martin, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech recognition, Second Ed., 2009.

2. Chris Manning and HinrichSchütze, Foundations of Statistical Natural Language Processing

| PE-IT-D415A | Server Side Programming Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credit** | **Practical** | **Minor Test** | **Total** | **Time** |
| **0** | **0** | **3** | **1.5** | **60** | **40** | **100** | **3 Hr.** |
| **Purpose** | **To gain familiarity with what server-side programming is, what it can do, and how it differs from client-side programming.** | | | | | | |
| | **Course Outcomes** | | | | | | |
| **CO1** | To study Fundamentals of server side programming and basic programs. | | | | | | |
| **CO2** | To Implement program in ASP to display day, month, date, digital clock. | | | | | | |
| **CO3** | To implement string function using ASP. | | | | | | |
| **CO4** | To implement the use of Forms and its validations using ASP. | | | | | | |

**List of Experiments:**

1. Create a Subroutine with arguments passing & call the subroutine for specific no. of time.
2. Write a program in ASP which define an object & then display the properties of object with method.
3. Write a program in ASP to display present day, month & date. Also display digital clock.
4. Write a program in ASP which will check that a specific file, folder & drive exist or not. Also return the extension of file. Then use the read & write properties on a file using text-stream object.
5. Send information to the user after he submit the form using GET & POST method & implement from validation.
6. Write a program in ASP that has a form taking the user's name as input. Store this name in a permanent cookie & whenever the page is opened again, then value of the name field should be attached with the cookie's content.
7. Use ad-rotator to change advertisements on client side request.
8. Create a session dictionary using object tag. In session-on start add keys for time, user agent, remote I.P. & add appropriate values. Create a simple page to display the values.
9. Implement session tracking using user authentication.
10. Write a program to delete all cookies of your web site that has created on the client's computer.
11. Write a program is ASP to check the capabilities of the browser using browser capability component.
12. Using data base to store & retrieves values input by a user showing them & make updating & add new records to existing database.
13. Create two ASP pages, a form creation web page (selectprice.asp) and a form processing script (liststockbyprice.asp). In selectprice.asp, the user should be shown a form in which he can enter the item & desired maximum price. When it is submitted liststockbyprice.asp will return all the stocks from database whose cost are less than the price entered by user.

**Note:** A student has to perform at least 10 experiments. At least seven experiments should be performed from the above list. Three experiments may be designed & set by the concerned institution as per the scope of the syllabus.

| PE-IT-D417A | Python Programming Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credit** | **Practical** | **Minor Test** | **Total** | **Time** |
| **0** | **0** | **3** | **1.5** | **60** | **40** | **100** | **3 Hour** |
| **Purpose** | The course is designed to provide Basic knowledge of Python. | | | | | | |
| | **Course Outcomes** | | | | | | |
| **CO1** | To study fundamentals of python programming and implement basic programs. | | | | | | |
| **CO2** | To implement the searching technique using python. | | | | | | |
| **CO3** | To implement sorting techniques using python. | | | | | | |
| **CO4** | To implement matrix multiplication using python. | | | | | | |

**LIST OF PRACTICALS:**

1. WAP to compute the GCD of two numbers.
2. WAP to find the square root of a number
3. WAP to find the Exponentiation (power of a number)
4. WAP to find the maximum of a list of numbers
5. WAP for Linear search and Binary search
6. WAP for Selection sort, Insertion sort
7. WAP for Merge sort
8. WAP to find first n prime numbers
9. WAP to multiply matrices
10. WAP that take command line arguments (word count)
11. WAP to find the most frequent words in a text read from a file
12. WAP to Simulate elliptical orbits in Pygame
13. WAP to Simulate bouncing ball using Pygame

**Note:** A student has to perform at least 10 experiments. At least seven experiments should be performed from the above list. Three experiments may be designed & set by the concerned institution as per the scope of the syllabus.

| Bachelor of Technology (Information Technology ) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Credit-Based Scheme of Studies/Examination** | | | | | | | | | | |
| **Semester VIII(w.e.f. session 2021-2022 )** | | | | | | | | | | |
| **S. No.** | **Course Code** | **Subject** | **L:T:P** | **Hours /Week** | **Credits** | **Examination Schedule (Marks)** | | | | **Duration of Exam (Hrs.)** |
| | | | | | | **Major Test** | **Minor Test** | **Practical** | **Total** | |
| 1 | PE | Elective-VI | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | OE | Open Elective-III | 2:0:0 | 2 | 2 | 75 | 25 | 0 | 100 | 3 |
| 3 | OE | Open Elective-IV | 2:0:0 | 2 | 2 | 75 | 25 | 0 | 100 | 3 |
| 4 | PROJ-IT-402A | Project-III | 0:0:12 | 12 | 6 | 0 | 40 | 60 | 100 | 3 |
| 5 | PE-IT-A410A | Mobile Application Development Lab | 0:0:4 | 4 | 2 | 0 | 40 | 60 | 100 | 3 |
| | | **Total** | | **23** | **15** | **225** | **155** | **120** | **500** | |

**The course of both PE & OE will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.**

| **PE Elective-VI** | |
|---|---|
| Introduction to Internet of Things: PE-IT-A402A | |
| Cloud Computing: PE-IT-A404A | |
| Machine learning: PE-IT-A406A | |
| Mobile Apps Development: PE-IT-A408A | |
| **OE Elective-III** | **OE Elective-IV** |
| Cyber Security: OE-IT-402A | Information Security: OE-IT-410A |
| Bioinformatics: OE-IT-404A | Image Processing: OE-IT-412A |
| Social Networks: OE-IT-406A | IPR, Bioethics and Biosafety: OE-IT-414A |
| Human Computer Interaction: OE-IT-408A | Sensor and Transducer: OE-IT-416A |

| PE-IT-A402A | Introduction to Internet of Things | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hour** |
| **Purpose** | **To make the students conversant with basics of Internet of Things.** | | | | | | |
| | **Course Outcomes** | | | | | | |
| **CO1** | Understand general concepts of Internet of Things (IoT) and Recognize various devices, sensors and applications | | | | | | |
| **CO2** | To help students apply design concept to IoT solutions. | | | | | | |
| **CO3** | To familiarize about the design issues in IoT applications | | | | | | |
| **CO4** | To help students create IoT solutions using sensors, actuators and Devices | | | | | | |

**UNIT 1**

**Introduction to IoT**: Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs, IOT concepts ,Technologies that led to evolution of IOT , IOT and SCADA, IOT and M2M , IOT and Big Data , IOT Standards , Requirement of international standard ( case study) , IOT standards in practice, Operating platforms /systems.

**UNIT 2**

**Components of IoT:** Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs. Components of IOT System, Design of IOT systems ,Development of prototypes, Relevance of IOT for the future, IOT in everyday life, Internet of Everything , IOT and Individual Privacy

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**UNIT 3**

**Domain specific applications of IoT:** Home automation, Industry applications, Surveillance applications, Other IoT application. i) Lighting as a service ( case study) ii) Intelligent Traffic systems ( case study) iii) Smart Parking ( case study) iv) Smart water management ( case study) f) IOT for smart cities ( Case study Smart city ), IOT in Indian Scenario, IOT and Aadhaar, IOT for health services , IOT for financial inclusion , IOT for rural empowerment

**UNIT 4**

**Developing IoT solutions:** Introduction to Python, Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi Implementation of IoT with Arduino and Raspberry, Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities, Privacy and Security Issues in IoT.

**Suggested books**

- Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
- Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013
- The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World"
- Vijay Madisetti, ArshdeepBahga, "Internet of Things: A Hands-OnApproach".

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| PE-IT-A404A | Cloud Computing | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **03 Hrs.** |
| **Purpose** | **To familiar the concepts of cloud services and storage to deploy various resources and arbitrary software.** | | | | | | |
| **Course Outcomes(CO)** | | | | | | | |
| **CO1** | Facilitate the basic usage and applicability of computing paradigm. | | | | | | |
| **CO2** | Explore various cloud service and deployment models to utilize different cloud services. | | | | | | |
| **CO3** | To get enabled for various data, scalability & cloud services in order to get efficient database for cloud storage. | | | | | | |
| **CO4** | To deal with various security threats and their controlling mechanism for accessing safe cloud services. | | | | | | |

## UNIT 1

**Overview of Computing Paradigm**: Recent trends in Computing, Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing, evolution of cloud computing, Business driver for adopting cloud computing. Cloud Computing (NIST Model), History of Cloud Computing, Cloud service providers, Properties, Characteristics & Disadvantages, Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing, Role of Open Standards.

## UNIT 2

**Cloud Computing Architecture:** Cloud computing stack, Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services, Service Models (XaaS) - Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Deployment Models- Public cloud, Private cloud, Hybrid cloud, Community cloud.

## UNIT 3

**Service Management in Cloud Computing:** Service Level Agreements (SLAs), Billing & Accounting, comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously, Managing Data- Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing.

Case study: Eucalyptus, Microsoft Azure, Amazon EC2.

## UNIT 4

**Cloud Security:** Infrastructure Security, Network level security, Host level security, Application level security, Data security and Storage, Data privacy and security Issues, Jurisdictional issues raised by Data location, Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations.

**Text Books**


1. Barrie Sosinsky, Cloud Computing Bible, Wiley-India, 2010.
2. RajkumarBuyya,JamesBroberg, Andrzej M. Goscinski,CloudComputing: Principles and Paradigms, Wiley, 2011.

**Reference Books**

1. Nikos Antonopoulos, Lee Gillam, Cloud Computing: Principles, Systems and Applications, Springer, 2012.
2. Ronald L. Krutz, Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley-India, 2010

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| PE-IT-A406A | Machine Learning | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | 75 | 25 | **100** | **03 Hr.** |
| **Purpose** | **To familiar the concepts of Machine Learning.** | | | | | | |
| **Course Outcomes(CO)** | | | | | | | |
| **CO1** | Study basics of Machine learning | | | | | | |
| **CO2** | To understand various types of learning | | | | | | |
| **CO3** | Study types of Reinforcement learning | | | | | | |
| **CO4** | Study of Artificial neural network | | | | | | |

## Unit I

**Introduction**: Well posed learning problems, designing a learning system, Issues in machine learning, the concept learning task, types of learning: inductive learning, learning by analogy, Deductive learning, Reinforcement learning.

## Unit II

**Supervised Learning**: Introduction to linear regression, estimating the coefficients, Accessing the accuracy of the coefficient estimates, Accessing the accuracy of the regression model, Multiple linear regression, Logistic regression, basic decision tree learning (ID3) algorithm, Hypothesis space search in decision tree learning algorithm, Inductive bias in decision tree learning, Issues in decision tree learning, k-nearest neighbour learning.

## Unit III

**Unsupervised Learning**:

About clustering, type of data in clustering analysis, k-means and k-medoids, DBSCAN density-based clustering method, Performance analysis of clustering algorithms,

## Unit IV

**Artificial Neural networks**: Neural Network representations, Appropriate problems for neural network learning, Perceptron. The perceptron training rule, Gradient descent and delta rule, Multilayer Networks and back propagation algorithm.

**Text and Reference Books:**


1. Tom M. Mitchell, Machine Learning, McGraw-Hill, 1997.

2. Bishop Christopher, Pattern Recognition and Machine Learning, Springer Verlag, 2006.

3. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning: Data Mining, Inference and Prediction, Springer, 2nd edition, 2009..J. Han and M. Kamber, Data Mining Concepts and Techniques, 3rd Edition, Elsevier, 2012.

4. S. Rajeshkaran, G. A. VijayalakshmiPai, Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, PHI, 2003.

| PE-IT-A408A | Mobile Apps Development | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | **To introduce the concepts of developing the mobile applications.** | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | Be exposed to technology and Mobile apps development aspects. | | | | | | |
| **CO2** | Be competent with the characterization and architecture of mobile applications. | | | | | | |
| **CO3** | Appreciation of nuances such as native hardware play, location awareness, graphics, and multimedia. | | | | | | |
| **CO4** | Perform testing, signing, packaging and distribution of mobile apps. | | | | | | |

**Unit I:** Introduction to Mobility

Mobility landscape, Mobile platforms, Mobile apps development, Overview of Android platform, Setting up the Mobile App Development environment along with an Emulator.

App User Interface Designing – Mobile UI resources (Layout, UI elements, Drawable, Menu).

**Unit II:** Building blocks of Mobile Apps

Activity- States and Life Cycle, Interaction amongst Activities.

App functionality beyond user interface - Threads, Async task, Services – States and Life Cycle, Notifications, Broadcast receivers, Content provider.

**Unit III**: Sprucing up Mobile Apps

Graphics and animation – Custom views, Canvas, Animation APIs, Multimedia – Audio/Video playback and record, Location awareness.

Native data handling–file I/O, Shared preferences, Mobile databases such as SQLite, and Enterprise data access (viaInternet/Intranet).

**Unit IV**: Testing Mobile Apps

Debugging mobile apps, White box testing, Black box testing, and test automation of Mobile apps, JUnit for Android.

## Text Books:


1. Barry Burd, Android Application Development All in one for Dummies, Wiley publications, 2nd Edition2015.
2. Android Developer Fundamentals Course– Concepts (Learn to develop Android applications) Concepts Reference *Developed by Google Developer Training Team,2016.*
3. Valentino Lee, Heather Schneider, and Robbie Schell, Mobile Applications: Architecture, Design, and Development, Prentice Hall,2004.
4. Rick Boyer, Kyle Mew,Android Application Development Cookbook - SecondEdition,2016.


## Reference Books:


1. Carmen Delessio, Lauren Darcey, Teach Yourself Android Application Development In 24 Hours , SAMS,2013.
2. Brian Fling, Mobile Design and Development, O'Reilly Media,2009.
3.

| OE-IT-402A | Cyber Security | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **0** | **0** | **2** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To gain a broad understanding in order to get predictive ways out related to cyber security. | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | To facilitate the basic knowledge of cyber security. | | | | | | |
| **CO2** | To explore and sort issues related to different types of activities in cyber crime. | | | | | | |
| **CO3** | To get enable to fix the various cyber attacks. | | | | | | |
| **CO4** | To deal with the digital forensics and related scenarios of cyber crimes. | | | | | | |

**Unit-I**

Introduction: Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime: crime against individual, Crime against property, Cyber extortion, Drug trafficking, cyber terrorism.
Need for Information security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis.

