Bachelor of Technology (Computer Science and Engineering)
Credit Based Scheme of Studies/Examination
Semester III (w.e.f Session 2019-2020)

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	ES-205	Principles of Programming Languages	3:0:0	3	3	75	25	0	100	3
2	PC-CS-201	Data Structure and Algorithms	3:0:0	3	3	75	25	0	100	3
3	ES-207	Digital Electronics	3:0:0	3	3	75	25	0	100	3
4	PC-CS-203	Object Oriented Programming	3:0:0	3	3	75	25	0	100	3
5	BS-205	Mathematics-III	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-205 L	Data Structure and Algorithms Lab	0:0:4	4	2	0	40	60	100	3
8	ES-209L	Digital Electronics Lab	0:0:4	4	2	0	40	60	100	3
9	PC-CS-207 L	Object Oriented Programming Lab	0:0:4	4	2	0	40	60	100	3
		Total		**30**	**24**	**450**	**270**	**180**	**900**	
10	SIM-201*	Seminar on Summer Internship	2:0:0	2		0	50	0	50	

***Note: SIM-201* 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.**

Bachelor of Technology (Computer Science and Engineering)
Credit Based Scheme of Studies/Examination
Semester IV (w.e.f Session 2019-2020)

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-202	Discrete Mathematics	3:0:0	3	3	75	25	0	100	3
2	PC-CS-204	Internet Technology and Management	3:0:0	3	3	75	25	0	100	3
3	PC-CS-206	Operating Systems	3:0:0	3	3	75	25	0	100	3
4	PC-CS-208	Design and Analysis of Algorithms	3:0:0	3	3	75	25	0	100	3
5	HM-901	Organizational Behaviour	3:0:0	3	3	75	25	0	100	3
6	PC-CS-210L	Internet Technology and Management Lab	0:0:4	4	2	0	40	60	100	3
7	PC-CS-212L	Operating Systems Lab	0:0:4	4	2	0	40	60	100	3
8	PC-CS-214L	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-901 *	Environmental Sciences	3:0:0	3	0	75	25	0	100	3

***MC-901 is a mandatory credit-less course and student has to get passing marks in order to qualify for the award of B.Tech. Degree.**

Bachelor of Technology (Computer Science & Engineering)										
Credit-Based Scheme of Studies/Examination										
Semester V (w.e.f. session 2020-2021)										
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-301	Microprocessor & Interfacing	3:0:0	3	3	75	25	0	100	3
2	PC-CS-301	Database Management Systems	3:0:0	3	3	75	25	0	100	3
3	PC-CS-303	Formal Language & Automata Theory	3:0:0	3	3	75	25	0	100	3
4	PC-CS-305	Essential of Information Technology	3:0:0	3	3	75	25	0	100	3
5	PC-CS-307	Computer Organization & Architecture	2:0:0	2	2	75	25	0	100	3
6	PEC	Elective-I	3:0:0	3	3	75	25	0	100	3
7	PC-CS-309L	Database Management Systems Lab	0:0:4	4	2	0	40	60	100	3
8	PC-CS-311L	Essential of Information Technology Lab	0:0:4	4	2	0	40	60	100	3
		Total		**25**	**21**	**450**	**230**	**120**	**800**	
9	MC-904	Energy Resources & Management	3:0:0	3	0	0	100	0	100	3
10	SIM-301*	Seminar on Summer Internship	2:0:0	2	0	0	50	0	50	

PEC Elective-I
Digital Data Communication: PE-CS-T301
Parallel and Distributed Computing: PE-CS-T303
Information Theory and Coding: PE-CS-T305
Advanced Algorithms: PE-CS-T307

***Note:** SIM-301* is a mandatory credit-less course in which the students will be evaluated for the Summer Internship undergone after 4th semester and students will be required to get passing marks to qualify.

Bachelor of Technology (Computer Science & Engineering)										
Credit-Based Scheme of Studies/Examination										
Semester VI (w.e.f. session 2020-2021)										
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	PC-CS-302	Complier Design	3:0:0	3	3	75	25	0	100	3
2	PC-CS-304	Computer Networks	3:0:0	3	3	75	25	0	100	3
3	PEC	Elective-II	3:0:0	3	3	75	25	0	100	3
4	PEC	Elective-III	3:0:0	3	3	75	25	0	100	3
5	OEC	Open Elective-I	3:0:0	3	3	75	25	0	100	3
6	PROJ – CS-302	Project-1	0:0:6	6	3	0	40	60	100	3
7	PC-CS-306L	UNIX and Linux Programming Lab	0:0:4	4	2	0	40	60	100	3
8	PC-CS-308L	Computer Networks Lab	0:0:4	4	2	0	40	60	100	3
Total				**29**	**22**	**375**	**245**	**180**	**800**	

PEC Elective-II	**PEC Elective-III**
Advanced Computer Architecture: PE-CS-S302	Simulation & Modeling: PE-CS-S310
Distributed Systems: PE-CS-S304	Mobile Computing: PE-CS-S312
Fault Tolerant Computing: PE-CS-S306	Unix & Linux Programming: PE-CS-S314
Mobile Ad-hoc and Wireless Sensor Networks: PE-CS-S308	Real Time Systems: PE-CS-S316
OEC Open Elective-I	
Soft Skills and Interpersonal Communication: OE-CS-302	
Management Information System: OE-CS-304	
Enterprise Resource Planning: OE-CS-306	

Note: Students be encouraged to go to 6-8 weeks summer internships mandatory during the summer break after the completion of sixth semester exams.

The course of both PE & OE will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.

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-401	Project-II	0:0:12	12	6	0	40	60	100	3
5	PE-417L	Elective-IV Lab	0:0:2	2	1	0	40	60	100	3
6	PE-419L	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-D401	Soft Computing: PE-CS-D407
Software Verification and Validation and Testing:: PE-CS-D403	Neural Networks and Deep Learning: PE-CS-D409
Information Retrieval: PE-CS-D405	Object Oriented Software Engineering: PE-CS-D411
	Expert Systems: PE-CS-D413

OE Elective-II
Cyber Law and Ethics: OE-CS-401
Bioinformatics: OE-CS-403
Fiber Optic Communications: OE-CS-405
Industrial Electrical Systems: OE-CS-407

The course of both PE & OE will be offered at 1/3rd 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 6th semester and students will be required to get passing marks to qualify.

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-402	Project-III	0:0:12	12	6	0	40	60	100	3
5	PE410-L	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-A402
Computer Graphics: PE-CS-A404
Software Reliability: PE-CS-A406
Mobile Apps Development: PE-CS-A408

OE Elective-III	**OE Elective-IV**
Cyber Security: OE-CS-402	Web and Internet Technology: OE-CS-410
Satellite Communication: OE-CS-404	Automation in Manufacturing: OE-CS-412
Social Networks Analysis & Mining: OE-CS-406	IPR, Bioethics and Biosafety: OE-CS-414
Agile Software Engineering: OE-CS-408	Signal & Systems: OE-CS-416

Bachelor of Technology (Computer Science and Engineering)
Credit Based Scheme of Studies/Examination
Semester III (w.e.f Session 2019-2020)

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	ES-205	Principles of Programming Languages	3:0:0	3	3	75	25	0	100	3
2	PC-CS-201	Data Structure and Algorithms	3:0:0	3	3	75	25	0	100	3
3	ES-207	Digital Electronics	3:0:0	3	3	75	25	0	100	3
4	PC-CS-203	Object Oriented Programming	3:0:0	3	3	75	25	0	100	3
5	BS-205	Mathematics-III	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-205 L	Data Structure and Algorithms Lab	0:0:4	4	2	0	40	60	100	3
8	ES-209L	Digital Electronics Lab	0:0:4	4	2	0	40	60	100	3
9	PC-CS-207 L	Object Oriented Programming Lab	0:0:4	4	2	0	40	60	100	3
		Total		**30**	**24**	**450**	**270**	**180**	**900**	
10	SIM-201*	Seminar on Summer Internship	2:0:0	2		0	50	0	50	

***Note: SIM-201* 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.**

ES-205	Principles of Programming Languages						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3.0**	**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, 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.

PC-CS201	Data Structure and Algorithms						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	0	0	3.0	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's 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.

ES-207	Digital Electronics						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3.0	75	25	100	3 Hour
Purpose	To learn the basic methods for the design of digital circuits and provide the fundamental concepts used in the design of digital systems.						
Course Outcomes (CO)							
CO1	To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions						
CO2	To introduce the methods for simplifying Boolean expressions						
CO3	To outline the formal proccdurcs for the analysis and design of combinational circuits and sequential circuits						
CO4	To introduce the concept of memories and programmable logic devices.						

UNIT I MINIMIZATION TECHNIQUES AND LOGIC GATES

Binary Digits, Logic Levels, and Digital Waveforms, Logic Systems-Positive and negative, Logic Operations,Logical Operators, Logic Gates-AND, OR, NOT, NAND, NOR, Exclusive-OR and Exclusive-NOR, Active high and Active low concepts, Universal Gates and realization of other gates using universal gates, Gate Performance Characteristics and Parameters.Boolean Algebra: Rules and laws of Boolean algebra, Demorgan's Theorems, Boolean Expressions and Truth Tables, Standard SOP and POS forms; Minterm and Maxterms, Canaonical representation of Boolean expressions, Duality Theorem, Simplification of Boolean Expressions, Minimization Techniques for Boolean Expressions using Karnaugh Map and Quine McCluskey Tabular method.introduction of TTL and CMOS Logic and their characteristics, Tristate gates.