**Unit-II**

Cyber Crime Issues: Unauthorized Access to Computers, Computer Intrusions, Viruses and Malicious Code, Internet Hacking and Cracking, Virus and worms, Software Piracy, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Password Cracking, Steganography, Key loggers and Spyware, Trojan and backdoors, phishing, DOS and DDOS attack, SQL injection, Buffer Overflow.

**Unit-III**

Introduction to cyber attacks: passive attacks, active attacks, Cyber crime prevention methods, Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control, Hardware protection mechanisms, OS Security

**Unit-IV**

Digital Forensics: Introduction to Digital Forensics, historical background of digital forensics, Forensic Software and Hardware, need for computer forensics science, special tools and techniques digital forensic life cycle, challenges in digital forensic.
Law Perspective: Introduction to the Legal Perspectives of Cybercrimes and Cyber security, Cybercrime and the Legal Landscape around the World, Why Do We Need Cyber laws, The Indian IT Act, Cybercrime Scenario in India, Digital Signatures and the Indian IT Act, Cybercrime and Punishment.

**Text Books:**

1. Nelson Phillips and EnfingerSteuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.

**Reference Books:**

1. Robert M Slade," Software Forensics", Tata McGraw - Hill, New Delhi, 2005.

SunitBelapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt. Ltd.

| OE-IT-404A | **Bioinformatics** | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **0** | **0** | **2** | **75** | **25** | **100** | **3Hr.** |
| **Purpose** | **The objective of course is to study of information on Biological data.** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO 1** | Encompasses the development of databases to analyze and determine their relationships with biological data. | | | | | | |
| **CO 2** | Enriches their understanding of how genes or molecular sequences of species evolve. | | | | | | |
| **CO 3** | To enable them of using computational techniques to characterize protein and RNA structure. | | | | | | |
| **CO 4** | Understand the assembling of sequences and analysis of structure and function of genomics. | | | | | | |

**Unit -I**

Bioinformatics and Biological Databases Bioinformatics: Introduction, Goal, Scope, Applications, Limitations, and New Themes Biological Databases: Introduction, Types of Databases, Biological Databases, Pitfalls of Biological Databases, Information Retrieval from Biological Databases Database Similarity Searching: Unique Requirements of Database Searching, Heuristic Database Searching, Basic Local Alignment Search Tool (BLAST), FASTA, Comparison of FASTA and BLAST, Practical Issues Profiles and Hidden Markov Models: Position-Specific Scoring Matrices, Profiles, Markov Model and Hidden Markov Model Protein Motifs and Domain Prediction: Identification of Motifs and Domains in Multiple Sequence Alignment, Motif and Domain Databases Using Regular Expressions, Motif and Domain Databases Using Statistical Models, Protein Family Databases, Motif Discovery in Unaligned Sequences, Sequence Logos

**Unit -II**

Gene and Promoter Prediction Gene Prediction: Categories of Gene Prediction Programs, Gene Prediction in Prokaryotes, Gene Prediction in Eukaryotes Promoter and Regulatory Element Prediction: Promoter and Regulatory Elements in Prokaryotes, Promoter and Regulatory Elements in Eukaryotes, Prediction Algorithms Molecular Phylogenetics Phylogenetics Basics: Molecular Evolution and Molecular Phylogenetics, Terminology, Gene Phylogeny versus Species Phylogeny, Forms of Tree Representation, Why Finding a True Tree Is Difficult, Phylogenetic Tree Evaluation, Phylogenetic Programs 16

**Unit -III**

Structural Bioinformatics Protein Structure Basics: Amino Acids, Peptide Formation, Dihedral Angles, Hierarchy, Secondary Structures, Tertiary Structures, Determination of Protein ThreeDimensional Structure, Protein Structure Database Protein Structure Visualization, Comparison, and Classification: Protein Structural Visualization, Protein Structure Comparison, Protein Structure Classification Protein Secondary Structure Prediction: Secondary Structure Prediction for Globular Proteins, Secondary Structure Prediction for Transmembrane Proteins, Coiled Coil Prediction Protein Tertiary Structure Prediction: Methods, Homology Modeling, Threading and Fold Recognition, Ab Initio Protein Structural Prediction, CASP RNA Structure Prediction: Introduction, Types of RNA Structures, RNA Secondary Structure Prediction Methods, Ab Initio Approach, Comparative Approach, Performance Evaluation

**Unit -IV**

Genomics and Proteomics Genome Mapping, Assembly, and Comparison: Genome Mapping, Genome Sequence Assembly, Genome Annotation, Comparative Genomics Functional Genomics: Sequence-Based Approaches, Microarray-Based Approaches, Comparison of SAGE and DNA Microarrays Proteomics: Technology of Protein Expression Analysis, Posttranslational Modification, Protein Sorting, Protein–Protein Interactions

**Recommended Books:**

1. Bioinformatics for Dummies, Jean-Michel Claverie, Cedric Notredame, 2003, John Wiley & Sons
2. Bioinformatics Computing, Bryan P. Bergeron, 2002, Prentice Hall
3. Introduction to Bioinformatics, Arthur M. Lesk, 2002, Oxford University Press
4. Instant Notes in Bioinformatics, D.R. Westhead, J. H. Parish, R.M. Twyman, 2002, Bios Scientific Pub
5. Fundamental Concepts of Bioinformatics, Dan E. Krane, Michael L. Raymer, Michaeel L. Raymer, Elaine NicponMarieb, 2002, Benjamin/Cummings
6. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Second Edition, Andreas D. Baxevanis, B. F. Francis Ouellette, 2001, WileyInterscience
7. Introduction to Bioinformatics, Teresa Attwood, David Parry-Smith, 2001, Prentice Hall
8. Bioinformatics: A Primer, Charles Staben, 2001, Jones & Bartlett Pub
9. Bioinformatics: Sequence and Genome Analysis, David W. Mount, 2001, Cold Spring Harbor Laboratory Press
10. Bioinformatics: Sequence, Structure and Databanks: A Practical Approach (The Practical Approach Series, 236), Des Higgins (Editor), Willie Taylo

| OE-IT-406A | **Social Networks** | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **0** | **0** | **2** | **75** | **25** | **100** | **3 Hour** |
| **Purpose** | **To make the students conversant with basic fundamentals of the Electronics** | | | | | | |
| | **Course Outcomes** | | | | | | |
| **CO1** | Ability to understand and knowledge representation for the semantic web | | | | | | |
| **CO2** | Understand the basics of Semantic Web and Social Networks. | | | | | | |
| **CO3** | Understand Electronic sources for network analysis and different Ontology languages | | | | | | |
| **CO4** | Modeling and aggregating social network data. | | | | | | |

**UNIT –I**

Thinking and Intelligent Web Applications, The Information Age ,The World Wide Web, Limitations of Today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map, Logic on the semantic Web.

**UNIT -II**

Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web – Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML, XML/XML Schema. Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines.

**UNIT-III**

Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base ,XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods

**UNIT-IV**

What is social Networks analysis, Development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks. Building Semantic Web Applications with social network features.

**TEXT BOOKS:**

1. Thinking on the Web - Berners Lee, Godel and Turing, Wiley inter science, 2008.
2. Social Networks and the Semantic Web, Peter Mika, Springer, 2007.

**REFERENCE BOOKS:**

1. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J.Davies, R.Studer, P.Warren, John Wiley & Sons.
2. Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group)
3. Information Sharing on the semantic Web – HeinerStuckenschmidt; Frank Van Harmelen, Springer Publications.

| OE-IT-408A | Human Computer Interaction | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **0** | **0** | **2** | **75** | **25** | **100** | **3 Hour** |
| **Purpose** | **To Understand the structure of models and theories of human computer interaction and vision.** | | | | | | |
| | **Course Outcomes** | | | | | | |
| **CO1** | Learn the foundations of Human Computer Interaction | | | | | | |
| **CO2** | Be familiar with the design technologies for individuals and persons with disabilities | | | | | | |
| **CO3** | Be aware of mobile Human Computer interaction. | | | | | | |
| **CO4** | Learn the guidelines for user interface | | | | | | |

**Unit 1**

Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity-Paradigms.

**Unit 2**

Interactive Design basics – process – scenarios – navigation – screen design –Iteration and prototyping. HCI in software process – software life cycle –usability engineering – Prototyping in practice – design rationale. Design rules– principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

**Unit 3**

Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

**Unit 4**

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow.Case Studies.

**References**


- Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, 3rd Edition, Pearson Education, 2004 (UNIT I , II & III)
- Brian Fling, “Mobile Design and Development”, First Edition , O Reilly Media Inc., 2009
- Bill Scott and Theresa Neil, “Designing Web Interfaces”, First Edition, O Reilly, 2009.

| OE-IT-410A | Information Security | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | | **-** | **2** | **75** | **25** | **100** | **3Hr.** |
| **Purpose** | **The course will be useful for students who plan to do research/product development/analysis in areas related to secure computing in their career.** | | | | | | |
| **Course Outcomes** | | | | | | | |
| ***CO 1*** | To learn basics of network security and cryptography. | | | | | | |
| ***CO 2*** | To study network authentication mechanism, with security algorithms. | | | | | | |
| ***CO 3*** | To explore the knowledge of key exchange protocols. | | | | | | |
| ***CO 4*** | To realize the effect on digitized security. | | | | | | |

## Unit-1

**Attacks on Computers and Computer Security:** Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security.

**Cryptography: Concepts and Techniques:** Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, stenography, key range and key size, possible types of attacks.

## Unit-2

**Symmetric key Ciphers:** Block Cipher principles, Differential and Linear Cryptanalysis, Block cipher modes of operation, Stream ciphers, RC4, Location and placement of encryption function, Key distribution.

**Asymmetric key Ciphers:** Principles of public key crypto systems, Algorithms (RSA, Diffie-Hellman, and ECC), Key Distribution.

## Unit-3

**Message Authentication Algorithms and Hash Functions:** Authentication requirements, Functions, Message authentication codes, Hash Functions, Secure hash algorithm, HMAC, CMAC, Digital signatures, knapsack algorithm

**Authentication Applications:** Kerberos, X.509 Authentication Service, Public – Key Infrastructure, Biometric Authentication.

**Unit-4**

**E-Mail Security:** Pretty Good Privacy, S/MIME.

**Web Security:** Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction

**Intruders, virus and Firewalls:** Intruders, Intrusion detection, password management, virus and related threats, Firewall design principles, types of firewalls.

**TEXT BOOKS**


1. William Stallings , *"Cryptography and Network Security"* :, Pearson Education,4″‘ Edition
2. Atul Kahate , "*Cryptography and Network Security*", McGraw Hill Edition


**REFERENCE BOOKS**


1. Cryptography and Network Security : Forouzan Mukho padhyay, MC Graw Hill, 2″" Edition
2. Mark Stamp ,*"Information Security, Principles and Practice"* Wiley India.
3. WM.Arthur Conklin, Greg White , *"Principles of Computer Security",* TMH


**NOTE:**

Eight questions are to be set in all by the examiner taking two questions from each unit. Students will be required to attempt five questions in all, selecting at least one question from each unit.

| OE-IT-412A | Image Processing | | | | | | |
|---|---|---|---|---|---|---|---|
| L | T | P | Credit | Major Test | Minor Test | Total | Time |
| 2 | - | -- | 2 | 75 | 25 | 100 | 3Hr. |
| Purpose | The objective of this course is to prepare students to conduct research in Image Processing. | | | | | | |
| | Course outcomes | | | | | | |
| CO 1 | To Understand key algorithms for point, neighborhood, and geometric operations | | | | | | |
| CO 2 | To study image transformation methods. | | | | | | |
| CO 3 | To study different techniques of image compression. | | | | | | |
| CO 4 | To study different attributes of images. | | | | | | |

## Unit-1

**Digital image fundamentals**, application of digital image processing, elements of digital image processing systems, vidicon camera, Line scan CCD sensor, area sensor, flash A/D converter display – elements of visual perception, structure of the human eye, Luminance, brightness, contrast, mach band effect, image fidelity criteria, color models, - RGB, CMY, HIS mathematical preliminaries of 2D systems, convolution, Fourier transform – ZS transform – toeplitz and circulant matrices, orthogonal and unitary matrices.

## Unit- 2

**Image transforms**, Unitary transform, 2D, DFT, DCT, DST, Discrete wavelet transform, Discrete Hadamard, Walsh, Hostelling transform, SVD transform, Slant Haar transforms. Image Enhancement and Restoration: Constrast stretching, intensity level slicing, Histogram equalization, spatial averaging, directional smoothing, Median filtering, nonlinear filters, maximum, minimum, geometric mean contra harmonic mean, LP mean filters, edge detection, Roberts, Sobel, Isofropic, Kinesh, Campass gradient, Laplacian operators.

## Unit- 3

**Degradation model** - unconstrained and constrained restoration, inverse filtering, removal of blur caused by uniform linear motion, Wiener filtering, geometric transformations for image restoration.

## Unit –4

**Image compression**- Huffman coding, truncated Huffman coding, Br, Binary codes, arithmetic coding, bit plane coding contrast area coding, Run length encoding, transform coding JPEG and MPEG coding schemes. Image Segmentation, pixel based approach, feature threshold, choice of feature, optimum threshold, threshold selection methods, region based approach, region growing, region splitting, region merging, spilt and merge.

**Text books :**


1. Gonzalez, R.C. and Woods, R.E., “Digital image processing”, AddisonWesley.
2. A.K.Jain, “Fundamentals of Digital Processing”,PHI.

**Reference Books**

1. Umbaugh, S.E. “Computer vision and image processing”, Prentice Hall Int.NJ
2. W. Pratt, “Digital Image Processing”, WileyInter-science

| OE-IT-414A | IPR, Bioethics& Bio-safety | | | | | | |
|---|---|---|---|---|---|---|---|
| L | T | P | Credit | Major Test | Minor Test | Total | Time |
| 2 | - | -- | 2 | 75 | 25 | 100 | 3 Hr. |
| **Purpose** | **To introduce basic concepts of ethics and safety that are essential for different disciplines of science and procedures involved and protection of intellectual property and related rights. To understand balanced integration of scientific and social knowledge in sustainable development.** | | | | | | |
| | **Course outcomes** | | | | | | |
| **CO 1** | Understand the basic issues of bio-safety, bioethics and IPR arising from the commercialization of biotech products. | | | | | | |
| **CO 2** | Follow the regulatory framework in their future venture to ensure product safety and benefit the society | | | | | | |
| **CO 3** | Aware students about the society's moral principles and not violate or breach laws. | | | | | | |
| **CO 4** | Perform project management and choosing & processing the most appropriate form of IPR for protection of their research/ end product. | | | | | | |

## Unit - I

Biosafety: Introduction; Historical background; Biosafety in the laboratory; Laboratory associated infections and other hazards; Biosafety management for environmentally safe use ofbiotechnology;Biosafetyguidelines;RecommendedBiosafetyLevelsforInfectiousAgents and Infected Animals; Definition of GMOs & LMOs; Good manufacturing practices (GMP) and Good lab practices( GLP); Overview of National Regulations and relevant International AgreementsincludingCartagenaProtocol;RolesofInstitutionalBiosafetyCommittee(IBSC), RCGM,GEAC,MEC,SBCC,DLCandRDAC;Guidelinesforresearchintransgenicsciences and release of GMOs to environment; Bioterrorism and convention on biological weapons

## Unit- II

Bioethics: Ethical issues related to biotechnology research; Ethical issues associated with consumptions of genetically modified foods and other products, Ethical implications of human genome project, Social and ethical implications of biological weapons, Bioremediations and environmentalimpactsofusingGMOs;Ethicsofpatenting-anditsimpactonbiodiversityrich developing countries; Use of animals for research and testing and Alternatives for Animals in Research.

## Unit - III

Social, economic and legal issues related to biotechnology: Public education of the processes of biotechnology involved in generating new forms of life for informed decision making; Testing of drugs on human volunteers; Human cloning and Gene therapy - ethical and social issues; Organ transplantation- ethical and legal implications; Research focus to address the need of the poor and of environment.

Industrial licensing, venture capital, Biotechnological industries in India and potential job opportunities.

## Unit - IV

Intellectual Property Rights: Intellectual property rights and IPR protection; Patenting and the procedureinvolvedintheapplicationofpatentsandgrantingofapatent;Compulsorylicenses;
Legislations covering IPR's in India, Patent search; Patent Cooperation Treaty (PCT); Traditional knowledge commercial exploitation; Farmers rights; Plant breeder's rights; International and National conventions on Biotechnology and related areas- GATT, TRIPS, Biodiversity convention,etc.

**Recommended Books:**


1. Thomas, J. A. and Fuch, R. L. Biotechnology and Safety Assessment. Academic Press.(2002).
2. Fleming, D. A., Hunt, D. L., Biological safety Principles and practices. ASM Press. (2000).
3. Sateesh, M. K. Bioethics & Biosafety, IK Publishers.(2008).
4. Singh B. D. Biotechnology: Expanding Horizon. Kalyani; edition(2015)
5. Singh K., Intellectual Property Rights on Biotechnology BCIL, New Delhi.(2008).
6. Desai, V., Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House(2007).
7. Singh, I. and Kaur, B., Patent law and Entrepreneurship, Kalyani Publishers(2006).
8. Goel and Prashar, IPR, Biosafety and Bioethics, Pearson education, India(2013)

| OE-IT-416A | Sensor and Transducer | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **0** | **0** | **2** | **75** | **25** | **100** | **3 Hour** |
| **Purpose** | **To make the students conversant with sensor and transducer based electronics system** | | | | | | |
| | **Course Outcomes** | | | | | | |
| **CO1** | To familiarize the students about Static characteristics of sensor and transducer base Instruments | | | | | | |
| **CO2** | To introduce the students to various errors while using measurement systems | | | | | | |
| **CO3** | Application of transducers for measuring non electrical quantities | | | | | | |
| **CO4** | Introduction to Display devices and Data acquisition system | | | | | | |

## UNIT 1

**Introduction to Measurement and instrumentation: Measurement**; Instrumentation; Significance of measurement; Why study measurement systems, Classification of types of measurement application ; Methods and Modes of measurement , Generalized measurement system and its functional elements.

**Static Characteristics of Sensor and Transducer base Instruments :** Define 1) True or actual value ; 2) Static error , 3) Indicated value ; 4) Correction ; 5) Range ; 6) Span ; 7) Sensitivity ; 8) Resolution ; 9)Threshold ; 10) Response ;11) Response time ; 12) Gain ; 13) Linearity ; 14)Scale sensitivity ; 15) Scale readability ; 16 ) Reproducibility ; 17) Accuracy ; 18) Precision ; 19) Tolerance ; 20) Dead band ; 21) Backlash ; 22) Drift ; 23) stability ; 24) Uncertainty ; 25 ) Hysteresis ; 26) Static calibration

## UNIT 2

**Dynamic Characteristics:** Define **:** 1)Transient response 2) Dynamic error ; 3) Fidelity ; 4) Bandwidth ; 5) Speed of response ; 6) Time constant ; 7) Measuring Lag ; 8) Settling or response time ; 9) Dynamic range

**Errors in measurement :** Significant Figures ; Limiting or Guarantee Errors ; Relative Limiting Error ; Absolute Error ; Types of error – a) Gross error , b) Systematic Error c) Random or Accidental error ; Sources of error

## UNIT 3

**Sensors and Transducers (Electrical):** What is a transducer? ; Classification of transducer, Factors influencing choice of transducer; Advantages and disadvantages of electrical transducers, Basic requirement of Transducers;

**Measurement of Non electrical quantities using sensors / Transducers** : Strain Gage , Types of strain gage , Thermocouple ; Measurement of thermocouple output ; Temperature measurement using Thermister ; Linear Variable Differential Transformer ( LVDT) ; Advantages and disadvantages of LVDT , Measurement of linear displacement using LVDT ; Measurement of Angular displacement using RVDT ; Pressure measurement using Bourdon tube and LVDT ; Speed measurement using AC and DC tachometer ; Measurement of liquid level using a) Variable dielectric method b) Float and voltage divider method

## UNIT 4

**Display and Recorders :** Seven segment display ; Liquid Crystal Display ; Plasma display ; Strip Chart Recorder ; X Y Recorder ; UV recorder ;
**Data Acquisition System and Telemetry :** Generalized Data Acquisition system ( DAS) **,** Objectives of DAS ; Configuration of DAS ; Single and multiple channel DAS ; Signal Conditioning ; Necessity of Signal conditioning , Functions of signal conditioning equipment ; General Telemetry System , Types of Telemetry

**Suggested books**

- Doebelin and Manik , “Measurement Systems” , McGraw Hill
- Smaili and Mrad , “Mechatronics” , Oxford
- R. K. Rajput , “Electrical Electronics measurement and Instrumentation“ , S Chand
- J.B Gupta , “ A course in Electronic and Electrical Measurements and Instrumentation “ , Katsons
- Nakra and Choudhary , “ Instrument Measurement and Analysis” , Tata McGraw Hill
- A. K .Sawhney , “A course in Electrical and Electronic Electrical Measurements and Instrumentation” , DhanpatRai and Co.

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

| PE-IT-A410A | Mobile Application Development Lab | | | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Credit** | **Practical** | **Minor Test** | **Total** | **Time** |
| **0** | **0** | **4** | **2** | **60** | **40** | **100** | **3 Hour** |
| **Purpose** | **In this lab, a student is expected to design, implement, document and present a mobile** | | | | | | |
| | **Course Outcomes** | | | | | | |
| **CO1** | Build a native application using GUI components and Mobile application development | | | | | | |
| **CO2** | Develop an application using basic graphical primitives and databases | | | | | | |
| **CO3** | Construct an application using multi threading and RSS feed | | | | | | |
| **CO4** | Make use of location identification using GPS in an application | | | | | | |

**LIST OF PRACTICALS:**

1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Implement an application that implements Multi threading
6. Develop a native application that uses GPS location information.
7. Implement an application that writes data to the SD card.
8. Implement an application that creates an alert upon receiving a message.
9. Write a mobile application that creates alarm clock.
10. Develop a sign-in page with appropriate validation.
11. Develop a real life application that makes use of database.

**Note:** A student has to perform at least 10 experiments. At least seven experiments should be performed from the above list. Three experiments may be designed & set by the concerned institution as per the scope of the syllabus.

# Bachelor of Technology (CIVIL Engineering), KUK

*SCHEME OF STUDIES/EXAMINATIONS (Modified)*

**(Semester -IV) Credit-Based (w.e.f. 2021-22)**

| S. No. | Course No./ Code | Subject | L:T:P | Hours/ Week | Credits | Examination Schedule (Marks) | | | | Duration of exam (Hours) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Major Test | Minor Test | Practical | Total | |
| 1 | HTM-901A | Universal Human Values II : Understanding Harmony | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | ES-205A | Engineering Mechanics | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 3 | CE-202A | Structural Analysis-I | 3:1:0 | 4 | 4 | 75 | 25 | 0 | 100 | 3 |
| 4 | CE-204A | Design of Steel Structure-I | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 5 | CE-206A | Soil Mechanics | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 6 | CE-208A | Hydraulic Engineering | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 7 | CE-212LA | Structural Analysis-I Lab | 0:0:2 | 2 | 1 | - | 40 | 60 | 100 | 3 |
| 8 | CE-216LA | Soil Mechanics Lab | 0:0:2 | 2 | 1 | -- | 40 | 60 | 100 | 3 |
| 9 | CE-218LA | Hydraulic Engineering Lab | 0:0:2 | 2 | 1 | -- | 40 | 60 | 100 | 3 |
| | | Total | 18:1:6 | 25 | 22 | 450 | 270 | 180 | 900 | |

| HTM-901A | Universal Human Values II: Understanding Harmony | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3.0** | **75** | **25** | **100** | **3 Hours** |
| **Purpose** | Purpose and motivation for the course, recapitulation from Universal Human Values-I | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO 1** | Development of a holistic perspective based on self-exploration about themselves (human being),family, society and nature/existence. | | | | | | |
| **CO 2** | Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence. | | | | | | |
| **CO 3** | Strengthening of self-reflection. | | | | | | |
| **CO 4** | Development of commitment and courage to act. | | | | | | |

**Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' andExperiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment ofaspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at variouslevels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrarinessin choice based on liking-disliking

**Module 2: Understanding Harmony in the Human Being - Harmony in Myself!**

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

**Module 3: Understanding Harmony in the Family and Society- Harmony in**

**Human-HumanRelationship**

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as thefoundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the othersalient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- fromfamily to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

**Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" canbe used), pollution, depletion of resources and role of technology etc.

**Module 5: Implications of the above Holistic Understanding of Harmony on ProfessionalEthics**

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and

organizations

28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. todiscuss the conduct as an engineer or scientist etc.

**READINGS:**

**Text Book**

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010

**Reference Books**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J CKumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

**MODE OF CONDUCT**

Lecture hours are to be used for lecture/practice sessions.

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at handand motivating students to reflect, explore and verify them.

Practice hours are to be used for practice sessions.

While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elementsto help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions, the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration. Scenarios may be used to initiate discussion. The student is encouraged to take up" ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Practice experiments are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based onbasic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.
This course is to be taught by faculty from every teaching department, including HSS faculty. Teacher preparation with a minimum exposure to at least one 8-day FDP on Universal Human Values is deemed essential.

**ASSESSMENT:**
This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.
Example:
Assessment by
faculty mentor: 5 marks
Self-assessment: 5 marks
Assessment by peers: 5 marks
Socially relevant project/Group Activities/Assignments: 10 marks
Semester End Examination: 75 marks
The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

**Bachelor of Technology (CIVIL Engineering), KUK**
**CreditBased (2018-19 Onwards)**
*SCHEME OF STUDIES/EXAMINATIONS (***Semester VII***)*

| S. No. | Course No./ Code | Subject | L:T:P | Hours/ Week | Credits | Examination Schedule (Marks) | | | | Duration of exam (Hours) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Major Test | Minor Test | Practical | Total | |
| 1 | CE401A | Design of Concrete StructureII | 2:0:0 | 2 | 2 | 75 | 25 | 0 | 100 | 3 |
| 2 | ES212A | Energy Science & Engineering | 2:0:0 | 2 | 2 | 75 | 25 | 0 | 100 | 3 |
| 3 | CE405A | Water Resources Engineering | 2:0:0 | 2 | 2 | 75 | 25 | 0 | 100 | 3 |
| 4 | OEII | Open ElectiveII | 2:0:0 | 2 | 2 | 75 | 25 | 0 | 100 | 3 |
| 5 | ELIII | ElectiveIII | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 6 | ELIV | ElectiveIV | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 7 | CE411LA | Concrete Drawing | 0:0:3 | 3 | 1.5 | | 40 | 60 | 100 | 3 |
| 8 | ES212LA | Energy Science & Engineering Lab | 0:0:2 | 2 | 1 | | 40 | 60 | 100 | 3 |
| 9 | CE415LA | Minor Project | 0:0:8 | 8 | 4 | | 40 | 60 | 100 | 3 |
| 10 | SIM903A | Seminar on Summer Internship | 1:0:0 | 1 | 0 | | 50 | | 50 | 3 |
| | | Total | 15:0:13 | 28 | 22.5 | 450 | 320 | 180 | 950 | |

**Note: (1) SIM903A is a credit course in which the students will be evaluated for the Summer Internship (training) undergone after 6th semester.**

**(2)The students have to carry out the MINOR Project either from Transportation Engineering, Hydraulic Engineering and GeotechnicalEngineering.**

## OPEN ELECTIVE II

| Sl. No | Code No. | Subject | Semester | Credits |
|---|---|---|---|---|
| 1. | OE407A | Metro Systems and Engineering | VII | 3 |
| 2. | OE409A | Indian Music System | VII | 3 |
| 3. | OE417A | Introduction to Philosophical Thoughts | VII | 3 |

## ELECTIVEIII A

| Sl. No | Code No. | Subject | Semester | Credits |
|---|---|---|---|---|
| 1. | EL419A | Environmental Impact Assessment | VII | 3 |
| 2. | EL421A | Air and Noise Pollution Control | VII | 3 |
| 3. | EL423A | Foundation engineering | VII | 3 |
| 4. | EL425A | Rock Mechanics | VII | 3 |