UNIT II COMBINATIONAL CIRCUITS

Introduction to combinational Circuits, Adders-Half-Adder and Full-Adder, Subtractors- Half and Full Subtractor; Parallel adder and Subtractor; Look-Ahead Carry Adders. BCD adder, BCD subtractor, Parity Checker/Generator, Multiplexer, Demultiplexer, Encoder, Priority Encoder; Decoder ,BCD to Seven segment Display Decoder/Driver, LCD Display, and Comparators.

UNIT III SEQUENTIAL CIRCUITS

Introduction to Sequential Circuits, Flip-Flops: Types of Flip Flops -RS, T, D, JK; Edge triggering, Level Triggering; Flip Flop conversions; Master-Salve JK.

Introduction to shift registers, Basic Shift Register Operations, types of shift registers, Bidirectional Shift Registers, Shift Register Counters. Introduction to counters, Types of Counters-Asynchronous and synchronous counters, Up/Down Synchronous Counters, Modulo-n Counter , State table, excitation table concepts, Design of asynchronous and synchronous counters, Ring Counter, Applications of counters.

UNIT IV CONVERTER and MEMORY DEVICES

Digital to Analog Converter, Weighed Register: R-2R Ladder Network: Analog to Digital Conversion, Successive Approximation Type, Dual Slope Type.

Classification of memories - ROM: ROM organization, PROM, EPROM, EEPROM, EAPROM, RAM: - RAM organization - Write operation, Read operation, Memory cycle, Timing wave forms, memory expansion, Static RAM Cell, MOSFET RAM cell structure, Dynamic RAM cell structure, Programmable Logic Devices - Programmable Logic Array (PLA), Programmable Array Logic (PAL), Implementation of PLA, PAL using ROM.

Suggested Books:

- Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 8th Edition, TMH, 2003.M.
- Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India Pvt. Ltd., 2003 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
- ALI, Digital Switching Systems, , TMH
- A.K. Maini, Digital Electronics, Wiley India
- John F. Wakerly, Digital Design, Fourth Edition, Pearson/PHI, 2006
- John. M Yarbrough, Digital Logic Applications and Design, Thomson Learning, 2002.
- S. Salivahanan and S. Arivazhagan, Digital Circuits and Design, 3rd Edition., Vikas Publishing House Pvt. Ltd, New Delhi, 2006
- William H. Gothmann, Digital Electronics, 2nd Edition, PHI, 1982.
- Thomas L. Floyd, Digital Fundamentals, 8th Edition, Pearson Education Inc, New Delhi, 2003
- Donald D. Givone, Digital Principles and Design, TMH, 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-CS203	Object Oriented Programming						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	0	0	3.0	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–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.

BS-205	Mathematics-III						
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**	**Sessional**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hour**
Purpose	To familiarize the prospective engineers with techniques in sequence and series, multivariable calculus, and ordinary differential equations.						
Course Outcomes (CO)							
CO1	To develop the tool of sequence, series and Fourier series for learning advanced Engineering Mathematics.						
CO2	To introduce effective mathematical tools for the solutions of differential equations that model physical processes.						
CO3	To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.						
CO4	To familiarize the student with calculus of vector functions that is essential in most branches of engineering.						

UNIT-I

Sequence and Series: Convergence of sequence and series, tests for convergence (Comparison test, D'Alembert's Ratio test, Logarithmic test, Cauchy root test, Raabe's test).

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.

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

Multivariable Calculus (Integration): Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar) Applications: areas and volumes; Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.

UNIT-IV

Vector Calculus: Introduction, Scalar and Vector point functions, Gradient, divergence and Curl and their properties, Directional derivative. Line integrals, surface integrals, volume integrals, Theorems of Green, Gauss and Stokes (without proof).

Suggested Books:

- G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
- Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
- Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
- 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.
- Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley and Sons, 2006.
- W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
- S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
- 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.
- Erwin Kreyszig and Sanjeev Ahuja, Applied Mathematics-I, reprint 2015, Wiley India Publication.

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	3.0	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:

- "Entrepreneurship development small business enterprises", Pearson, Poornima M Charantimath,2013.
- Roy Rajiv, "Entrepreneurship", Oxford University Press, 2011.
- "Innovation and Entrepreneurship",Harper business- Drucker.F, Peter, 2006.
- "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
- Enterpreneurship Development- S.Chand and Co.,Delhi- S.S.Khanka 1999
- Small-Scale Industries and Entrepreneurship. Himalaya Publishing House, Delhi –Vasant Desai 2003.
- 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-CS205 L	Data Structure and Algorithms Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**4**	**2.0**	**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	To introduce the basic concepts of Data structure, basic data types, searching and sorting based on array data types.						
CO2	To introduce the structured data types like Stacks and Queue and its basic operation's implementation.						
CO3	To introduce dynamic implementation of linked list.						
CO4	To introduce the concepts of Tree and graph and implementation of traversal algorithms.						

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:
At least seven experiments are to be performed from above list and the concerned institution as per the scope of the syllabus may set remaining eight.

ES-209L	Digital Electronics Lab						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
0	0	4	2.0	40	60	100	3
Purpose	To learn the basic methods for the design of digital circuits and systems.						
Course Outcomes (CO)							
CO1	To Familiarization with Digital Trainer Kit and associated equipment.						
CO2	To Study and design of TTL gates						
CO3	To learn the formal procedures for the analysis and design of combinational circuits.						
CO4	To learn the formal procedures for the analysis and design of sequential circuits						

LIST OF EXPERIMENTS:

1. Familiarization with Digital Trainer Kit and associated equipment.
2. Study of TTL gates AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.
3. Design and realize a given function using K-Maps and verify its performance.
4. To verify the operation of Multiplexer and De-multiplexer.
5. To verify the operation of Comparator.
6. To verify the truth table of S-R, J-K, T, D Flip-flops.
7. To verify the operation of Bi-directional shift register.
8. To design and verify the operation of 3-bit asynchronous counter.
9. To design and verify the operation of asynchronous Up/down counter using J-K FFs.
10. To design and verify the operation of asynchronous Decade counter.
11. Study of TTL logic family characteristics.
12. Study of Encoder and Decoder.
13. Study of BCD to 7 segment Decoder.

NOTE:

At least ten experiments are to be performed from above list and the concerned institution as per the scope of the syllabus may set remaining five.

PC-CS207 L	Object Oriented Programming Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**4**	**2.0**	**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	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.						

Q1. 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.

Q2. 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

Q3. 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

Q4. 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

Q5. 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.

Q6. 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.

Q7. 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<< endl:}
};
```

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.

Q8. 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.

Q9. 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).

Q10. 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.

Q11. 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.

Q12. 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)".

25

Q13. 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.

Q14. 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.

Q15. 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:
At least ten experiments are to be performed from above list and the concerned institution as per the scope of the syllabus may set remaining five.

Bachelor of Technology (Computer Science and Engineering)
Credit Based Scheme of Studies/Examination
Semester IV (w.e.f Session 2019-2020)

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-202	Discrete Mathematics	3:0:0	3	3	75	25	0	100	3
2	PC-CS-204	Internet Technology and Management	3:0:0	3	3	75	25	0	100	3
3	PC-CS-206	Operating Systems	3:0:0	3	3	75	25	0	100	3
4	PC-CS-208	Design and Analysis of Algorithms	3:0:0	3	3	75	25	0	100	3
5	HM-901	Organizational Behaviour	3:0:0	3	3	75	25	0	100	3
6	PC-CS-210L	Internet Technology and Management Lab	0:0:4	4	2	0	40	60	100	3
7	PC-CS-212L	Operating Systems Lab	0:0:4	4	2	0	40	60	100	3
8	PC-CS-214L	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-901 *	Environmental Sciences	3:0:0	3	0	75	25	0	100	3

***MC-901 is a mandatory credit-less course and student has to get passing marks in order to qualify for the award of B.Tech. Degree.**

PC-CS202	Discrete Mathematics						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	0	0	3.0	75	25	100	3
Purpose	To provide the conceptual knowledge of Discrete structure.						
Course Outcomes (CO)							
CO1	To study various fundamental concepts of Set Theory and Logics.						
CO2	To study and understand the Relations, diagraphs and lattices.						
CO3	To study the Functions and Combinatorics.						
CO4	To study the Algebraic Structures.						

Unit 1 Set Theory and Logic

Fundamentals - Sets and subsets, Venn Diagrams, Operations on sets, Laws of Set Theory, Power Sets and Products, Partition of sets, The Principle of Inclusion- Exclusion.

Logic : Propositions and Logical operations, Truth tables, Equivalence, Implications, Laws of Logic, Normal forms, Predicates and quantifiers, Mathematical Induction.

Unit 2: Relations, diagraphs and lattices

Product sets and partitions, relations and diagraphs, paths in relations and diagraphs, properties of relations, equivalence and partially ordered relations, computer representation of relations and diagraphs, manipulation of relations, Transitive closure and Warshall's algorithm, Posets and Hasse Diagrams, Lattice.

Unit 3 Functions and Combinatorics

Definitions and types of functions: injective, subjective and bijective, Composition, identity and inverse, Review of Permutation and combination-Mathematical Induction, Pigeon hole principle, Principle of inclusion and exclusion, Generating function-Recurrence relations.

Unit 4: Algebraic Structures

Algebraic structures with one binary operation - semi groups, monoids and groups, Product and quotient of algebraic structures, Isomorphism, homomorphism, automorphism, Cyclic groups, Normal sub group, codes and group codes, Ring homomorphism and Isomorphism.

Suggested Books:

- Elements of Discrete Mathematics C.L Liu, 1985, Reprinted 2000, McGraw Hill
- Discrete Mathematics - Revised (SIE) (Schaum's Outline Series), LIPSCHUTZ , TMH
- Discrete mathematical structures by B Kolman RC Busby, S Ross PHI Pvt. Ltd.
- Discrete Mathematical Structures with Applications to Computer Science , by Tremblay J.P, and Manohar R., McGraw Hill Book Company, 1975, International Edition, 1987.
- Discrete and Combinatorial mathematics ", Ralph P., Grimaldi, Addison-Wesley Publishing Company, Reprinted in 1985.
- Discrete Mathematics and its Applications ", Kenneth H.Rosen, McGraw Hill Book Company, 1999. Sections: 7.1 to 7.5.
- Discrete Mathematics for computer scientists and Mathematicians, Joe L. Mott, Abraham

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-CS204	Internet Technology and Management						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	0	0	3.0	75	25	100	3
Purpose	To provide the conceptual knowledge of Internet and methodologies used in web and secure internet communication and networking.						
Course Outcomes (CO)							
CO1	To study various fundamental concepts of Internetworking techniques with their characteristics.						
CO2	To study and understand the requirements for world-wide-web formats and techniques.						
CO3	To study the E-mail functioning and basics of HTML, XML and DHTML languages.						
CO4	To study the functioning of Servers and Privacy and Security related mechanisms.						

UNIT-1 : THE INTERNET

Introduction to networks and internet, history, Internet, Intranet and Extranet, Working of Internet, Internet Congestion, internet culture, business culture on internet. Collaborative computing and the internet. Modes of Connecting to Internet, Internet Service Providers(ISPs), Internet address, standard address, domain name, DNS, IP.v6.Modems, Speed and time continuum, communications software; internet tools.

UNIT-II : WORLD WIDW WEB

Introduction, Miscellaneous Web Browser details, searching the www: Directories search engines and meta search engines, search fundamentals, search strategies, working of the search engines, Telnet and FTP, HTTP, Gophar Commands, TCP/IP. Introduction to Browser, Coast-to-coast surfing, hypertext markup language, Web page installation, Web page setup, Basics of HTML and formatting and hyperlink creation.Using FrontPage Express, Plug-ins.

UNIT-III : INTERNET PLATEFORM AND MAILING SYSTEMS

Introduction, advantages and disadvantages, User Ids, Pass words, e-mail addresses, message components, message composition, mailer features, E-mail inner workings, E-mail management, MIME types, Newsgroups, mailing lists, chat rooms, secure-mails, SMTP, PICO, Pine, Library cards catalog, online ref. works.
Languages: Basic and advanced HTML, Basics of scripting languages – XML, DHTML, Java Script.

UNIT-IV : SERVERS

Introduction to Web Servers: PWS, IIS, Apache; Microsoft Personal Web Server. Accessing and using these servers.
Privacy and security topics: Introduction, Software Complexity, Attacks, security and privacy levels, security policy, accessibility and risk analysis, Encryption schemes, Secure Web document, Digital Signatures, Firewalls, Intrusion detection systems

Suggested Books:

- Internet and World Wide Programming, Deitel,Deitel and Nieto, 2012, Pearson Education
- Fundamentals of the Internet and the World Wide Web, Raymond Greenlaw and Ellen Hepp, TMH- 2012
- Inline/Online: Fundamentals of The Internet And The World Wide Web, GREENLAW, TMH
- Complete idiots guide to java script,. Aron Weiss, QUE, 2013
- Network firewalls, Kironjeet syan -New Rider Pub.2014
- Networking Essentials – Firewall Media.Latest-2015
- www.secinf.com
- www.hackers.com
- Alfred Glkossbrenner-Internet 101 Computing MGH, 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.

PC-CS-206	OPERATING SYSTEMS						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	0	0	3.0	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.						
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 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 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.
- Simon 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-CS208	Design and Analysis of Algorithms						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3.0**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To introduce advanced data structures and algorithms concepts involving their implementation for solving complex applications.						
Course Outcomes (CO)							
CO1	To introduce the basic concepts of Data Structures and their analysis.						
CO2	To study the concept of Dynamic Programming and various advanced Data Structures.						
CO3	To introduce various Graph algorithms and concepts of Computational complexities.						
CO4	To study various Flow and Sorting Networks						

Unit 1: Introduction

Review:- Elementary Data Structures, Algorithms and its complexity(Time and Space), Analysing Algorithms, Asymptotic Notations, Priority Queue, Quick Sort.

Recurrence relation:- Methods for solving recurrence(Substitution , Recursion tree, Master theorem), Strassen multiplication.

Unit 2: Advanced Design and analysis Techniques

Dynamic programming:- Elements, Matrix-chain multiplication, longest common subsequence,
Greedy algorithms:- Elements , Activity- Selection problem, Huffman codes, Task scheduling problem, Travelling Salesman Problem.

Advanced data Structures:- Binomial heaps, Fibonacci heaps, Splay Trees, Red-Black Trees.

Unit 3: Graph Algorithms

Review of graph algorithms:-Traversal Methods(Depth first and Breadth first search),Topological sort, Strongly connected components, Minimum spanning trees- Kruskal and Prims, Single source shortest paths, Relaxation, Dijkstras Algorithm, Bellman- Ford algorithm, Single source shortest paths for directed acyclic graphs, All pairs shortest paths- shortest paths and matrix multiplication, Floyd-Warshall algorithm.

Computational Complexity:-Basic Concepts, Polynomial Vs Non-Polynomial Complexity, NP- hard and NP-complete classes.

Unit 4: Network and Sorting Algorithms

Flow and Sorting Networks Flow networks, Ford- Fulkerson method, Maximum Bipartite matching, Sorting Networks, Comparison network, The zero- One principle, Bitonic sorting network, Merging networks

Suggested Books :

- Corman, Leiserson and Rivest : Introduction to Algorithms, 2/e, PHI
- Das Gupta :Algorithms, TMH.
- Horowitz, Ellis and Sahni, Sartaj: Fundamentals of Computer Algorithms. Galgotia Publications
- Aho, Hopcroft and Ullman: The Design and Analyses of Computer Algorithms. Addison Wesley.
- R.B.Patel: Expert Data Structures with C, Khanna Publications , Delhi, India, 2nd Edition 2004, ISBN 81-87325-07-0.
- R.B.Patel and M.M.S Rauthan: Expert Data Structures with C++, Khana Publications, Delhi , India, 2nd Edition 2004,ISBN 87522-03-8

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-901	Organizational Behavior						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3.0	75	25	100	3
Purpose	To make the students conversant with the basics concepts of organizational culture and behavior for nurturing their managerial skills.						
Course Outcomes (CO)							
CO1	An overview about organizational behavior as a discipline and understanding the concept of individual behavior.						
CO2	Understand the concept and importance of personality ,emotions and its importance in decision making and effective leadership.						
CO3	Enabling the students to know about the importance of effective motivation and its contribution in group dynamics and resolving conflicts.						
CO4	Understand how to overcome organizational stress by maintaining proper organizational culture and effective communication.						

Unit 1

Introduction to Organizational Behavior: Concept and importance of Organizational Behavior, Role of Managers in OB, Foundations or Approaches to Organizational Behavior, Challenges and Opportunities for OB.