## ELECTIVEIV A

| Sl. No | Code No. | Subject | Semester | Credits |
|---|---|---|---|---|
| 1. | EL427A | Railway Engineering | VII | 3 |
| 2. | EL429A | Airport Planning and Design | VII | 3 |
| 3. | EL431A | River Engineering | VII | 3 |
| 4. | EL433A | Pipeline Engineering | VII | 3 |

**Bachelor of Technology (CIVIL Engineering), KUK**
**CreditBased (2018-19 Onwards)**
*SCHEME OF STUDIES/EXAMINATIONS* **(Semester VIII)**

| S. No. | Course No./ Code | Subject | L:T:P | Hours / Week | Credits | Examination Schedule (Marks) | | | | Duration of exam (Hours) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Major Test | Minor Test | Practical | Total | |
| 1 | CE402A | Engineering Economics, Estimation & Costing | 2:0:0 | 2 | 2 | 75 | 25 | 0 | 100 | 3 |
| 2 | CE404A | Bridge Engineering | 2:0:0 | 2 | 2 | 75 | 25 | 0 | 100 | 3 |
| 3 | OEIII | Open ElectiveIII | 2:0:0 | 2 | 2 | 75 | 25 | 0 | 100 | 3 |
| 4 | ELV | ElectiveV | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 5 | ELVI | ElectiveVI | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 6 | CE412LA | Compressive Viva | 0:0:0 | 0 | 0 | | | 50 | 50 | 3 |
| 7 | CE414LA | Major Project | 0:0:10 | 10 | 5 | | 40 | 60 | 100 | 3 |
| 8 | CE LA | SeminarII | 0:0:2 | 2 | 0 | | 50 | 0 | 50 | 3 |
| | | Total | 12:0:12 | 24 | 19 | 375 | 215 | 110 | 700 | |

**Note: The student have to carry out the MAJOR Project either from Structural Engineering, Environmental Engineering and Water ResourceEngineering.**

## OPEN ELECTIVE – III

| Sl. No | Code No. | Subject | Semester | Credits |
|---|---|---|---|---|
| 1. | OE406A | ICT for Development | VIII | 3 |
| 2. | OE408A | Comparative Study of Literature | VIII | 3 |
| 3. | OE410A | History of Science & Engineering | VIII | 3 |
| 4 | OE418A | Economic Policies in India | VIII | 3 |

## ELECTIVEV A

| Sl. No | Code No. | Subject | Semester | Credits |
|---|---|---|---|---|
| 1. | EL420A | Prestress Concrete | VIII | 3 |
| 2. | EL422A | Earthquake Engineering | VIII | 3 |
| 3. | EL424A | Offshore Engineering | VIII | 3 |
| 4. | EL426A | Structural Geology | VIII | 3 |

## ELECTIVEVI A

| Sl. No | Code No. | Subject | Semester | Credits |
|---|---|---|---|---|
| 1. | EL428A | Wastewater Treatment | VIII | 3 |
| 2. | EL430A | Water and Air Quality Modelling | VIII | 3 |
| 3. | EL432A | Traffic Engineering and Management | VIII | 3 |
| 4. | EL434A | Infrastructure Planning and Design | VIII | 3 |

| B. Tech. VII Semester (Civil Engineering) | | | | | |
|---|---|---|---|---|---|
| **SUBJECT: DESIGN OF CONCRETE STRUCTUTRESII** | | | | | |
| L | T | P/D | Total | **Subject Code: CE-401A** | Max. Marks: 100 |
| 2 | 0 | 0 | 2 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |

| | |
|---|---|
| Course Objective | Students will acquire the knowledge about the design of concrete structures like Beam, Slabs, Stair case, Water Tanks and Building frames. |
| **UNIT** | **Course Outcomes** |
| I | Students will be able to study behavior in the Beam and Prestressed concrete – moments, shear and design of beam. |
| II | Students will be able to design different types of Slabs, Stair case and Foundations. |
| III | Students will be able to design of Water tanks, Silos and Bunkers. |
| IV | Students will be able to analyze the frames structures |

## UNIT I

**Continuous Beams:**
Basic assumptions, Moment of inertia, settlements, Modification of moments, maximum moments and shear, beams curved in plananalysis for torsion, redistribution of moments for single and multispan beams, design examples.

**Prestressed Concrete:**
Basic principles, classification of prestressed members, various Prestressing systems, losses in prestress, initial and final stress conditions, analysis and design of sections for flexure and shear, load balancing concept, I:S:Specifications. End blocksAnalysis of stresses, Magnel's method, Guyon's method, Bursting and spelling stresses, design examples.

## UNIT II

**Flat slabs and staircases:**
Advantages of flat slabs, general design considerations, approximate direct design method, design of flat slabs, openings in flat slab, design of various types of staircases, design examples.

**Foundations:**
Combined footings, raft foundation, design of pile cap and piles, underreamed piles, design examples.

## UNIT III

**Water Tanks, Silos and Bunkers:**
Estimation of Wind and earthquake forces, design requirements, rectangular and cylindrical underground and overhead tanks, Intze tanks, design considerations, design examples. Silos and BunkersVarious theories, Bunkers with sloping bottoms and with high side walls, battery of bunkers, design examples.

## UNIT IV

**Building Frames:**
Introduction, Member stiffness's, Loads, Analysis for vertical and lateral loads, Torsion in buildings, Ductility of beams, design and detailing for ductility, design examples.

**Yield Line Theory:**
Basic assumptions, Methods of analysis, yield line patterns and failure mechanisms, analysis of one way and two way rectangular and nonrectangular slabs, effect of top corner steel in square slabs, design exampl

**Books:**

1. Plain and Reinforced Concrete, Vol.2, Jai Krishna &O.P.Jain, Nem Chand & Bros.,Roorkee.
2. PreStressed Concrete, Krishna Raju, TMH Pub,New, Delhi.
3. Design of Prestressed Concrete Structures, T.Y.Lin, John Wiley &Sons, New .Delhi.
4. Reinforced ConcreteLimit Stage Design, A.K.Jain, Nem Chand & Bros., Roorkee.
5. IS 13431980,IS Code of Practice for Prestressed Concrete.
6. IS 33701976(Part I to IV), Indian Standard Code of Practice for Liquid Retaining Structures.
7. IS 4562000, Indian Standard of Practice for Plain and Reinforced Concrete, IS 1893, 4326 & 13920 Indian Standard Code of Practice for Earthquake Resistant Design of Structures.

| B. Tech. VII Semester (Civil Engineering) | | | | | |
|---|---|---|---|---|---|
| **SUBJECT: Energy Science & Engineering** | | | | | |
| L | T | P/D | Total | **Subject Code: ES-212A** | Max. Marks: 100 |
| 2 | 0 | 0 | 2 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |

| | |
|---|---|
| Course Objective | The knowledge acquired lays a goodfoundation for design of various civil engineering systems/ projects dealing with these energy generation paradigms in an efficient manner. |
| **UNIT** | **Course Outcomes** |
| I | To provide an introduction to energy systems and renewable energy resources |
| II | It will explore fossil fuels and nuclear energy, and then focus on alternatives, renewable energy sources such as solar, biomass (conversions), wind power, waves and tidal, geothermal, ocean thermal, hydro and nuclear. |
| III | It will explore society's present needs and future energy demands, examine conventional energy sources. |
| IV | Energy conservation methods will be emphasized from Civil Engineering perspective. |

**UNIT I**

**Introduction to Energy Science:** Introduction to Energy, sustainability & the environment, Energy systems and resources Scientific principles and historical interpretation of energy use in critical societal, environmental and climate issues.

**UNIT II**

**Energy Sources:** Fossil fuels (coal, oil, oilbearing shale and sands, coal gasification) past, present & future, Remedies & alternatives for fossil fuels biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sustainability and environmental tradeoffs of different energy systems; possibilities for energy storage or regeneration.

**UNIT III**

**Energy & Environment:** Energy efficiency and conservation; introduction to clean energy technologies and its importance in sustainable development; Carbon footprint, energy consumption and sustainability; economics of energy.

**UNIT IV**

**Civil Engineering Projects connected with the Energy Sources:** Coal mining technologies, Oil exploration off shore platforms, Underground and undersea oil pipelines, solar chimney project, wave energy caissons, coastal installations for tidal power, wind mill towers; hydro power stations aboveground and underground along with associated dams, tunnels, penstocks, etc.

**Books:**


1. Boyle, Godfrey (2004), Renewable Energy (2nd edition). Oxford University Press
2. Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press
3. Schaeffer, John (2007), Real Goods Solar Living Sourcebook: The Complete Guide to Renewable Energy Technologies and Sustainable Living, Gaiam

4. JeanPhilippe; Zaccour, Georges (Eds.), (2005), Energy and Environment Set: Mathematics of
Decision Making, Loulou, Richard; Waaub, XVIII,
5. Ristinen, Robert A. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A. (2006) Energy
and the Environment, 2nd Edition, John Wiley
6. UNDP (2000), Energy and the Challenge of Sustainability, World Energy assessment
7. E H Thorndike (1976), Energy & Environment: A Primer for Scientists and Engineers, AddisonWesley Publishing Company

<table>
<tr><td colspan="6">B. Tech. VII Semester (Civil Engineering)</td></tr>
<tr><td colspan="6">SUBJECT: Water Resource Engineering</td></tr>
<tr><td>L</td><td>T</td><td>P/D</td><td>Total</td><td>Subject Code: CE-405A</td><td>Max. Marks: 100</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>2</td><td></td><td>Theory: 75 marks</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>Sessional: 25 Marks</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>Duration: 3 hrs.</td></tr>
<tr><td colspan="2">Course Objective</td><td colspan="4">Understand application of systems concept, advanced optimization techniques to cover the sociotechnical aspects in the field of water resources</td></tr>
<tr><td colspan="2">UNIT</td><td colspan="4">Course Outcomes</td></tr>
<tr><td colspan="2">I</td><td colspan="4">Students will able to study the concept of water resource planning</td></tr>
<tr><td colspan="2">II</td><td colspan="4">Students will of understand basics of economics</td></tr>
<tr><td colspan="2">III</td><td colspan="4">Students will study about water resource systems</td></tr>
<tr><td colspan="2">IV</td><td colspan="4">Students Will study about application of system approaches for water resources</td></tr>
</table>

## UNIT I

**Water Resources Planning:**

Role of water in national development, assessment of water resources, planning process, environmental consideration in planning, system analysis in water planning, somecommon problems in project planning, functional requirements in multipurpose projects,multipurpose planning, basin wise planning, long term planning.Reservoir planningdependable yield, sedimentation in reservoir, reservoir capacity,empiricalarea reduction method.

## UNIT II

**Economic and Financial Analysis:**

Meaning and nature of economic theory, micro and macroeconomics, the concept ofequilibrium, equivalence of kind, equivalence of time and value, cost benefit, discountingfactors and techniques, conditions for project optimality, cost benefit analysis, cost allocation, separable and nonseparable cost, alternate justifiable and remaining benefitmethods, profitability analysis.

## UNIT III

**Water Resources Systems Engineering:**

Concept of system's engineering, optimal policy analysis, simulation and simulationmodeling, nature of water resources system, analog simulation, limitations of simulation,objective function, production function, optimality condition, linear, nonlinear anddynamic programming, applications to real time operations of existing system,hydrologic modeling and applications of basic concepts.

## UNIT IV

**Applications of System Approach in Water Resources:**

Applications of system engineering in practical problems like hydrology, irrigation anddrainage engineering, distribution network, and mathematical models for forecasting andother water resources related problems.

**Books:**


1 Water Resources Engineering by Linseley and Franzini

2 Economics of Water Resources Engineering by James and Lee.

3 Optimisation Theory and Applications by S.S.Roy

4 Water Resources Systems Planning & Economics by R.S.Varshney.

5 Operational ResearchAn Introduction by HamdyA.Taha.

| B. Tech. VII Semester (Civil Engineering) | | | | | |
|---|---|---|---|---|---|
| **SUBJECT: Metro Systems and Engineering** | | | | | |
| L | T | P/D | Total | **Subject Code: OE-407A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |
| Course Objective | To impart the knowledge about basic engineering principles of Metro System. | | | | |
| **UNIT** | **Course Outcomes** | | | | |
| I | Students will be able to know about the metro systems. | | | | |
| II | Students will be able to learn about different metro structures and their construction methods. | | | | |
| III | Students will be able to learn about electronic signaling systems and Automatic fare collection. | | | | |
| IV | Students will be able to understand different facilities in metro. | | | | |

## Unit – I

**General:** Overview of Metro Systems; Need for Metros; routing studies; Basic Planning and Financials.

## Unit –II

**Civil Engineering** Overview and construction methods for: Elevated and underground Stations; Viaduct spans and bridges; Underground tunnels; Depots; Commercial and Service buildings. Initial Surveys & Investigations; Basics of Construction Planning & Management, Construction Quality & Safety Systems. Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systemspermanent way. Facilities Management

## UnitIII

**Electronics And Communication Engineering** Signaling systems; Automatic fare collection; Operation Control Centre (OCC and BCC); SCADA and other control systems; Platform Screen Doors.

## UnitIV

**Mechanical &TVS, AC:** Rolling stock, vehicle dynamics and structure; Tunnel Ventilation systems; Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators. ELECTRICAL: OHE, Traction Power; Substations TSS and ASS; Power SCADA; Standby and Backup systems.

**Textbook:**

1. Guidebook on Delhi Metro, DMRC
2. World Metro System, Paul. E. Garbutt.
3. Metro Rail in India for Urban Mobility, M.M Agarwal, S.Chandra, K.K Miglani

| B. Tech. VII Semester (Civil Engineering) | | | | | |
|---|---|---|---|---|---|
| **SUBJECT: Indian music system** | | | | | |
| L | T | P/D | Total | **Subject Code: CE-409A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |
| Course Objective | To learn basic concept of Indian Music. | | | | |
| **UNIT** | **Course Outcomes** | | | | |
| I | Students will be able to learn about ragas | | | | |
| II | Students will be able to understand to learn about different notation of sound. | | | | |
| III | Students will able to learn notation compositions. | | | | |
| IV | Students will learn theory of ragas. | | | | |

**UNIT I**

Raga, Va( Nada, Swara, Shruti, Raga, Mela ( Thata), Alankar, Tana, Gamak, Sthaya, Kaku, MargiDeshi, RagalapRupkalap, Vadi, Samvadi, Anuvadi, Vivadi, Tala, Laya, Avirbhav, Tirobhav, Parmelpraveshak Raga, Sandhiprakash ggeyakara, Kalawant.

**UNIT II**

Vibration, Pitch, Intensity, Timbre, Just intonation, Equal tempered scale, forced Vibration, Free Vibration.

**UNIT III**

Notation of compositions in prescribed ragas.

**UNIT IV**

Theoretical knowledge of prescribed ragas.

**Books**


1. S.S. Paranjape Bhartiya Sangeet Ka Itihasa
2. S.S. Paranjape Sangeet Bodh
3. V.N. Bhatkhande Bhatkhande Sangeet Shastra PartIII
4. Swami Prajnananda History of Indian Music

| | | | | | |
|---|---|---|---|---|---|
| **B. Tech. VII Semester (Civil Engineering)** | | | | | |
| **SUBJECT: Introduction to Philosophical Thoughts** | | | | | |
| L | T | P/D | Total | **Subject Code**: **OE-417A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |
| Course Objective | | Students will acquire the knowledge about the Philosophical concepts | | | |
| **UNIT** | | **Course Outcomes** | | | |
| I | | Students will be able to understand concept of philosophy | | | |
| II | | Students will be able to understand concept of ethics | | | |
| III | | Students will be able to understand concept of philosophy of religion | | | |
| IV | | Students will be able to understand concept of aesthetics | | | |

## UNIT I

**Introduction to Class:** Introduction to Philosophy and its worldview. 7 fold criteria for analysis, Presocratic Philosophy, Metaphysics & Epistemology: Ancient (Plato; Aristotle), Medieval (Plotinus; St. Augustine; St. Aquinas), Metaphysics & Epistemology continued: Stoicism, Epicureanism, Skepticism, & NeoPlatonism Berkeley; Leibniz; Spinoza; Locke; Hume; Kant; Introduction to Continental Philosophy

## UNIT II

**Introduction to Ethics:** Virtue, Deontological, & Consequential Ethics: Consequential Ethics; Utilitarianism (Jeremy Bentham; John Stuart Mill); Egoism of Ayn Rand; Relativism; Ethics of Care vs. Ethics of Justice (Carol Gilligan) Existentialism/ Nihilism

## UNIT III

**Introduction to Philosophy** of Religion: Existence of God: Arguments; Evidences; Existential; Religious Experience, Problem of Evil: Moral Evil: Natural Evil: God as Origin of Evil; Natural Evil; Pointless Evil, Problem of Miracles:

## UNIT IV

**Introduction to Aesthetics:** Historical Survey: From Plato to Kuspit Read and discuss“Aesthetic Universals” by Denis Dutton Aesthetics continued: Objective/subjective beauty; aesthetic value; aesthetic experience

**Books:**

The Power of Idea, Book by Isaiah Berlin

| | | | | | |
|---|---|---|---|---|---|
| **B. Tech. VII Semester (Civil Engineering)** | | | | | |
| **SUBJECT: Environmental Impact Assessment** | | | | | |
| L | T | P/D | Total | **Subject Code: EL-419A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |
| Course Objective | The aim of study is to understand the effect of Environment , Air and Water pollution on environment | | | | |
| **UNIT** | **Course Outcomes** | | | | |
| I | Students will study the different sources of Environment pollution | | | | |
| II | Students will study the different sources of Air pollution and its effects | | | | |
| III | Students will study about the Waste management and its disposal of waste | | | | |
| IV | Students will study about Environmental assessment | | | | |

### UNIT I

**Environment and Human Activity**: Resources, pollution, reuse and environmental management. Management of Aquatic Environment: Water quality controls. Drainage basin activities and water pollution. The impact of human activity on aquatic resources. The control measures, regional planning.

### UNIT II

**Air Quality Management:** Atmosphere, effect of human activity on air quality, waste disposal alternative. Optimization, planning of waste disposal.

### UNIT III

**Waste Management:** Waste disposal methods, impact of waste disposal of human activity. Land Use Management: Impact of land use on human life. Control, of hazards in land use, management of land use.

### UNIT IV

**Environmental Assessment:** National environmental policy, implication of environment assessment in design process. Preparation of assessment, quantification. General requirements of environmental standards. Techniques of setting standards.

**Books:**


1. Environmental Impact Analysis by R.K. Jail and L.V. Urban.
2. Environmental Impact Assessment by Canter
3. Environmental Impact Assessment by J.Glasson.

| B. Tech. VII Semester (Civil Engineering) | | | | | |
|---|---|---|---|---|---|
| **SUBJECT: Air and Noise Pollution Control** | | | | | |
| L | T | P/D | Total | **Subject Code EL-421A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |
| Course Objective | To impart the knowledge about basic engineering principles of River Engineering | | | | |
| **UNIT** | **Course Outcomes** | | | | |
| I | To take up the basic concepts of air pollution | | | | |
| II | The contents involved the knowledge of causes of air pollution | | | | |
| III | The contents involved the knowledge of health related to air pollution and to develop skills relevant to control of air pollution. | | | | |
| IV | To take up the basic concepts of Noise pollution | | | | |

## Unit I

Introduction: History of Air pollution and episodes, Sources of air pollution and types, Introduction to meteorology and transport of air pollution: Global winds, Headley cells, wind rose terrestrial wind profile, Effects of terrain and topography on winds, lapse rate, maximum mixing depths, plume rise

## Unit II

Effects of Air Pollution: Effects of Air Pollution on human beings, plants and animals and Properties. Global EffectsGreen house effect, Ozone depletion, heat island, dust storms, Automobile pollution sources and control, Photochemical smog, Future engines and fuels

## Unit III

Air Pollution control: Air Pollution control at sourceequipments for control of air pollutionFor particulate matterSettling chambersFabric filtersScrubbersCyclones, Electrostatic precipitators, For Gaseous pollutantscontrol by absorptionadsorption scrubberssecondary combustion after burners, Working principles advantages and disadvantages, design criteria and examples.

Air Quality Sampling and Monitoring: Stack sampling, instrumentation and methods of analysis of SO2, CO etc, legislation for control of air pollution and automobile pollution.

## Unit IV

Noise pollution: Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psychoacoustics and noise criteria, effects of noise on health, annoyance rating schemes; special noise environments: Infrasound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure. Noise indices. Noise control methods.

**Books:**

1. C. S. Rao, “Environmental Pollution Control Engineering”, Wiley Eastern Limited, 2000.

2. M. N. Rao, H. V. N. Rao, Air pollution, Tata McGraw Hill Pvt Ltd, New Delhi, 1993

3. Dr. Y. Anjaneyulu, “Air Pollution and Control Technologies”, Allied publishers Pvt. Ltd., 2002.
4. Advanced Air and Noise Pollution Control by Lawrence K. Wang, Norman C. Pereira & Yung Ise Hung.
5. Noise Pollution and Control by S. P.Singhal, Narosa Pub House

| B. Tech. VII Semester (Civil Engineering) | | | | | |
|---|---|---|---|---|---|
| **SUBJECT: Foundation Engineering** | | | | | |
| L | T | P/D | Total | **Subject Code: EL-423A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |
| Course Objective | To impart the knowledge on various soil exploration techniques, and analyses and design of various substructure | | | | |
| **UNIT** | **Course Outcomes** | | | | |
| I | Students will be able to study different types of soil exploration | | | | |
| II | Students will be able to study slope stability | | | | |
| III | Students will be able to understand Earth pressure theories | | | | |
| IV | Students will be able to understand shallow foundation and pile foundation | | | | |

## UNIT I

**Soil Exploration:** Need – methods of soil exploration – boring and sampling methods – penetration tests – plate load test – pressure meter – planning of soil exploration programand preparation of soil investigation report.

## UNIT II

**Slope Stability:** Infinite and finite earth slopes – types of failures – factor of safety of infiniteSlopes – stability analysis by Swedish slip circle method, method of slices, Bishop's Simplified method of slices – Taylor's Stability Number stability of slopes of earth dams under different conditions.

## UNIT III

**Earth Pressure Theories:** Atrest earth pressures, Rankin's theory of earth pressure – earth pressures in layered soils – Coulomb's earth pressure theory – Cullman's graphical method, effect of pore water, earth pressure due to surcharge loads.

**Retaining Walls:** Types of retaining walls – stability of gravity and cantilever retaining walls against overturning, sliding and, bearing capacity modes of failure, Drainage from backfill, introduction to reinforced earth walls.

## UNIT IV

**Shallow Foundations** Types choice of foundation, location and depth safe bearing capacity, shear criteria, Terzaghi's, and IS code methods settlement criteria, allowable bearing pressure based on SPT N value and plate load test, allowable settlements of structures.

**Pile Foundation:** Types of piles, load carrying capacity of piles based on static pileformulae, dynamic pile formulae – Pile Capacity through SPT and CPT results pile loadtests load carrying capacity of pile groups in sands and clays, Settlement of pile groups, negative skin friction

**TEXT BOOKS:**

1. Das, B.M., (2011) Principles of Foundation Engineering –7th edition, CengagePublishing.
2. Foundation Design Principles and Practices, Donald P. Coduto, 2nd Edition, PearsonPublishers.
3. Bowles, J.E., (2012) Foundation Analysis, and Design – 5th Edition, McGrawHill Publishing Company, Newyork.

| B. Tech. VII Semester (Civil Engineering) | | | | | |
|---|---|---|---|---|---|
| **SUBJECT: Rock Mechanics** | | | | | |
| L | T | P/D | Total | **Subject Code: EL-425A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |

| | |
|---|---|
| **Course Objective** | To impart the knowledge about rock mechanism. |
| **UNIT** | **Course Outcomes** |
| **I** | Students will be able to understand basic concepts of rock engineering |
| **II** | Students will be able to learn about different methods of rock exploration |
| **III** | Students will be able to learn different tests performed on rocks. |
| **IV** | Students will be able to learn about Pressure arch theory, subsidence and suitable protective measures |

## Unit I

**Definition & its importance:** Rock mass & material form; Effects of discontinuities on rock mass. Physical properties of rocks, Mechanical properties of rocks. Engineering Classification of rock Masses (by deer & miller). Moh's scale of Hardness Rock Pressure & Subsidence.

## Unit II

Object and Methods of rock exploration, Rock exploration by direct penetration Core boring Core recovery Rock quality designation Fracture frequency by indirect penetration Large diameter calyx hole Logging of core

## Unit III

Sampling and Sample preparation, Specimen Uniaxial compressive strength Test; Protodykanov strength index. Tests for measuring rock strengths Tensile strength tests, Flexural strength test, Shear strength test, Punch shear test and In situ tests.

## Unit IV

**Pressure arch theory** Rectangular opening, circular shaft & long wall working. Creep, Convergence, Rock burst & Coal bumps, Rock Mass Rating. Subsidence: Definition & factors governing subsidence. Angle of draw, line of break; Critical area, Subcritical area, super critical area. Protective measures against Subsidence.

**Books:**

1. Fundamentals of Rock Mechanics" by J C Jaeger and N G W Cook
2. Rock Mechanics and Design Structures of Rock" by Obert and W I Duvall

| B. Tech. VII Semester (Civil Engineering) | | | | | |
|---|---|---|---|---|---|
| **SUBJECT: Railway Engineering** | | | | | |
| L | T | P/D | Total | **Subject Code: EL-427A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |
| Course Objective | Students will acquire the knowledge about the design of Railways | | | | |
| **UNIT** | **Course Outcomes** | | | | |
| I | Students will be able to study about permanent way and different types of rails | | | | |
| II | Students will be able to study different types of Sleepers, fastenings and Ballast | | | | |
| III | Students will be able to learn about Points and crossings, signalling and interlocking system | | | | |
| IV | Students will be able to learn geometric design of Rails and stations | | | | |

## UNIT I

**Introduction, Permanent Way and Rails**

Rail transportation and its importance in India. Permanent way: requirements and components. Gauges in India and abroad. Selection of gauge. Coning of wheels. Adzing of sleepers. Rails: functions, composition of rail steel, types of rail sections, requirements of an ideal rail section, length of rails. Defects in rails. Creep of rails. Long welded rails and continuously welded rails.

## UNIT II

**Sleepers, Fastenings and Ballast**

Sleepers: functions, requirements of an ideal sleeper. Types of sleepers: wooden, cast iron, steel and concrete sleepers, advantages, disadvantages and suitability of each type. Sleeper density. Fastenings for various types of sleepers: fish plates, spikes, bolts, bearing plates, keys, chairs, jaws, tie bars. Elastic fastenings. Ballast: functions, requirements, types of ballast and their suitability.

## UNIT III

**Points and Crossings**

Necessity. Turnout: various components, working principle. Switch: components, types. Crossing: components and types. Design elements of a turnout, design of a simple turnout. Layout plan of track junctions: crossovers, diamond crossing, singledouble slips, throw switch, turn table, triangle.

**Signalling, Interlocking and Train Control**

Signals: objects, types and classification. Semaphore signal: components, working principle. Requirements / principles of a good interlocking system. Brief introduction to devices used in interlocking. Methods of control of train movements: absolute block system, automatic block system, centralized train control and automatic train control systems.

## UNIT IV

**Geometric Design of the Track**

Gradients, grade compensation. Super elevation, cant deficiency, negative super elevation. Maximum permissible speed on curves .Tractive resistances, types. Hauling capacity of a locomotive.

**Stations, Yards and Track Maintenance**

Stations: functions and classification. Junction, nonjunction and terminal stations. Yards: functions, types. Marshalling yard: functions, types. Maintenance of railway track: necessity, types of maintenance. Brief introduction to mechanized maintenance, M.S.P and D.T.M.