Foundation of individual behavior: Biographical characteristics, concept of Abilities and Learning , Learning and Learning Cycle, Components of Learning, concept of values and attitude, types of attitude, attitude and workforce diversity.

Unit 2

Introduction to Personality and Emotions: Definition and Meaning of Personality, Determinants of Personality, Personality Traits Influencing OB, Nature and Meaning of Emotions, Emotions dimensions, concept of Emotional intelligence

Perception and individual decision making: Meaning of perception, factors influencing perception, Rational decision making process, concept of bounded rationality. Leadership- Trait approaches, Behavioral approaches, Situational approaches, and emerging approaches to leadership.

Unit-3

Motivation: concept and theories of Motivation, theories of motivation-Maslow, Two Factor theory, Theory X and Y,ERG Theory, McClelland's Theory of needs, goal setting theory, Application of theories in Organizational Scenario, linkage between MBO and goal setting theory, employee recognition and involvement program.

Foundations of Group Behavior and conflict management :Defining and classifying of Groups, stages of group development, Informal and Formal Groups – Group Dynamics, Managing Conflict and Negotiation , a contemporary perspective of intergroup conflict, causes of group conflicts, Managing intergroup conflict through Resolution.

Unit-4:

Introduction to Organizational Communication: Meaning and Importance of Communication process, importance of Organizational Communication, Effective Communication, Organizational Stress: Definition and Meaning , Sources and Types of Stress, Impact of Stress on Organizations, Stress Management Techniques.

Introduction to Organization Culture- Meaning and Nature of Organization Culture, Types of Culture, Managing Cultural Diversity, Managing Change and Innovation – Change at work, Resistance to change, A model for managing organizational change.

Suggested Books

- Colquitt, Jason A., Jeffery A. LePine, and Michael Wesson. Organizational Behavior: Improving Performance and Commitment in the Workplace. 5th ed. New York: McGraw-Hill Education, 2017.
- Hitt, Michael A., C. Chet Miller, and Adrienne Colella. Organizational Behavior. 4th ed. Hoboken, NJ: John Wiley, 2015.
- Robbins, Stephen P., and Timothy Judge. Organizational Behavior. 17th ed. Harlow, UK: Pearson Education, 2017.
- Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, 11th edition, 2008.
- Schermerhorn, Hunt and Osborn, Organisational behavior, John Wiley.
- UdaiPareek, Understanding OrganisationalBehaviour, Oxford Higher Education.
- Mc Shane and Von Glinov, OrganisationalBehaviour, Tata Mc Graw Hill.
- Aswathappa, K., OrganisationalBehaviour– Text and Problem, Himalaya Publication

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-CS210L	Internet Technology and Management Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**4**	**2.0**	**40**	**60**	**100**	**3 Hour**
Purpose	Learn the internet and design different web pages using HTML.						
Course Outcomes (CO)							
CO1	Understanding different PC software and their applications.						
CO2	To be able to learn HTML.						
CO3	To be able to write Web pages using HTML.						
CO4	To be able to install modems and understand the e-mail systems.						

PC Software: Application of basics of MS Word 2000, MS Excel 2000, MS Power Point 2000, MS Access 2000, HTML

1. To prepare the Your Bio Data using MS Word
2. To prepare the list of marks obtained by students in different subjects and show with the help of chart/graph the average, min and max marks in each subject.
3. Prepare a presentation explaining the facilities/infrastructure available in your college/institute.
4. Design Web pages containing information of the Deptt.

HTML Lists:

1. Create a new document that takes the format of a business letter. Combine <P> and
 tags to properly separate the different parts of the documents. Such as the address, greeting, content and signature. What works best for each?
2. Create a document that uses multiple
 and <P> tags, and put returns between <PRE> tags to add blank lines to your document see if your browser senders them differently.
3. Create a document using the <PRE>tags to work as an invoice or bill of sale, complete with aligned dollar values and a total. Remember not to use the Tab key, and avoid using emphasis tags like <B> or <EM> within your list.
4. Create a seven-item ordered list using Roman numerals. After the fifth item, increase the next list value by 5.
5. Beginning with an ordered list, create a list that nests both an unordered list and a definition list.
6. Use the ALIGN attribute of an <IMG> tags to align another image to the top of the first image.. play with this feature, aligning images to TOP, MIDDLE and BOTTOM.
7. Create a 'table of contents' style page (using regular and section links) that loads a different document for each chapter or section of the document.

Internet:

1. Instilling internet and external modems, NIC and assign IP address.
2. Study of E-mail system.
3. Create your own mail-id in yahoo and indiatimes.com.
4. Add names (mail-id's) in your address book, compose and search an element.

NOTE:

At least ten experiments are to be performed from above list and the concerned institution as per the scope of the syllabus may set remaining five.

PC-CS212L	Operating Systems Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Sessional**	**Practical**	**Total**	**Time**
0	**0**	**4**	**2.0**	**40**	**60**	**100**	**3**
Purpose	To familiarize the students with the basics of Operating Systems.						
Course Outcomes (CO)							
CO1	To understand the CPU scheduling.						
CO2	To learn about memory management.						
CO3	To understand system calls.						
CO4	To understand the concept of file operations.						
CO5	To learn various classical problems.						

1. Simulation of the CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority
2. Program for paging techniques of memory management.
3. Program for page replacement algorithms
4. Simulation of Bankers Deadlock Avoidance and Prevention algorithms.
5. Program for Implementation of System Calls.
6. Program for File Permissions
7. Program for File Operations.
8. Program for File Copy and Move.
9. Program for Dining Philosophers Problem.
10. Program For Producer – Consumer Problem concept.
11. Program for disk scheduling algorithms.

NOTE:
At least ten experiments are to be performed from above list and the concerned institution as per the scope of the syllabus may set remaining five.

PC-CS214L	Design and Analysis of algorithms Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**4**	**2.0**	**40**	**60**	**100**	**3**
Purpose	The student should be made to Learn the algorithm analysis techniques, become familiar with the different algorithm design techniques and Understand the limitations of Algorithm power.						
Course Outcomes (CO)							
CO1	The student should be able to Design algorithms for various computing problems.						
CO2	The student should be able to Analyze the time and space complexity of algorithms.						
CO3	The student should be able to Critically analyze the different algorithm design techniques for a given problem.						
CO4	The student should be able to Modify existing algorithms to improve efficiency.						

1. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the IIst to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
2. Using Open, implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
3. a. Obtain the Topological ordering of vertices in a given digraph.
   b. Compute the transitive closure of a given directed graph using Warshall's algorithm.
4. Implement 0/1 Knapsack problem using Dynamic Programming.
5. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
6. Find Minimum Cost Spanning Tree of a given undirected graph using Kristal's algorithm.
7. a. Print all the nodes reachable from a given starting node in a digraph using BFS method.
   b. Check whether a given graph is connected or not using DFS method.
8. Find a subset of a given set S = {sl,s2,.....,sn} of n positive integers whose sum is equal to a given positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions{1,2,6}and{1,8}.A suitable message is to be displayed if the given problem instance doesn't have a solution.
9. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
10. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
11. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm, implement it using Open and determine the speed-up achieved.
12. Implement N Queen's problem using Back Tracking.
13. Use divides and conquers method to recursively implement Binary Search

NOTE:
At least ten experiments are to be performed from above list and the concerned institution as per the scope of the syllabus may set remaining five.

MC-901	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 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.

(a) Forest Resources: Use and over-exploitation, deforestation, case studies. Timber eztraction, 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. Sturcture 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. Biodiversityof global, National and local levels. India as a mega-diversity nation Hot spots 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 depressan 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 and will have to set the question paper according to the template provided along with the syllabus.

PE-CS-D401	Data Mining						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	0	0	3	75	25	100	3
Purpose	Data mining techniques discover the knowledge intelligently by extracting the desired patterns from data warehouses or web repositories data streams.						
Course Outcomes (CO)							
CO1	Learn about various Data Mining concepts						
CO2	Apply Frequent Itemsets Associations Rules to discover the knowledge						
CO3	Analyze the desired information using Classification Methods						
CO4	Evaluating knowledge from specific data sources using data mining trends						

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, Multidimensional 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: Classification Methods and Cluster Analysis

Advanced pattern mining, Mining multilevel patterns, multidimensional patterns, Classification : Basic Concepts, Decision Tree Induction, Naïve 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, Statistical 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.

Text Books:

1. "Data Mining" Concepts and Techniques by Jiawei Han, Micheline Kamber and Jian Pei, 3rd. Edition Elsevier Morgan Kaufmann Series USA 2012, ISBN 978-0-12-381479-1
2. "Datawarehousing: Concepts, Techniques, Products and Applications", by C.S.R. Prabhu PHI
3. "Data Mining with Microsoft SQL Server", by Seidman, Prentice Hall of India.

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-401	Project-II	0:0:12	12	6	0	40	60	100	3
5	PE-417L	Elective-IV Lab	0:0:2	2	1	0	40	60	100	3
6	PE-419L	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-D401	Soft Computing: PE-CS-D407
Software Verification and Validation and Testing:: PE-CS-D403	Neural Networks and Deep Learning: PE-CS-D409
Information Retrieval: PE-CS-D405	Object Oriented Software Engineering: PE-CS-D411
	Expert Systems: PE-CS-D413

OE Elective-II
Cyber Law and Ethics: OE-CS-401
Bioinformatics: OE-CS-403
Fiber Optic Communications: OE-CS-405