**Books:**

1. A text book of Railway Engineering by S.C.Saxena and S.P.Arora, Dhanpat Rai Publicatios, N.Delhi
2. Railway Track Engg. ByJ.S.Mundray, Tata McGrawHill Publishing Co. Ltd. N.Delhi.

| B. Tech. VII Semester (Civil Engineering) | | | | | |
|---|---|---|---|---|---|
| **SUBJECT: Airport Planning and Design** | | | | | |
| L | T | P/D | Total | **Subject Code**: **EL-429A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |

| | |
|---|---|
| Course Objective | Students will acquire the knowledge about airport planning and design. |
| **UNIT** | **Course Outcomes** |
| I | Students will be able to understand layout of airport plan |
| II | Students will be able to design runway |
| III | Students will be able to understand Structural design of airport pavement |
| IV | Students will be able to understand basics of visual aids and to understand basics of airport grading and drainage |

## UNIT I

**Airport Planning:** General Regional Planning Development of New Airport Data Required before Site Selection Airport Site Selection Surveys for Site Selection Drawings to be prepared Estimation of Future Air Traffic Needs.

## UNIT II

**Runway Design:** Runway Orientation Basic Runway Length Corrections for Elevation, Temperature and Gradient Airport Classification Runway Geometric Design Airport Capacity Runway Configurations Runway Intersection Design.

## UNIT III

**Structural Design of Airport Pavements:** Introduction Various Design Factors Design Methods for Flexible Pavement Design Methods for Rigid Pavement LCN System of Pavement Design Joints in Cement Concrete Pavement Airport Pavement Overlays Design of an Overlay.

## UNIT IV

**Visual Aids:** General Airport Marking Airport Lighting.

**Airport Grading And Drainage:** General Computation of Earthwork Airport Drainage Special Characteristics and Requirements of Airport Drainage Design Data Surface Drainage Design Subsurface Drainage Design.

**Books:**

1. Airport Planning and Designing by S.K. Khanna, M.G. Arora.
2. Highway Engineering including Expressways and Airport Engineering by Dr. L. R. Kadyali, Dr. N. B. Lal.
3. Highway Engineering including Airport Pavements by Dr. S. K. Sharma.
4. Transportation Engineering by S. P. Chandola.

| B. Tech. VII Semester (Civil Engineering) | | | | | |
|---|---|---|---|---|---|
| **SUBJECT: River Engineering** | | | | | |
| L | T | P/D | Total | **Subject Code: EL-431A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |
| Course Objective | To impart the knowledge about basic engineering principles of River Engineering | | | | |
| **UNIT** | **Course Outcomes** | | | | |
| I | Students will be able to study different rivers and related budgets and schemes | | | | |
| II | Students will be able to study behavior of rivers | | | | |
| III | Students will be able to understand mechanics of alluvial river and bio engineering techniques | | | | |
| IV | Students will be able to understand various river training works | | | | |

## Unit I

**Introduction,** classification of Rivers, Mechanics of alluvial rivers including channel and flood plain features, Sediment transport and budgets, River morphology and various classification schemes.

## Unit II

**Behavior of Rivers:** Introduction, River Channel patterns, Straight river channels, causes, characteristics and shapes of meanders and control, cutoff, Braided Rivers, Bed forms, Instability of rivers, Hydraulic geometry, Delta formation and control.

## Unit III

**Mechanics of Alluvial Rivers**, Rivers and restoration structures, Sociocultural influences and ethics of stream restoration.

**Bioengineering Techniques**, Classification review, Natural Channel Design Analysis, Time Series, and Analysis of flow, Sediment and channel geometry data.

## Unit IV

**River Training and Protection Works:** Introduction, Classification of River Training, Types of training works, Protection for Bridges with reduced waterway, Design of Guide Band, embankment and spurs/dampers and other river/ flood protection works.

**Books:**


1. River Behaviour Management and Training (Vol. I & II), CBI&P, New Delhi.
2. Irrigation & Water Power Engineering, B. C. Punmia and Pande B. B. Lal.
3. River Engineering by Margeret Peterson

| B. Tech. VII Semester (Civil Engineering) | | | | | |
|---|---|---|---|---|---|
| **SUBJECT: Pipeline Engineering** | | | | | |
| L | T | P/D | Total | **Subject Code: EL-433A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |
| Course Objective | To impart the knowledge about basic engineering principles of Pipeline Engineering | | | | |
| **UNIT** | **Course Outcomes** | | | | |
| I | To familiarize the students with the various elements and stages involved in transportation of oil and gas. | | | | |
| II | To understand international standards and practices in piping design. | | | | |
| III | To know various equipment and their operation in pipeline transportation. | | | | |
| IV | To understand modern trends in transportation of oil and gas | | | | |

## UNIT I

Elements of pipeline design: Fluid properties, Environment, Effects of pressure and temperature, Supply / Demand scenario, Route selection, Codes and standards Environmental and hydrological considerations,

## UNIT II

Economics – Materials / Construction, Operation, Pipeline protection, Pipeline integrity monitoring. Pipeline route selection, survey and geotechnical guidelines: Introduction – Preliminary route selection. Key factors for route selection -Engineering survey – Legal survey – Construction / Asbuilt survey – Geotechnical design.

## UNIT III

Natural gas transmission: General flow equation, Steady state, Impact of gas molecular weight and compressibility factor on flow capacity, Flow regimes, Widely used steadystate flow equations. Summary of the impact of different gas and pipeline parameters on the gas flow efficiency

Pressure drop calculation for pipeline in series and parallel, Pipeline gas velocity, Erosional velocity – Optimum pressure drop for design purposes – Pipeline packing – Determining gas leakage using pressure drop method – Wall thickness / pipe grade, Temperature profile, Optimization process – Gas transmission solved problems.

## UNIT IV

Gas compression and coolers: Types of compressors, Compressor drivers, Compressor station configuration. Thermodynamics of isothermal and adiabatic gas compression, Temperature change in adiabatic gas compression, Thermodynamics of polytropic gas compression, Gas compressors in series. Centrifugal compressor horsepower, Enthalpy

/ Entropy charts (Mollier diagram) – Centrifugal compressor performance curve . Influence of pipeline resistance on centrifugal compressor

**Textbooks**

1. MSc Pipeline Engineering, Newcastle University
2. MSc Subsea Engineering & Management, Newcastle University
3. MSc Offshore & Ocean Technology, Cranfield University
4. MSc Pipeline Asset Management, North Umbria University (This is a Distance Learning course available online worldwide

**B. Tech. VII Semester (Civil)**
**CE-411LA CONCRETE DRAWING**

**L T P/D: 0 0 3**
**Total Marks: 100** **Sessional: 40 marks**
**Vivavoce: 60 marks** **Duration: 3 hrs.**

Preparing drawing sheets showing reinforcement details in case of:

1. Flat slabs
2. Underground and Overhead Water Tanks.
3. Combined Footings, Pile Foundations and Raft foundation.
4. T-Beam Bridge.
5. Silo/Bunker.

**B. Tech. (Civil) VII Semester**
**ES – 212LA Energy Science & Engineering Lab**

**L T P/D 0 0 2**
**Total Marks: 100** **Sessional: 40 marks**
**Vivavoce: 60 marks** **Duration: 3 hrs.**

**LIST OF EXPERIMENTS**

1 Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Pensky Martin (closed) Apparatus.

2 Determination of Calorific values of solid, liquid and gaseous fuels

3 Determination of Viscosity of lubricating oil using Redwood and Saybolt Viscometers

4 Valve Timing diagram of an I.C. Engine.

5 To determine the flash and fire point of the lubricating oil by Pensky martens apparatus

6 To determine the kinematic and absolute viscosities of the given oil using red wood viscometer.

7 To determine the viscosity of given oil using torsion viscometer

| B. Tech. VIII Semester (Civil Engineering) | | | | | |
|---|---|---|---|---|---|
| **SUBJECT: Engineering Economics, Estimation & Costing** | | | | | |
| L | T | P/D | Total | **Subject Code: CE-402A** | Max. Marks: 100 |
| 2 | 0 | 0 | 2 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |
| **Course Objective** | The aim of study is to get knowledge about estimation of different civil works. | | | | |
| **UNIT** | **Course Outcomes** | | | | |
| I | Students will study the different methods of estimation | | | | |
| II | Students will study about different types of specification used in civil works | | | | |
| III | Students will study about rate analysis of different items | | | | |
| IV | Students will study the terms used in civil works and public works accounts | | | | |

## UNIT I

**Estimate:**

Principles of estimation, units, items of work, different kinds of estimates, different methods of estimation, estimation of materials in single room building, two roomed building with different sections of walls, foundation, floors and roofs, R.B. and R.VC.C. Works, Plastering, Whitewashing, Distempering and painting, doors and windows, lump sum items, Estimates of canals, roads etc.

## UNIT II

**Specification of Works:**

Necessity of specifications, types of specifications, general specifications, specification for bricks, cement, sand, water, lime, reinforcement; Detailed specifications for Earthwork, Cement, concrete, brick work, floorings, D.P.C., R.C.C., cement plastering, white and colour washing, distempering, painting.

## UNIT III

**Rate Analysis:**

Purpose, importance and requirements of rate analysis, units of measurement, preparation of rate analysis, procedure of rate analysis for items: Earthwork, concrete works, R.C.C. works, reinforced brick work, plastering, painting, finishing (whitewashing, distempering).

## UNIT IV

**Public Works Account:**

Introduction, function of P.W. department, contract, guidelines, types of contracts, their advantages and disadvantages, Tender and acceptance of tender, Earnest money, security money, retention money, measurement book, cash book, preparation, examination and payment of bills, first and final bills, administrative sanction, technical sanction.

**Books**


1. Estimating and Costing for Building & Civil Engg.Works by P.L.Bhasin, S.Chand& Co., N.Delhi.
2. Estimating, Costing & Specification in Civil Engg. ByM.Chakarborty, Calcutta.
3. Estimating & Costing in Civil Engg..: Theory & Practice by B.N.Dutta, S.Dutta& Co., Lucknow.
4. Building Construction Estimating by George H.Cooper, McGraw Hill Book Co., New York.

| B. Tech. VIII Semester (Civil Engineering) | | | | | |
|---|---|---|---|---|---|
| **SUBJECT: BRIDGE ENGINEERING** | | | | | |
| L | T | P/D | Total | **Subject Code: CE-404A** | Max. Marks: 100 |
| 2 | 0 | 0 | 2 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |
| Course Objective | Students will acquire the knowledge about the design of Railway, R.C.C and Steel Bridge and its foundation | | | | |
| **UNIT** | **Course Outcomes** | | | | |
| I | Students will be able to study Specifications for Roads and Railways Bridges | | | | |
| II | Students will be able to design consideration for R. C. C. Bridges | | | | |
| III | Students will be able to design consideration for Steel Bridges | | | | |
| IV | Students will be able to Hydraulic & Structural design of Bridge | | | | |

## UNIT I

**Introduction:**

Definition, components of bridge, classification of bridges, selection of site , economical span, aesthetics consideration, necessary investigations and essential design data.

**Standard Specifications for Roads and Railways Bridges:**

General, Indian Road Congress Bridge Code, width of carriage way, clearance, various loads to be considered for the design of roads and railway bridges, detailed explanation of IRC standard live loads.

## UNIT II

**Design Consideration for R. C. C. Bridges:**

Various types of R.C.C. bridges, design of R.C.C. culvert and Tbeam bridges.

## UNIT III

**Design Consideration for Steel Bridges:**

Various types of steel bridges (brief description of each), design of truss and plate girder bridges.

## UNIT IV

**Hydraulic & Structural Design:**

Piers, abutments, wingwall and approaches. Bearings, joints, articulation and other details.

**Bridge Foundation:**

Various types, necessary investigations and design criteria of well foundation.

**Books:**


1. Essentials of Bridge Engineering, D.J.Victor, Oxford & IBH Pub.N.Delhi.
2. Design of Bridges, N.Krishna Raju, Oxford & IBH, N.Delhi.
3. Bridge Deck Analysis, R.P.Pama&A.R.Cusens, John Wiley & Sons.
4. Design of Bridge Structures, T.R.Jagadish&M.A.Jairam, Prentice Hall of India, N.Delhi.

| B. Tech. VIII Semester (Civil Engineering) | | | | | |
|---|---|---|---|---|---|
| **SUBJECT: ICT for Development** | | | | | |
| L | T | P/D | Total | **Subject Code**: **OE-406A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |
| Course Objective | To apply basics of Information technology in Civil Engineering problems. | | | | |
| **UNIT** | **Course Outcomes** | | | | |
| I | To study various optimization techniques in real world problems related to civil engineering | | | | |
| II | To study the inventory models | | | | |
| III | To study about assigning jobs to people in an efficient way | | | | |
| IV | To study about sequencing techniques | | | | |

## UNIT I

Introduction to ICT: New media and ICT, Different types of ICT. Use of ICT for development; e-learning; Web commerce; Mobile telephony and Development: telecom industry in India. ICT Projects implemented in India and Northeast – Problems and Prospects

## UNIT II

Digital Revolution and Digital Communication: Basics of New media theories - Information Society; Surveillance society; Digital Divide, Knowledge society; Network society. Works of Machlup, Bell, Negroponte and Castells

## UNIT III

Technology and Development: ICT for Development its societal implications; Evolution of ICT in Development Endeavour; ICT and Millennium Development Goals. Democratic and decentralized processes in development. Technology and culture: community and identity; participatory culture and ICT, community informatics

## UNIT IV

Computer Mediated Communication and development:Different types of CMC; Important theoretical framework of CMC, cyber platform and communities, Social Networking Site; Convergent media, Multimedia platforms, Scope of convergent journalism for Development; Characteristics of convergent journalism; Different types of convergent journalism: precision journalism; annotative and open-source journalism; wiki journalism; open source journalism; citizen journalism; back-pack journalism,

**Books**


1. Heeks, R. (2017). Information and communication technology for development (ICT4D). Routledge.
2. Gairola, C. M., Chandra, M., Mall, P., Chacko, J. G., Phet, S., & Loh, H. (2004). Information and Communications Technology for development.