Industrial Electrical Systems: OE-CS-407

The course of both PE & OE will be offered at 1/3rd 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 6th semester and students will be required to get passing marks to qualify.

PE-CS-D403	Software Verification and Validation and Testing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	0	0	3	75	25	100	3
Program Objective (PO)	**The objective of this course is to provide the in-depth coverage of software quality models and software testing strategies. It focuses on test case generation techniques and testing levels. It also focuses on testing different kinds of software.**						
Course Outcomes (CO)							
CO1	To develop test cases for any problem						
CO2	To pursue testing on any level of software design by using different testing strategies						
CO3	To learn the test management and testing activities by using different testing methods.						
CO4	To apply testing and quality model of software testing in achieving high-quality software.						

UNIT – I

Introduction: Overview of software evolution, SDLC, Testing Process, Terminologies in Testing: Error, Fault, Failure, Verification, 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.

Miscellaneous topics: Stress Testing, Ad hoc testing: Buddy testing, Exploratory testing, Agile and extreme testing.

Suggested Books:

1. Naresh Chauhan "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.
4. William Perry, "Effective Methods for Software Testing", John Wiley & Sons, New York.
5. CemKaner, Jack Falk, Nguyen Quoc, "Testing Computer Software", Second Edition, Van Nostrand Reinhold, New York.
6. K.K. Aggarwal & Yogesh Singh, "Software Engineering", 2nd Ed., New Age International Publishers, New Delhi, 2005
7. Boris Beizer, "Software Testing Techniques", Second Volume, Second Edition, Van Nostrand Reinhold, New York.

PE-CS-D405	Information Retrieval						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	3	75	25	100	**3 Hour**
Purpose	To provide an overview of Information Retrieval and implementation insight about various evaluation methods.						
Course Outcomes							
CO 1	To make understanding about different Information retrieval model.						
CO 2	To understand the experimental evaluation of performance metrics.						
CO 3	To gain knowledge about various web search engines.						
CO 4	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 metrics; 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: naive Bayes; decision trees; and nearest neighbor. Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM). Applications to information filtering; organization; and relevance feedback.

Recommender Systems: Collaborative filtering and content-based recommendation of documents and products

Suggested Books:

1. Introduction to Information Retrieval Manning, Raghavan and Schutze, Cambridge University Press, 2008.
2. R. Baeza-Yates and B. Ribeiro Neto,"Modern Information Retrieval: The Concepts and Technology behind Search", Second Edition, Addison Wesley, 2011.
3. David A. Grossman and Ophir Frieder "Information Retrieval: Algorithms and Heuristics", Second Edition, Springer 2004.
4. Mining the Web, SoumenCharabarti, Morgan-Kaufmann, 2002.
5. Ricci, F, Rokach, L. Shapira, B.Kantor, Recommender Systems Handbook, First Edition, 2011.

PE-CS-D407	Soft Computing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	0	0	3	75	25	100	3
Purpose	Soft Computing deals with imprecision, uncertainty, partial truth, approximation to achieve practicability, robustness, and low cost solution for complex problems in real world using neural networks, fuzzy systems, evolutionary computation with optimization approaches to design intelligent systems.						
Course Outcomes (CO)							
CO1	Learn about various supervised and unsupervised Artificial Neural Networks.						
CO2	Apply the concepts of Fuzzy Logic for decision making in Fuzzy based Systems						
CO3	Analyze Nature-Inspired Algorithms like Genetic, Differential Evolution, PSO, ABC.						
CO4	Evaluate the values of new ideas by creating a new solution using Optimization.						

Unit I: Artificial Neural Networks

Fundamentals of Biological Neural Network and Artificial Neural Network, Evolution of Neural Networks, Learning – supervised, unsupervised and reinforcement, Terminologies – weights, bias, threshold, learning rate, Hebb Network, Perceptron Networks, Backpropagation Network, Associative Memory Network, Hopfield Networks, Counterpropagation Networks, Adaptive Resonance Theory Network, Optical Neural Networks, Applications of Neural Networks.

Unit II: Fuzzy Systems

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets, Operations on Crisp Sets and Fuzzy Sets, Classical Relation and Fuzzy Relations, Membership Functions, Methods of Membership Value Assignments, Fuzzy Arithmetic and Fuzzy Measures, Fuzzy Rule Base and Approximate Reasoning, Fuzzy Decision Making, Fuzzy Logic Control Systems, Applications of Fuzzy Logic based systems.

Unit III: Nature-Inspired Algorithms

Introduction to Nature-Inspired algorithms, Swarm Intelligence, Genetic Algorithm (GA), Operators in Genetic Algorithm – Encoding, Selection, Crossover, Mutation, Stopping Condition for GA, Differential Evolution (DE) Algorithm, Particle Swarm Optimization (PSO) Algorithm, Ant Bee Colony (ABC) Algorithm, Flower Pollination Algorithm, Solution of Real World Problems using Nature-Inspired Algorithms.

Unit IV: Optimization

Objective of Optimization, Single-objective Optimization, Multi-objective Optimization, Pareto-optimal solutions, Travelling Salesman Problem solution using any optimization technique, Engineering problems solution using any Soft Computing approach, Architecture of Neuro-Fuzzy Systems and Genetic Neuro-Fuzzy Hybrid Systems, Applications of Soft Computing.

Text Books:

4. "Principle of Soft Computing" by Dr. S.N. Sivanandam and Dr. S.N Deepa, 2nd. Edition
   Wiley India 2012, ISBN: 978-81-265-2741-0
5. "Soft Computing" Fundamentals, Techniques and Applications by Dr. Saroj Kaushik and Dr. Sunita Tiwari, McGraw Hill Education 2018, ISBN: 10:93-5316-066-9
6. "Neuro-Fuzzy and Soft Computing" A Computational Approach to Learning and Machine Intelligence by Jyh-Shing Roger Jang, Chuen-Tsai Sun and EijiMizutani Pearson 2018, ISBN: 978-93-325-4988-3
7. "Neural Networks, Fuzzy Logic and Genetic Algorithms" Synthesis and Applications by S. Rajasekaran and G.A VijayalakshmiPai PHI 2012, ISBN: 978-81-203-2186-1
8. "Nature-Inspired Optimization Algorithms" Xin-She Yang Elsevier USA 2014, ISBN: 978-0-12-416743-8

PE-CS-D409	Neural Networks and Deep Learning						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	0	0	3	75	25	100	3
Purpose	Neural network solves complex problems that require analytical calculations similar to those of the human brain. Deep learning is an artificial intelligence (AI) function that imitates human brain in processing data and creating patterns for decision making.						
Course Outcomes (CO)							
CO1	Learn about various concepts related to Neural Networks and Deep Learning.						
CO2	Understand about various supervised and unsupervised neural networks.						
CO3	Explore the knowledge about advanced types of Neural Networks.						
CO4	Apply biologically-inspired deep learning for expert systems in AI.						

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 algorithm, Backpropagation Network architecture and training algorithm, Associative Memory Network architecture and training algorithm, Hopfield Networks architecture and training algorithm, Counterpropagation Networks architecture and training algorithm, Adaptive Resonance Theory Network architecture and training algorithm.

Unit III: Advanced Neural Networks

Kohonen Self-Organising Feature Maps architecture and training algorithm, Learning Vector Quantization architecture and training algorithm, Boltzmann Machine, Cognitron Network, Neocognitron Network, Optical Neural Networks Electro-optical Multipliers and Holographic Correlators.

Unit IV: Deep Learning

Machine learning basics, Simple Machine Learning Algorithm -- Linear Regression, underfitting and overfitting challenges in Machine Learning, Supervised Learning approach for Support Vector Machine, Deep Feedforward Networks, Convolutional Networks, Deep Recurrent Networks, Deep Boltzmann Machine, Applications in Speech Recognition and Natural Language Processing.

Suggested Books:

1. "Neural Networks and Deep Learning" by Michaeil Nielsen, Online Book
2. "Principle of Soft Computing" by Dr. S.N. Sivanandam and Dr. S.N Deepa, 2nd. Edition
   Wiley India 2012, ISBN: 978-81-265-2741-0
3. "Soft Computing" Fundamentals, Techniques and Applications by Dr. Saroj Kaushik and Dr. Sunita Tiwari, McGraw Hill Education 2018, ISBN: 10:93-5316-066-9

4. "Neuro-Fuzzy and Soft Computing" A Computational Approach to Learning and Machine Intelligence by Jyh-Shing Roger Jang, Chuen-Tsai Sun and EijiMizutani Pearson 2018, ISBN: 978-93-325-4988-3
5. "Deep Learning" by YoshuaBengio and Aaron Courville, Online Book

PE-CS-D411	Object Oriented Software Engineering						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hrs.
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)						
CO1	To learn the basic concepts of object oriented systems and software engineering.						
CO2	To get exposure of various object modeling methodologies, tools for analyzing and designing software based systems using UML.						
CO3	To explore problems using Use Cases, analyzing relations, responsibilities and collaborations among classes and their behavior in problem domain.						
CO4	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, Booch Methodology, 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:

1. Ali Bahrami, Object Oriented Systems Development, McGraw HillPublishing Company Limited, New Delhi, 2013.
2. Rumbaugh *et al.*, Object Oriented Modeling and Design, PHI, 2006.
3. Robert Laganière and Timothy C. Lethbridge, Object-Oriented Software Engineering: Practical Software Development, McGraw-Hill Publishing Company Limited, New Delhi, Sixth Print 2008.

4. Ivar Jacobson, MagnosChristerson, Patrick Jonsson, Gunnar Overgaard, Object-oriented Software Engineering: A Use Case Driven Approach, Pearson Education, New Delhi, Seventh Edition Reprint, 2009.
5. Bernd Bruegge, Allen H. Dutoit, Object-Oriented Software Engineering Using UML, Patterns, and Java: Pearson New International, Third Edition, 2013.

PE-CS-D413	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	Design and implement expert systems for real life problem						

UNIT I

Introduction to Expert System Features of expert system, Representation and organization of knowledge, Basic characteristics, Types of problems handled by expert systems, Case study of PROSPECTOR.

UNIT II

Expert System Tools Techniques of knowledge representation 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

1.Waterman D.A.: A Guide to Expert Systems, Addison Wesley Longman
2.Hayes-Roth, Lenat and Waterman: Building Expert Systems, Addison Wesley
3.Weiss S.M. and Kulikowski C.A.: A Practical Guide to Designing Expert Systems, Rowman &Allanheld, New Jersey

OE-CS-401	Cyber Law and Ethics						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	-	-	3	75	25	100	3 Hrs.
Purpose	To gain a broad understanding in order to get cyber law and ethics.						
Course Outcomes							
CO1	To facilitate the basic knowledge of cyber Law.						