| B. Tech. VIII Semester (Civil Engineering) | | | | | |
|---|---|---|---|---|---|
| **SUBJECT: Comparative Study of Literature** | | | | | |
| L | T | P/D | Total | **Subject Code**: **OE-408A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |
| Course Objective | The course aims to give the basic knowledge of methods and models of Comparative Literature. | | | | |
| **UNIT** | **Course Outcomes** | | | | |
| I | The course is expected to introduce the students about Conceptual Framework of Comparative Literature | | | | |
| II | It will give the idea to students about the History of Comparative Literature. | | | | |
| III | It will orient students towards History and Politics of Translation | | | | |
| IV | It will give closer look at Indian Poetics and Literary Theory | | | | |

## Unit I

**Conceptual Framework of Comparative Literature:** The Emergence of Comparative Literature. Difference/ Alterity and the Ethics of Plurality. Limitations of the Idea of National Literature. Theories of Interpretation

## Unit II

**History of Comparative Literature:** French, German, Russian and Tel Aviv Schools Comparative Literature in India: From Tagore to the Present. World Literature: From Goethe to the Present, “The State of the Discipline” Reports

## Unit III

**History and Politics of Translation**: Translation as Reception, Problems and Promises of Translation in Multilingual Situations, Untranslatability and Silence

## Unit IV

**Poetics and Literary Theory:** Indian Poetics: Sanskrit and Tamil, Perso-Arabic Traditions, Western Classical Literary Theory

**Books:**


1. Bassnett, S. (1993). Comparative Literature: A Critical Introduction. Oxford: Blackwell.
2. Claudio Guillen. (1993). The Challenge of Comparative Literature. (Cola Franzen, Trans.). London: Harvard University Press.
3. Dev, A. (1984). The Idea of Comparative Literature in India. Kolkata: Papyrus.
4. Bernheimer, C. (1995). Ed. Comparative Literature in the Age of Multiculturalism. Baltimore: The Johns Hopkins University Press.

| | | | | | |
|---|---|---|---|---|---|
| **B. Tech. VIII Semester (Civil Engineering)** | | | | | |
| **SUBJECT: History of Science & Engineering** | | | | | |
| L | T | P/D | Total | **Subject Code**: **OE-410A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |

| | |
|---|---|
| Course Objective | To provide the insight about the history of Science and Technology |
| **UNIT** | **Course Outcomes** |
| I | The course is expected to introduce the history of development of science and technology |
| II | Students will able to learn statistical profile of science & engineering |
| III | Students will able to learn about keys of effective learning. |
| IV | Students will able to gain problem solving skill. |

### Unit I

**History of science & technology:** introduction, beginning of science, technology & engineering, traveling through the ages. Science, Engineering & technology Major: Introduction, function, emerging field.

### Unit II

**Profile of Engineers, scientist & technologist**: Statistical profile of science & engineering profession: Statistical, overview, college enrolment trends of science and engineering students, college majors of recent science &engineering students. Job placement trends, diversity of profession distribution of scientist and engineers by type of employer.

### Unit III

**Succeeding in the classroom:** Introduction, attitude, goal, key to effectiveness, test taking, learning style, accountability and overcoming challenges. Biography of Isaac Newton, Einstein, Thomas Edison, Alfred Nobel, M. Visvesvaraya .

### Unit IV

**Problem solving:** Introduction, analytical and creative problem solving, analytical problem solving, personal problem solving styles, brainstorming strategies, critical thinking. Failure of science & technology.

**Textbooks;**

1. Engineering your future by William C. Oaks, Oxford university press.

| | | | | | |
|---|---|---|---|---|---|
| **B. Tech. VIII Semester (Civil Engineering)** | | | | | |
| **SUBJECT: Economic Policies in India** | | | | | |
| L | T | P/D | Total | **Subject Code**: **OE-418A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |
| Course Objective | Students will acquire the knowledge about Economic policies practiced in India | | | | |
| **UNIT** | **Course Outcomes** | | | | |
| I | Students will be able to understand concept of economy | | | | |
| II | Students will be able to calculate National Income for India | | | | |
| III | Students will be able to get introduction to five year plans. | | | | |
| IV | Students will be able to understand role of agriculture in economy | | | | |

## Unit I

**Underdevelopment –** Basic Features of Indian Economy: Growth and Structural Changes in Indian Economy – Demographic Features – Population: Size, Growth, Composition and their Implications on Indian Economy – Concept of Demographic Dividend –Occupational Distribution of Population in India – Population Policy of India.

## Unit II

**Estimation of National Income** – Trends and Composition of National Income in India – Income Inequalities in India: Magnitude, Causes, Consequences and Remedial Measures – Poverty in India: Concept, Types, Causes and Consequences – Unemployment in India: Concept, Types, Trends, Causes and Consequences – Poverty Alleviation and Employment Generation Programmes in India.

## Unit III

**Five Year Plans: Concept and Objectives –** Review of Five Year Plans – NITI Aayog – Economic Reforms: Liberalization, Privatization and Globalization – Impact of WTO onIndian Economy.

## Unit IV

**Importance and Role of Agriculture in Indian Economy** – Trends in Agricultural Production and Productivity – Land Reforms – Green Revolution – Agricultural Finance – Agricultural Marketing – Agricultural Pricing – Food Security in India. Structure, Growth, Importance and Problems of Indian Industry – Large, Medium and Small Scale Industries: Role and Problems – Industrial Policies of 1948, 1956 and 1991– FEMA and Competition Commission of India –Disinvestment Policy – Foreign Direct Investment

**Books:**

1) SK Misra and Puri : Indian Economy, Himalaya Publishing House
2) Ishwar C Dhigra : The Indian Economy: Environment and Policy, SC Chand & Sons, New Delhi Dutt and Sundaram : Indian Economy

| B. Tech. VIII Semester (Civil Engineering) | | | | | |
|---|---|---|---|---|---|
| **SUBJECT: Prestress Concrete** | | | | | |
| L | T | P/ D | Total | **Subject Code: EL-420A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |

| | |
|---|---|
| **Course Objective** | To understand the concept of pre stress Concrete |
| **UNIT** | **Course Outcomes** |
| I | To learn the principles, materials, methods and systems of prestressing |
| II | To know the different types of losses and deflection of prestressed members |
| III | To learn the design of prestressed concrete beams for flexural, shear and tension |
| IV | To learn the design the flexural members in pre stress |

## UNIT I

**Introduction:** Basic concepts of Prestressing, terminology, advantages and applications of prestressed concrete. Materials for Prestressed Concrete: High strength Concrete, permissible stresses in concrete, high strength steel, permissible stresses in steel. Prestressing Systems: Prestensioning and post tensioning systems, various types of tensioning devices, LecMacall systems, MagnelBlaton post tensioning, Freyssinet systems, Gifford Udal system.

## UNIT II

**Losses of Prestress:** Types of losses of Prestress, loss due to elastic deformation of concrete, loss due to shrinkage of concrete, loss due to creep of concrete, loss due to relaxation of stress in steel, loss due to friction, loss due to anchorage slip, total loss in pretension and post tensioned members. Analysis of Prestress and bending stresses: Basic assumptions, resultant stresses at a section, concept of load balancing, cracking moment.

## UNIT III

**Deflections:** Factors influencing deflections, short term deflections of uncracked members, deflections of cracked members, prediction of long term deflections. Shear and Torsional Resistance: Ultimate shear resistance of prestressed concrete members, prestressed concrete members in torsion, design of reinforcements for torsion, shear and bending.

## UNIT IV

**Design of Flexural Members :** Dimensioning of flexural members, design of pretensioned andpost tensioned beams, design of partially prestressed members, design of one way and two way slabs, continuous beams.Design for axial tension, compression and bending, bond and bearing.

**Books:**


1. Prestressed Concrete by N. Krishna Raju, TMH Publishing Company, New Delhi,
2. Prestressed Concrete by P. Dayartnam, Oxford and IBH Publication, New Delhi.
3. Design of Prestressed Concreet Structures by T Y Lin& Ned H. Burns

| B. Tech. VIII Semester (Civil Engineering) | | | | | |
|---|---|---|---|---|---|
| **SUBJECT: Earthquake Engineering** | | | | | |
| L | T | P/ D | Total | **Subject Code: EL-422A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |
| **Course Objective** | To understand basics of Earthquake Engineering | | | | |
| **UNIT** | **Course Outcomes** | | | | |
| I | To introduce the basics of Seismology | | | | |
| II | To introduce the seismic analysis and design | | | | |
| III | To learn to assess the seismic performance of the structure | | | | |
| IV | To learn about vibration control measures | | | | |

## UNIT I

**Seismology:** Introduction, plate tectonics, earthquake distribution & mechanism, seismicity, seismic wave, earthquake magnitude & intensity, seismic zoning &seismometer.

## UNIT II

**Seismic Analysis and Design:** General principles, assumptions, Seismic coefficient method, response spectrum method, strength and deflection, design criterion for structures, significance of ductility, codal provisions, and design examples.

## UNIT III

**Seismic performance,** Repair and strengthening: Methods for assessing seismic performance influence of design ductility and masonry infills, criterion for repair and strengthening techniques and their applications, addition of new structural elements.

## UNIT IV

**Vibrational control:** General features of structural control, base isolation, active and passive, Control system, earthquake resistance design as per IS: 1893, IS: 4326 and: 13920.

**Books:**


1. Elements Of Earthquake of Engineering, Jai Krishna, A. R. Chandershekaran&Brajesh Chandra, South Asian Pub New Delhi.
2. Dynamics of Structures, Clough &Penzion, McGraw Hill.
3. Earthquake Engineering, YX Hu, SC. Liu and W. Dong, E and FN Sons., Madras.
4. Earthquake Resistant Concrete Structures, George G. Penelis and J. Kapoors, E and FN Sons., Madras.Structural Dynamic, Mario Paz, CBB Pub. N.Delhi.

| B. Tech. VIII Semester (Civil Engineering) | | | | | |
|---|---|---|---|---|---|
| **SUBJECT: Offshore Engineering** | | | | | |
| L | T | P/ D | Total | **Subject Code: EL-424A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |
| **Course Objective** | To impart the basic knowledge of off shore engineering | | | | |
| **UNIT** | **Course Outcomes** | | | | |
| I | To introduce the basics of offshore structures | | | | |
| II | To introduces different loads on offshore structure | | | | |
| III | To introduce the concept of general layout and consideration given | | | | |
| IV | To introduce the concept of installation of offshore structurs | | | | |

**UNIT I**

**Historical Development of Offshore Structures**

Introduction, Definition of Offshore Structure, Historical Developments Deepwater challenges, Functions of Offshore Structures, selection of Offshore Structure and its Configurations, Bottom Supported Fixed Structures, Complaint Structures, Floating Structures, Novel offshore design, Field development concepts

**UNIT II**

**Load and Responses**

Introduction, Gravity Load, Hydrostatic Loads, Resistance Loads, Current loads on Structures, Current Drag and Lift Force, Steady and Dynamic Wind Loads on Structures, Wave Loads on Structures, Varying Wind Load, Impulse loads and Introduction to design

**UNIT III**

**Topside Facilities and Layout**

Introduction General layout Considerations Areas and Equipment Deck Impact Loads Deck Placement and Configuration Float over Deck Installation Helipad Platform Crane Living quarters Oil and gas treatment Oil and gas storage, offloading and export Utility and process support systems Drilling facilities

**UNIT IV**

**Offshore Installation**

Introduction , Installation of Fixed Platform Substructures Floating Structures, Foundations Subsea Templates , loadouts transportation Platform Installation Methods and installation criteria, Installation of Pipelines and Risers

**Books:**

1. Dawson, T.H., “Offshore Structural Engineering”, Prentice Hall, 1983
2. B.C Gerwick, Jr. “Construction of Marine and Offshore Structures”, CRC Press, Florida, 2000.
3. Subrata K Ckakrabarti, “Handbook of Offshore Engineering”, Vol 1, Vol 2, Elsevier Publishers, 1st edition, 2005.

| B. Tech. VIII Semester (Civil Engineering) | | | | | |
|---|---|---|---|---|---|
| **SUBJECT: STRUCTURAL GEOLOGY** | | | | | |
| L | T | P/D | Total | **Subject Code: EL-426A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |

| | |
|---|---|
| **Course Objective** | To introduce the concept of structural geology |
| **UNIT** | **Course Outcomes** |
| I | To introduce the concept of topography and its impact on structure. |
| II | To introduce the concept of rock deformation. |
| III | To understand geometric and genetic classification of folds |
| IV | To learn origin and classification of fractures and fault. |

## UNITI

**Structure and Topography** Effects of topography on structural features, Topographic and structural maps; Importance representative factors of the map

## UNIT II

**Stress and strain in rocks** Concept of rock deformation: Stress and Strain in rocks, Strain ellipses of different types and their geological significance. Planar and linear structures; Concept of dip and strike; Outcrop patterns of different structures.

## UNIT III

**Folds and Fold morphology**; Geometric and genetic classification of folds; Introduction to the mechanics of folding: Buckling, Bending, Flexural slip and flow folding

## UNIT IV

**Foliation and lineation** Description and origin of foliations: axial plane cleavage and its tectonic significance Description and origin of lineation and relationship with the major structures

**Fractures and faults Geometric and genetic** classification of fractures and faults Effects of faulting on the outcrops Geologic/geomorphic criteria for recognition of faults and fault plane solutions

**Books:**


1. Davis, G. R. (1984) Structural Geology of Rocks and Region. John Wiley
2. Billings, M. P. (1987) Structural Geology, 4th edition, PrenticeHall.
3. Park, R. G. (2004) Foundations of Structural Geology.Chapman & Hall
4. Pollard, D. D. (2005) Fundamental of Structural Geology. Cambridge University Press.
5. Ragan, D. M. (2009) Structural Geology: an introduction to geometrical techniques (4th Ed). Cambridge University Press (For Practical)
6. Lahee F. H. (1962) Field Geology. McGraw Hill

| | | | | | |
|---|---|---|---|---|---|
| **B. Tech. VIII Semester (Civil Engineering)** | | | | | |
| **SUBJECT: Waste Water Treatment** | | | | | |
| L | T | P/D | Total | **Subject Code: EL-428A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |

| | |
|---|---|
| **Course Objective** | The aim of study is to understand the effect of waste water on environment and its treatment |
| **UNIT** | **Course Outcomes** |
| I | Students will study the effect of waste water on streams |
| II | Students will study the working process of treatment plant |
| III | Students will study about the standard for disposal |
| IV | Students will study the types of industry responsible for waste generation |

## Unit I

**Sewer appurtenances:** Man holes, Catch basin, flushing devices, inverted siphon. Ventilation of sewers. Sewage, Sewerage, Systems of sewerage, Sewage characteristics Physical, chemical and biological parameters, Biological oxygen demand, first stage BOD, Chemical Oxygen demand, Relative stability, Population equivalent.