CO2	To learn about how to maintain the Confidentiality, Integrity and Availability of information technology act.						
CO3	To get enable to fix the various Cyber Law and Related Legislation.						
CO4	To deal with the 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: 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:

1. Cyber Security : Understanding Cyber Crimes , Computer Forensics and Legal Perspectives By Nina Godbole, SunitBelapur , Wiley
2. Understanding cybercrime: phenomena , and legal challenges response, ITU 2012.

OE-CS-403	Bioinformatics						
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 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 :Databases

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

Structure Databases: Introduction to structures. PDB (Protein Data bank) Molecular Modeling database at NCBI. , visualizing structural information, database structureviewers.Sequence and Structure File Formats; **The Entrez system**: Integrated information axis, Information retrieval from biological database, sequence database beyond NCBI. Medicaldatabases.

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.

PhylogeneticAnalysis: 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, extending Seqlab by including programmes that are not part of the Wiscosin package.

Unit-IV : Plasmid Mapping And PrimerDesign

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

Suggested Books-

1. Bioinformatics by Andreas D.Boxevanis. Wiley Interscience,4th edition 2020.
2. Bioinformatics: Sequence and genome analysis by David W.Mount, Cold Spring Harbor,2004.

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.

OE-CS-405	Fiber Optic Communications						
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 concepts of Optical communication covering the contents of optical fibers, losses in fibers, optical sources, detectors etc.**						
	Course Outcomes (CO)						
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:

1. John Power, An Introduction to Fiber optic systems, McGraw Hill International.
2. John Gowar , Optical communication Systems.
3. R. Ramaswamy, Optical Networks, Narosa Publication

4. John M. Senior,Optical Fiber Communication
5. Gerd Keiser, Optical Fiber Communication

OE-CS-407	Industrial Electrical Systems						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0		75	25	100	3
Purpose	To provide the conceptual knowledge of various Industrial Electrical Systems.						
Course Outcomes							
CO 1	To study various fundamental concepts of Electrical Components.						
CO 2	To study and understand the Residential and Commercial Electrical Systems						
CO 3	To study the functions and selection of Industrial Electrical Components						
CO 4	To study the basics and role of PLC & SCADA in automation						

UNIT-1

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-11

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, protectiondevices, requirements of commercial installation, earthingofcommercial installation, selection and sizing of components.

UNIT-I11

Industrial Electrical Systems

HT connection, industrial substation, Transformer selection, Power factor correction–kVAR calculations, 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-1V

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

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 ISStandards.
4. 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-402	Project-III	0:0:12	12	6	0	40	60	100	3
5	PE410-L	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-A402
Computer Graphics: PE-CS-A404
Software Reliability: PE-CS-A406
Mobile Apps Development: PE-CS-A408

OE Elective-III	**OE Elective-IV**
Cyber Security: OE-CS-402	Web and Internet Technology: OE-CS-410
Satellite Communication: OE-CS-404	Automation in Manufacturing: OE-CS-412
Social Networks Analysis & Mining: OE-CS-406	IPR, Bioethics and Biosafety: OE-CS-414
Agile Software Engineering: OE-CS-408	Signal & Systems: OE-CS-416

PE-CS-A402	Cloud computing						
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 Cloud Computing						
Course Outcomes (CO)							
Co1	Introduction & Overview of Computing Paradigm						
Co2	To Cloud Computing Architecture						
Co3	To study the concepts of Service Management in Cloud Computing						
Co-4	To study the concepts of Cloud Security						

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

Introduction to Cloud Computing: Cloud Computing (NIST Model), introduction to Cloud Computing, 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.Data Security, Network Security

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 Applications: Scientific Applications – Health care, Geoscience and Biology. Business and Consumer Applications- CRM and ERP, Social Networking, Media Applications and Multiplayer Online Gaming.

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

Suggested books:

1. *Cloud Computing Bible,* Barrie Sosinsky, *Wiley-India,* 2010
2. *Cloud Computing: Principles and Paradigms,* Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, *Wile,* 2011
3. *Cloud Computing: Principles, Systems and Applications, Editors:* Nikos Antonopoulos, Lee Gillam, *Springer,* 2012
4. *Cloud Security: A Comprehensive Guide to Secure Cloud Computing,* Ronald L. Krutz, Russell Dean Vines, *Wiley-India,* 2010

PE-CS-A404	Computer Graphics						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	0	0	3	75	25	100	3
Purpose	**Introduces Computer Graphics that help in designing different kinds of static and movable objects.**						
Course Outcomes(CO)							
CO1	Explore the background and standard line and circle drawing algorithms.						
CO2	Exposure of various transformation approaches and its comparative analysis.						
CO3	Illustrate Projection and clipping with different techniques.						
CO4	Apply design principles to create different curves and explore hidden lines and surface techniques.						

UNIT – I: Introduction

Computer Graphics applications,Classification,Components,Display Devices, Scan conversion-Point & Line, Line drawing algorithms: DDA, Bresenham's, Circle drawing algorithms: Bresenham's,Mid pointAlgorithm.

UNIT – II: Advanced Design Techniques

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: Graph Algorithms

Clipping: Point & Line clipping algorithm, 4-bit code algorithm, Cohen-Sutherland Line clipping algorithms, Polygon clipping: Sutherland-Hodgeman Polygon clipping algorithm. Curve clipping, Text clipping.

Projection: Parallel, Perspective, Vanishing Points.

UNIT – IV: String Matching Algorithms

Representation of 3-D Curves and Surfaces: interpolation and approximation alpines, parametric conditions, Geometric continuity conditions, Bezier curves and surfaces: properties of bezier curves, bezier surfaces.

Hidden Surfaces removal: Hidden surface elimination, depth buffer algorithm, scan line coherence and area coherence algorithm, Painter's algorithm.

Text Books:

1. Donald Hearn &M.Pauline Baker, Computer Graphics, 2nd Edition, Pearson Education.
2. William M. Newmann& Robert F. Sproull, Principles of Interactive Computer Graphics, Tata McGraw-Hill Second Edition, New Delhi, India.
3. Zhigang Xiang & Roy A Plastock , Computer Graphics, Second Edition, Schaum's Outline, Tata McGraw Hill Education Private Limited, New Delhi, India.

PE-CS-A406	Software Reliability						
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 understand the working of software reliability models and reliability prediction models, and able to design and develop reliability models.						
Course Outcomes(CO)							
CO1	Develop reliable software systems.						
CO2	Understand the fault handling and failure forecasting techniques in software systems.						
CO3	To learn different time dependent and time independent software reliability models and design reliability models for software systems.						
CO4	Design reliability models for software systems.						

UNIT I

Basic Ideas of Software Reliability, Hardware reliability vs. Software reliability, Reliability metrics, Failure and Faults – Prevention, Removal, Tolerance, Forecast, Dependability Concept – Failure Behaviour, Characteristics, Maintenance Policy, Reliability and Availability Modeling, Reliability Evaluation Testing methods, Limits, Starvation, Coverage, Filtering, Microscopic Model of Software Risk.

UNIT II

Computation of software reliability, Functional and Operational Profile, Operational Profiles – Difficulties, Customer Type, User Type, System Mode, Test Selection - Selecting Operations, Regression Test.

UNIT III

Classes of software reliability Models, Time Dependent Software Reliability Models: Time between failure reliability Models, Fault Counting Reliability Models. Time Independent Software Reliability Models: Fault injection model of Software Reliability, Input Domain Reliability Model, Orthogonal defect classification, Software availability Models. Software Reliability Modeling: A general procedure for reliability modeling.

UNIT IV

Short and Long Term Prediction, Model Accuracy, Analysing Predictive Accuracy – Outcomes, PLR, U and Y Plot, Errors and Inaccuracy, Recalibration – Detecting Bias, Different Techniques, Power of Recalibration, Limitations in Present Techniques, Improvements.

Suggested Books

1. J.D. Musa, *Software Reliability Engineering*, McGraw Hill, New York , 2004
2. H. Pham, *Software Reliability*, Springer Verlag, New York , 2000
3. Patric D. T.O Connor, *Practical Reliability Engineering, 4th Edition*, John Wesley & Sons , 2003
4. D. Reled, *Software Reliability Methods*, Springer Verlag, New York , 2001

PE-CS-A408	Mobile Apps Development						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3
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 1: Introduction to Mobility

Mobility landscape, Mobile platforms, Mobile apps development, Overview of Android platform, challenges of Android app development, versions of Android, why develop apps for android, Setting up the Mobile App Development environment along with an Emulator.

Mobile Platforms: URIs for mobile apps, Compare and contrast native mobile platforms such as tightly controlled (IPhone), open (Android), and licensed (Windows Mobile), web as a mobile application platform.

Unit II: Building blocks of Mobile

Activities, Activity life cycle and interaction between activities, App User Interface Designing – User Interaction, user input controls, Mobile UI resources (Layout, UI elements, Drawable, Menu)screen navigation, Recycle view. App functionality beyond user interface - Threads, Async task, Services – States and Life Cycle, Notifications, Broadcast receivers, Content provider.

Unit III: Sprucing up Mobile Apps

Triggering, scheduling and optimizing background tasks: Notifications, Scheduling Alarms, transferring data efficiently.Graphics and animation – Custom views, Canvas, Animation APIs, Multimedia – Audio/Video playback and record, Location awareness.

Native data handling –file I/O, Shared preferences, shared data through content provider, Mobile databases such as SQLite, and Enterprise data access (via Internet/Intranet).

Unit IV: Testing and Launching Mobile Apps

Debugging mobile apps, White box testing, Black box testing, and test automation of Mobile apps, JUnit for Android. Loading data using loaders, Permissions, Performance and Security, Firebase and AdMob and publish.

Suggested Books:

1. Barry Burd, *Android Application Development All in one for Dummies*, Wiley publications, 2nd Edition 2015.
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 - Second Edition,2016.
5. Carmen Delessio, Lauren Darcey, Teach Yourself Android Application Development In 24 Hours , SAMS, 2013.
6. Brian Fling, Mobile Design and Development, O'Reilly Media, 2009.
7. Maximiliano Firtman, Programming the Mobile Web, O'Reilly Media, 2010.

OE-CS-402	Cyber Security						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**-**	**-**	**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 learn about how to maintain the Confidentiality, Integrity and Availability of a data.						
CO3	To get enable to fix the various cyber-attacks.						
CO4	To deal with the digital forensics and related scenarios of cybercrimes.						

Unit I

Introduction: Fundamentals of Cyber Crime, Types of Cyber Crime: crime against individual, Crime against property, Cyber extortion, Drug trafficking, cyber terrorism. Cybercrime issues. 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 linear crypt analysis of DES - block cipher modes of operations - triple DES – AES.

Unit 2

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

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 ,OS Security.
Web Security: Secure socket layer and transport layer security - secure electronic transaction (SET) - System Security: Intruders - Viruses and related threads - firewall design principals – trusted systems.

Unit 4

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, Cybercrime and Punishment.
IP Security: Architecture - Authentication header - Encapsulating security payloads - combining security associations - key management.

Suggested Books:

1. Nelson Phillips and EnfingerSteuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.
2. William Stallings, "Crpyptography and Network security Principles and Practices", Pearson/PHI.
3. Robert M Slade," Software Forensics", Tata McGraw - Hill, New Delhi, 2005.

4. SunitBelapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt. Ltd.

OE-CS-404	Satellite Communication:						
Lecture	**Tutorial**	**Practical**	**Credit**	**MajorTest**	**MinorTest**	**Total**	**Time**
2	0	0	2	75	25	100	3
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:

1. Timothy Pratt, Satellite Communications, Wiley India edition
2. Anil K Maini, Satellite Communication, Wiley India edition

OE-CS-406	Social Networks Analysis & Mining						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**2**	**75**	**25**	**100**	**3 Hrs.**
Program Objective (PO)	This emerging and innovative field will provide the insight into latest communication techniques used in the online social networks for identifying and representing the relationships and link prediction via the effective combination of graph theory, matrix, clustering, and equivalence between users.						
Course Outcomes (CO)							
CO1	To understand the essentials of social networks by learning link prediction, clustering, community detection and structural relationships among the nodes to determine their relative importance.						
CO2	To explore the detailed explanation of homophily, selection, closure, segregation, relationships and graph creation in an efficient distribution.						
CO3	To analyze the social networks using betweenness, centrality, equivalence relation, centralization, clustering coefficient and structural cohesion, page rank and random graph models to generate visualizations and to perform empirical investigations of network data.						
CO4	To interpret and synthesize the results with respect to modeling epidemics, experimental and generative models and the basic of collated datasets by using equivalence concepts for interpreting complex data to execute better recommendation.						

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 neighborhood overlap, Structure of weak ties, bridges, and local bridges, Emeddedness, Betweenness Measures and Graph Partitioning, Finding Communities in a graph (Brute Force Method), Community Detection Using Girvan Newman 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

Metrics 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, PageRank as a Matrix Operation, Introduction to Power Law, Rich Get Richer Phenomenon, Implementing a Random Graph (Erdos-Renyi Model)

Unit-IV

Rich Get Richer - The Long Tail, Epidemics- An Introduction, Simple Branching Process for Modeling 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:

1. David Easley and Jon Kleinberg, "Networks, Crowds and Markets", Cambridge UniversityPress.
2. Matthew O. Jackson, "Social and Economic Networks", Princeton University Press.
3. Matthew A. Russell, "Mining the Social Web", O'Reilly and SPD, Second edition New Delhi.

4. Hanneman, R. A., & Riddle, M., "Introduction to social network methods, Riverside, California: University of California, Riverside. Retrieved from http://faculty.ucr.edu/~hanneman/nettext/.
5. "Social network analysis: Theory and applications". A free, Wiki Book available at: http://train.ed.psu.edu/WFED-543/SocNet_TheoryApp.pdf.
6. John Scott, Peter J. Carrington, "Social Network Analysis", SAGE Publishing Ltd.

OE-CS-408	Agile Software Engineering						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	0	0	2	75	25	100	3
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

Agile Testing Planning and Managing Testing Cycle, Agile Lifecycle and its impact on testing, Principles of Agile Testing, Agile Testing Techniques, Test-Driven Development, User Acceptance Tests, Test Automation.

Agile Project Management Scheduling in an agile project, scheduling challenges, estimating costs, monitoring project progress, burning down the product backlog, reporting, controlling the project

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
- Enterprise-Scale Agile Software Development James Schiel Latest edition, CRC Press
- Succeeding with Agile: Software Development Using Scrum Mike Cohn Latest edition, Addison-Wesley

Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
-	-	4	2	40	60	100	3 Hrs.
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 Practical:

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: At least 5 to 10 more exercises are to be given by the teacher concerned.

OE-CS-410	Web and Internet Technology						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time

2	0	0	2	75	25	100	3 Hour
Purpose	To learn the architecture and programming of Internet and study of scripting language :Python						
Course Outcomes							
CO 1	To Learn the basic concepts of internet and its connectivity						
CO 2	To Learn about the services of internet , designing and its architecture						
CO 3	To Learn the basic concepts of Python and its applications in information industry						
CO 4	To Acquaint the knowledge of latest programming language for the implementation of object based and procedure based applications using Python.						

Unit-I: Introduction to Internet

Internet, Growth of Internet, Owners of the Internet, Anatomy of Internet, ARPANET and Internet history of the World Wide Web, basic Internet 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, Searching systems, Searching your web site, designing the search interface.

Unit-II: Internet Services and Web Publishing

Setting up a connection: Hardware requirement, Selection of a Modem, Software Requirement, Modem Configuration, Common terminologies: Node, Host, Workstation, bandwidth, Interoperability, Network administrator, network security, Network Components: Severs, Clients, Communication Media, Service options – E-mail, News Firewall, etc.
Introduction to XHTML and HTML5: Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms in HTML, Syntactic Differences between HTML5 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 of Scripting Language: Python

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: Advanced Python

Classes and Object-Oriented Programming: Abstract Data Types and Classes, Inheritance, Encapsulation and Information Hiding. File Handling, Exceptions Handling, Data base (MySQLdb) operation: file check, table creation, insertion and deletion of data, Regular Expressions – REs in Python and Plotting.

Suggested Books

1. "Information Architecture on the World Wide Web", By Peter Morville, Louis Rosenfeld, O'Reilly Media, 2006.
2. "Programming The World Wide Web", By Robert W. Sebesta, 8th Edition, Pearson India, 2015.
3. "The Fundamentals of Python: First Programs", By Kenneth A. Lambert, 2011, Cengage Learning.
4. "Python: The Complete Reference", By Martin C. Brown, Paperback March 2018

5. "Core Python Programming", by R. Nageswara Rao, Dreamtech Publication, 2018

OE-CS-412	Automation in Manufacturing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time

2	0	0	2	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.

Reference Books:

1. Automation, production system and computer integrated manufacturing- Mikell P. Groover, Pearson fourth edition.
2. CAD/CAM: Computer Aided Design and ManufacturingGroover-M.P. and Zimmers E. W.,Prentice Hall International, New Delhi, 1992.
3. CAD/CAM/CIM-P. Radhakrishnan, S. Subramanayan and V.Raju, New Age International (P) Ltd., New Delhi.
4. Computer Integrated Manufacturing- Alavudeen and Venkateshwaran, Prentice- Hall of India Pvt. Ltd., New Delhi.

OE-CS-414	IPR, Bioethics, and Biosafety						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	2	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 ccological 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.

Suggested 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 ShominiParashar, 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.

OE-CS-416	**Signals and Systems**						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**-**	**-**	**2**	**75**	**25**	**100**	**3 Hrs.**

Course Outcomes (CO) At the end of this course, students will demonstrate the ability to	
CO1	Analyze different types of signals.
CO2	Represent continuous and discrete systems in time and frequency domain using different transforms.
CO3	Understand sampling theorem and its implications.
CO4	Apply transform techniques to analyze continuous-time and discrete-time signal and systems

UNIT-I

Introduction to Signals: Continuous and discrete time signals, deterministic and stochastic signals, periodic and a periodic signal, even and odd signals, energy and power signals, exponential and sinusoidal signals and singular functions.

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 undersampling, 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.

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.

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,

Suggested Books:

- Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, Signals and Systems, Prentice Hall India, 2nd Edition, 2009
- Simon Haykins – "Signal & Systems", Wiley Eastern
- Tarun Kumar Rawat , Signals and Systems , Oxford University Press.
- H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.
- M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.
- B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.

ES-301	Microprocessor & Interfacing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	3	75	25	100	**3 Hour**
Purpose	To learn the architecture and programming of Intel family microprocessors and its interfacing.						
Course Outcomes							
CO 1	To study the Architecture of 8086 microprocessors						