## Unit II

**Waste water disposal systems** Selfpurification of streams, DilutionOxygen sag curve, Streeter Phelp's Equation, land treatment, Treatment of sewage, Preliminary and Primary treatment –Theory and design of Screen, Grit chamber, Detritus chamber, Flow Equalization tank and Sedimentation tank.

## Unit III

**Secondary treatment methods**Contact bed, Intermittent sand filter, Theory and design of Trickling filter, Activated sludge process, Trickling filterHigh rate, standard. Rotating biological contactor Design of Septic tank and Imhoff tank, Principle and working of Oxidation ditch and oxidation ponds.
Aerated lagoons, Design of up flow anaerobic sludge blanket reactors, Sludge treatment and disposalMethods of thickening, Sludge digestion Anaerobic digestion, Design of sludge digestion tanks and Sludge drying beds, methods of sludge disposal

## Unit IV

**Effects of industrial wastes on streams**, sewerage systems and wastewater treatment plants. Minimizing the effects of industrial effluents on waste water treatment plants and receiving streamsconservation of water, process change, reuse of waste water, volume reduction, strength reduction, neutralization, equalization and proportioning.

**Books:**

1. Industrial and Hazardous Waste Treatment by N.L.Nemerow&A.Dasgupta.
2. Industrial Effluents by N.Manivasakam.
3. Waste Water Treatment by M.N.Rao&A.K.Dutta.

<table>
<tr><td colspan="6">B. Tech. VIII Semester (Civil Engineering)</td></tr>
<tr><td colspan="6">SUBJECT: Water and Air Quality Modelling</td></tr>
<tr><td>L</td><td>T</td><td>P/ D</td><td>Total</td><td>Subject Code: EL-430A</td><td>Max. Marks: 100</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td></td><td>Theory: 75 marks</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>Sessional: 25 Marks</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>Duration: 3 hrs.</td></tr>
<tr><td colspan="2">Course Objective</td><td colspan="4">This course aims at developing mathematical models for air and water quality check</td></tr>
<tr><td colspan="2">UNIT</td><td colspan="4">Course Outcomes</td></tr>
<tr><td colspan="2">I</td><td colspan="4">Students will learn the Mathematical Models for water quality</td></tr>
<tr><td colspan="2">II</td><td colspan="4">Students will learn the Mathematical Models for dissolved oxygen.</td></tr>
<tr><td colspan="2">III</td><td colspan="4">Students will learn the Mathematical Models for Estuary and Lakes</td></tr>
<tr><td colspan="2">IV</td><td colspan="4">Students will learn about micrometeorological process.</td></tr>
</table>

## UNITI

**Introduction to Mathematical Models:** water quality modeldevelopment, calibration and verification cost: benefit analysis using models, Modelrequirements and limitations.

## UNITII

**D.O. Models for Streams:** Dissolved oxygen model for streams sources and sinks of dissolved oxygen estimation of system parameters Streeter Phelps model oxygen 'sag' curvedetermination of Deoxygenation and reaeration coefficients

## UNITIII

**Benthal oxygen demand mass transport mechanisms** Models for Estuary and Lakes: Physical chemical and biological processes in estuaries; Air quality models:

## UNITIV

**Micrometeorological processes,** wind rose, dispersion, coefficients and stability classes, Gaussian and dispersion model, Stack height computation, Regional air quality models, Source inventories and significance

**Books**


1. Deaton, M.L and Winebrake, J.J., Dynamic Modelling of Environmental Systems, Verlag, 2000.
2. Chapra, S.C. Surface Water-Quality Modelling, McGraw-Hill, 2008.
3. Arthur C.Stern., Air Pollution (Third Ed.) Volume I – Air Pollutants, their transformation and Transport, (Ed.), Academic Press, 2006.
4. Wainwright, J and Mulligan, M., Environmental Modelling Finding simplicity in complexity, John Wiley and Sons Inc., New York, 2013

| B. Tech. VIII Semester (Civil Engineering) | | | | | |
|---|---|---|---|---|---|
| **SUBJECT: TRAFFIC ENGINEERING AND MANAGEMENT** | | | | | |
| L | T | P/D | Total | **Subject Code: EL-432A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |
| Course Objective | | To understand and explain the various modes of Transport viz. Surface, Air, Rail and Water. | | | |
| **UNIT** | | **Course Outcomes** | | | |
| I | | To introduce the significance and scope of traffic engineering. | | | |
| II | | Describe the different methods of conducting Traffic volume studies. | | | |
| III | | Mention the various driver characteristics affecting traffic behavior onroads. | | | |
| IV | | State the objectives in providing road markings and describe its effectiveness in traffic regulation. | | | |

### ssUNIT I

**Introduction:** Importance of Transportation Employment in Transportation Transportation Systems and Organization Characteristics of Driver, the Pedestrian, the Vehicle and Road, Traffic and Environment, Introduction to MRTS, LRTS and Underground railways.

### UNIT II

**Traffic Engineering Studies:** Statistical studies for Traffic Engineering, Speed studies Volume Studies Travel time and Delay Studies Parking StudiesTraffic Forecasting Accident Studies, Traffic Flow Theory, Macroscopic and Microscopic Traffic model, Shock Waves Traffic Flow at signal and un signal intersection Simulation of Traffic.

### UNIT III

**Airport Planning:** Airport -Accessibility ,Transport Connections, Forecasting Future Traffic – Airfield Capacity and Delay Aircraft characteristics , Airport Site Selection, Airport Classification, Planning of Airfield Components, Runway, Taxiway, Apron, Hanger, Passenger Terminals.

### UNIT IV

**Waterways Transport Systems**: Fresh Water and Salt Water Navigation –Ocean, Currents and Tide, Canals and Waterways, Ports, Types of Ships Inland Water Transport-Planning, limitations and advantages Case Studies-Pipelines, Ropeways, Beltways and other means of transport.

**Books:**


1. Kadiyali L.R, "Traffic Engineering and Transportation Planning" Khanna Publishers, Delhi, 2005.
2. Khanna SK and Justo CEG, "Highway Engineering", Nem Chand & Bros, Roorkee, 2010.
3. Brase/Brase "Understandable Statistics 3rd edition",D C Health and Company, Lexington, Massachusetts,Toronko,1987.
4. Jason C.yu, Transportation Engineering: Introduction to Planning, Design and Operations, Elsevier,1992.
5. Taylor M.A.P and Young W,Traffic AnalysisNew Technology and New solution.

| B. Tech. VIII Semester (Civil Engineering) | | | | | |
|---|---|---|---|---|---|
| **SUBJECT: Infrastructure Planning and Design** | | | | | |
| L | T | P/ D | Total | **Subject Code: EL-434A** | Max. Marks: 100 |
| 3 | 0 | 0 | 3 | | Theory: 75 marks |
| | | | | | Sessional: 25 Marks |
| | | | | | Duration: 3 hrs. |
| **Course Objective** | To understand various concepts of infrastructure planning and management. | | | | |
| **UNIT** | **Course Outcomes** | | | | |
| I | To understand the basic concepts related to Infrastructure Projects | | | | |
| II | To understand the role of private sector infrastructure growth. | | | | |
| III | To impart the strategies for successful Infrastructure Project implementation. | | | | |
| IV | To develop Infrastructure modeling and Life Cycle AnalysisTechniques. | | | | |

## Unit I

**An Overview Of Basic Concepts Related To Infrastructure:** Introduction to Infrastructure, an overview of the Power Sector in India., an Overview of the Water Supply and Sanitation Sector in India., an overview of the Road, Rail, Air and Port Transportation Sectors in India. An overview of the Telecommunications Sector in India. An overview of the Urban Infrastructure in India, an overview of the Rural Infrastructure in India, an Introduction to Special Economic Zones, Organizations and layers in the field of Infrastructure, The Stages of an Infrastructure Project Lifecycle., an overview of Infrastructure Project Finance.

## Unit II

**Private Involvement In Infrastructure:** A Historical Overview of Infrastructure Privatization. The Benefits of Infrastructure Privatization, Problems with Infrastructure Privatization, Challenges in Privatization of Water Supply: A Case Study, Challenges in Privatization of Power: Case Study, Privatization of Infrastructure in India: Case Study, Privatization of Road Transportation Infrastructure in India.

## Unit III

**Challenges To Successful Infrastructure Planning And Implementation:** Mapping and Facing the Landscape of Risks in Infrastructure Projects, Economic and Demand Risks: The Case study for Political Risks, SocioEnvironmental Risks, Cultural Risks in International Infrastructure Projects, Legal and Contractual Issues in Infrastructure, Challenges in Construction and Maintenance of Infrastructure.

## Unit IV

**Sustainable Development Of Infrastructure:** Information Technology and Systems for Successful Infrastructure Management, Innovative Design and Maintenance of Infrastructure Facilities, Infrastructure Modeling and Life Cycle Analysis Techniques, Capacity Building and Improving the Governments Role in Infrastructure Implementation, An Integrated Framework for Successful Infrastructure Planning and Management Infrastructure Management Systems and Future Directions.

**Books:**


1. Grigg, Neil, Infrastructure engineering and management, Wiley, (1988).
2. Haas, Hudson, Zaniewski, Modern Pavement Management, Krieger, Malabar, (1994).

3. Hudson, Haas, Uddin, Infrastructure management: integrating design, construction, maintenance, rehabilitation, and renovation, McGraw Hill, (1997).
4. Munnell, Alicia, Editor, Is There a Shortfall in Public Capital Investment? Proceedings of a Conference Held in June (1990).
5. World Development Report 1994: Infrastructure for Development (1994).
6. Zimmerman, K. and F. Botelho, "Pavement Management Trends in the United States," 1st European Pavement Management Systems Conference, Budapest, September (2000).

**Bachelor of Technology (Mechatronics Engineering)**
**Kurukshetra University, Kurukshetra**
***SCHEME OF STUDIES/EXAMINATIONS w. e. f.* 2021-22 onwards**

**Semester–V**

| S. No. | Course No. | Course Title | L:T:P | Hours/ Week | Credits | Examination Schedule (Marks) | | | | Duration of Exam (Hours) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Major Test | Minor Test | Practical | Total | |
| 1 | HTM-901A | Universal Human Values II : Understanding Harmony | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | MTC-301A | Communication Systems | 3:1:0 | 4 | 4 | 75 | 25 | 0 | 100 | 3 |
| 3 | MTC-303A | Production Technology-II | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 4 | MTC-305A | Automatic Control Systems | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 5 | MTC-307A | Embedded Systems-I | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 6 | MTC-309LA | Communication Systems Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 7 | MTC-311LA | Production Technology-II Lab | 0:0:4 | 4 | 2 | 0 | 40 | 60 | 100 | 3 |
| 8 | MTC-313LA | Embedded Systems-I Lab | 0:0:2 | 2 | 1 | 0 | 40 | 60 | 100 | 3 |
| 9 | MTC-315LA | Project-I | 0:0:2 | 2 | 1 | 0 | 0 | 100 | 100 | 3 |
| 10 | *MTC-317A | Industrial Training-II | 2:0:0 | 2 | - | 0 | 100 | 0 | 100 | |
| 11 | **MC-903A | Essence of Indian Traditional Knowledge | 3:0:0 | 3 | - | 100 | - | - | 100 | 3 |
| | | Total | 20:1:10 | 31 | 21 | 375 | 245 | 280 | 900 | |

**Note:**

1. **MTC-317A is a mandatory non-credit course in which the students will be evaluated for the industrial training undergone after 4th semester.*
2. ***MC-903A is a mandatory credit-less course in which the students will be required to get passing marks in the major test.*
3. *Students are allowed to use programmable scientific calculator during examination.*

| HTM-901A | Universal Human Values II: Understanding Harmony | | | | | | |
|---|---|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3.0** | **75** | **25** | **100** | **3 Hours** |
| **Purpose** | Purpose and motivation for the course, recapitulation from Universal Human Values-I | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO 1** | Development of a holistic perspective based on self-exploration about themselves (human being),family, society and nature/existence. | | | | | | |
| **CO 2** | Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence. | | | | | | |
| **CO 3** | Strengthening of self-reflection. | | | | | | |
| **CO 4** | Development of commitment and courage to act. | | | | | | |

**Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for ValueEducation**

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' andExperiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment ofaspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at variouslevels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrarinessin choice based on liking-disliking

**Module 2: Understanding Harmony in the Human Being - Harmony in Myself!**

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

**Module 3: Understanding Harmony in the Family and Society- Harmony in Human-HumanRelationship**

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the othersalient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- fromfamily to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

**Module 4: Understanding Harmony in the Nature and Existence - Whole existence asCoexistence**

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" canbe used), pollution, depletion of resources and role of technology etc.

**Module 5: Implications of the above Holistic Understanding of Harmony on ProfessionalEthics**

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. todiscuss the conduct as an engineer or scientist etc.

**READINGS:**

**Text Book**

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010

**Reference Books**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J CKumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

**MODE OF CONDUCT**

Lecture hours are to be used for lecture/practice sessions.

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at handand motivating students to reflect, explore and verify them.

Practice hours are to be used for practice sessions.

While analysing and discussing the topic, the faculty mentor’s role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions, the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration. Scenarios may be used to initiate discussion. The student is encouraged to take up" ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Practice experiments are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.

This course is to be taught by faculty from every teaching department, including HSS faculty. Teacher preparation with a minimum exposure to at least one 8-day FDP on Universal Human Values is deemed essential.

**ASSESSMENT:**

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.

Example:

Assessment by

faculty mentor: 5 marks

Self-assessment: 5 marks

Assessment by peers: 5 marks

Socially relevant project/Group Activities/Assignments: 10 marks

Semester End Examination: 75 marks

The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.