CO 2	To implement the interfacing of memories to 8086 Microprocessor						
CO 3	To learn and analyze the instruction set of 8086 Microprocessor and implementation of assembly language programming of 8086 Microprocessor.						
CO 4	To design and implement the interfacing of interrupts, basic I/O and DMA with 8086 Microprocessor						

Unit I

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

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.

UNIT-III

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.

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 stepper motor, optical encoder with 8086.

Interrupts and DMA: 8086 Interrupt mechanism; interrupt types and interrupt vector table. Applications of interrupts, Intel's 8259. DMA operation. Intel's 8237.

Suggested Books:

1. Barry B. Brey, "The Intel Microprocessor8086/8088, 80186", Pearson Education, Eighth Edition, 2009
2. D.V. Hall, Microprocessors and Interfacing, McGraw Hill 2nd ed.
3. Liu, Gibson, "Microcomputer Systems: The 8086/88 Family", 2nd Edition, PHI,2005
4. Kenneth Ayala, "The 8086 Microprocessor: Programming & Interfacing the PC", Cengage Learning,
5. Indian Edition, 2008
6. Kip Irvine, "Assembly language for IBM PC", PHI, 2nd Edition, 1993
7. Peter Abel, "Assembly language programming", Pearson Edu,5th Edition,2002
8. Uffenback, "The 8086 Family Design" PHI, 2nd Edition.
9. Walter A Triebel and Avtar Singh; The 8088 and 8086 Microprocessors

Bachelor of Technology (Computer Science & Engineering)										
Credit-Based Scheme of Studies/Examination										
Semester V (w.e.f. session 2020-2021)										
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-301	Microprocessor & Interfacing	3:0:0	3	3	75	25	0	100	3
2	PC-CS-301	Database Management Systems	3:0:0	3	3	75	25	0	100	3
3	PC-CS-303	Formal Language & Automata Theory	3:0:0	3	3	75	25	0	100	3
4	PC-CS-305	Essential of Information Technology	3:0:0	3	3	75	25	0	100	3
5	PC-CS-307	Computer Organization & Architecture	2:0:0	2	2	75	25	0	100	3
6	PEC	Elective-I	3:0:0	3	3	75	25	0	100	3
7	PC-CS-309L	Database Management Systems Lab	0:0:4	4	2	0	40	60	100	3
8	PC-CS-311L	Essential of Information Technology Lab	0:0:4	4	2	0	40	60	100	3
		Total		**25**	**21**	**450**	**230**	**120**	**800**	
9	MC-904	Energy Resources & Management	3:0:0	3	0	0	100	0	100	3
10	SIM-301*	Seminar on Summer Internship	2:0:0	2	0	0	50	0	50	

PEC Elective-I
Digital Data Communication: PE-CS-T301
Parallel and Distributed Computing: PE-CS-T303
Information Theory and Coding: PE-CS-T305
Advanced Algorithms: PE-CS-T307

***Note:** SIM-301* is a mandatory credit-less course in which the students will be evaluated for the Summer Internship undergone after 4th semester and students will be required to get passing marks to qualify.

PC-CS-301	Database Management Systems						
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 Data Base Management system						
Course Outcomes							
CO 1	To provide introduction to relational model and ER diagrams.						
CO 2	To realize about Query Processing and Transaction Processing.						
CO 3	To comprehend about the concept of functional dependencies.						
CO 4	To learn the concept of failure recovery and concurrency control.						

UNIT I

Introduction: Concept & Overview of DBMS, Data Models-, Network, Hierarchical and Relational Model, Levels of abstraction. Administrator, Database Users, Three Schema architecture of DBMS, Application.
Entity-Relationship Model: : Entities, Attributes and Entity Sets, Relation and Relationships sets, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

UNIT II

Relational Model: Structure of relational Databases, Relational Algebra and Relational Calculus, Operations on Relational Algebra, Operations on Relational Calculus, Tuple Relational Calculus, Domain Relational Calculus.
SQL and Integrity Constraints: Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, Introduction to views, Querying, Nested Sub queries, Database security application development using SQL, Stored procedures and triggers.

UNIT III

Relational Database Design:
Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF.
Internals of RDBMS: Physical data structures, Query optimization: join algorithm, statistics and cost base optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols, two phase locking.

UNIT IV

Recovery System: Types of Failures, Recovery Techniques, ARIES.
Concurrency Control: Serial and Serializable Schedules-Conflict Serializability –Enforcing Serializability by Locks-Locking Systems with Several Lock Modes-Concurrency Control by Timestamps, validation.
Transaction Management: ACID Properties, Transaction states, Serializability and Recoverability-View, Serializability-Resolving Deadlocks-Distributed Databases: Commit and Lock

Suggested Books:

- Ramez Elmasri , Shamkant B. Navathe ,"Fundamentals of Database systems", Pearson
- Korth, Silberschatz, Sudarshan: database concepts, MGH,
- R. Ramakrishnan and J. Gehrks database management system; MGH, International edition,
- C. J. Date, data base systems: 7th edition, Addison Wesley, Pearson Education,
- Chakrabarti, Advance database management systems , Wiley Dreamtech

PC-CS-303	Formal Language & Automata Theory						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	0	0	3	75	25	100	3 Hour
Purpose	To understand the challenges for Theoretical Computer Science and its contribution to other sciences						
Course Outcomes							
CO 1	Students are able to explain and manipulate the different fundamental concepts in automata theory and formal languages.						
CO 2	Simplify automata and context-free grammars; Prove properties of languages, grammars and automata with rigorously formal mathematical methods, minimization.						
CO 3	Differentiate and manipulate formal descriptions of push down automata, its applications and transducer machines.						
CO 4	To understand basic properties of Turing machines and computing with Turing machine, the concepts of tractability and decidability.						

Unit - I

Introduction to Automata: Study and Central Concepts of Automata Theory, Applications of Finite Automata, An Introduction of Deterministic Finite Automata(DFA) and Non-Deterministic Finite Automata(NFA), Finite Automata with Epsilon (Є) Transitions.

Regular Expression and Languages: Regular Expressions (RE), Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws of Regular Expressions, Closure Properties of Regular Languages, RE to NFA, DFA Conversion and DFA to RE, Equivalence and Minimization of NFA and DFA automata.

Unit-II

Context free Grammars and Languages: Parse Trees, Context Sensitive Grammar, Context Free Grammar, Regular Grammar, Applications of Context Free Grammars, Ambiguity in Grammars and Languages. Closure Properties of CFL, Chomsky Theorem, Chomsky Hierarchy, Normal forms of context free grammars: Chomsky Normal Form, Greibach Normal Form.

Pumping Lemma: Introduction to Pumping Lemma, pumping lemma for context free languages, Applications of Pumping Lemma, Minimization of Finite Automata, and Recursive Language.

Unit-III

Mealey and Moore Machines: Definitions, Representation, Equivalence of Moore and Mealey Machines and its Designing.

Push Down Automata: Introduction of Push Down Automata (PDA), Language of PDA, Equivalence of PDA's and CFG's, Deterministic Push Down Automata, Designing of PDA, Applications of PDA.

Unit-IV

Introduction to Turing Machine: The Turing Machine, Programming Techniques for Turing Machine, Extensions of Turing Machine, Restricted Turing Machines, Universal Turing Machines and Designing of Turing Machines, Time and Tape Complexity Measures of Turing machines

Decidability: Post's Correspondence Problem (PCP), Rice's Theorem, Decidability and Undecidability properties, P-NP class and completeness.

Suggested Books:

- J.E.Hopcroft, R.Motwani and J.D.Ullman , "Introduction to Automata Theory Languages and
- computation", Pearson Education Asia , 2001.
- K.Krithivasan and R.Rama; Introduction to Formal Languages, Automata Theory and Computation; Pearson Education, 2009.
- Peter Linz, "An Introduction to Formal Language and Automata", 4th Edition, Narosa Publishing house , 2006.
- M.Sipser; Introduction to the Theory of Computation; Singapore: Brooks/Cole, Thomson Learning, 1997.
- John.C.martin, "Introduction to the Languages and the Theory of Computation", Third edition, Tata McGrawHill, 2003

PC-CS-305	Essential of Information Technology						
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 Advanced Java Programming						
Course Outcomes (CO)							
CO1	Study fundamental concepts of Java.						
CO2	Design of user interfaces using Java applets.						
CO3	To study and implement JDBC and Jbeans.						
CO4	To study concepts of servlets and its applications.						

UNIT-I

Introduction: Importance and features of Java, Concepts of Java Virtual machine (JVM), Keywords, Constants, Variables and data types, operators and expressions, Control statements, Conditional statements, loops and iterations. Class definition, adding variables and methods, creating objects, constructors, defining methods, calling methods, method overloading. Creating an array, one and two dimensional array, string array and methods String and String Buffer classes, Wrapper classes. Packages and Interfaces, exception handling.

UNIT-II

Design of User Interfaces: Swing, Applet, Icons and Labels, Text Fields, Buttons, button Class, Check Box, Radio Buttons, The Container, Panel, Windows, and Frame Classes, Combo Box, Tabbed Panes, Scroll Panes, Trees, Tables.

UNIT-III

Servlets: Introduction to Servlets, Life cycle of Servlets, Creating, Compiling and running servlet, Reading the servlet Parameters, Reading Initialization parameter, Packages- javax.servlet Package, Handling HTTP Request and Response (GET / POST Request), Cookies and Session Tracking.

UNIT-IV

Advance Java: Collection, list, Map, Tree, Hashing.

JDBC: JDBC Fundamentals, Establishing Connectivity and working with connection interface, working with statements, Creating and Executing SQL statements, working with Result Set Object & Result Set Meta Data.

Suggested Books:

1. Gary Cornell and Horstmann Cay S., Core Java, Vol I and Vol II, Sun Microsystems Press.
2. Herbert Schildt, Java: The Complete Reference, McGraw-Hill.
3. Philip Hanna, JSP: The Complete Reference, McGraw-Hill.
4. Deital and Deital, Java How to Program, Prentice Hall (2007).

PC-CS-307	Computer Organization & Architecture						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**2**	**75**	**25**	**100**	**3 Hrs.**
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 internal organization and operations of a computer.						
CO2	Be familiar with the design trade□offs in designing and constructing a computer processor.						
CO3	Be aware with the CPU design including the RISC/CISC architectures.						
CO4	Be acquainted with the basic knowledge of I/O devices and Select the appropriate interfacing standards for I/O devices.						

Unit- I

Data representation and Computer arithmetic: Introduction to Computer Systems, Organization and architecture, Von Neumann 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.

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

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 s
organization, Control Memory, address sequencing, Micro program Example, micro instruction format, Horizontal Vs Vertical micro-programming, design of control Unit, microprogram sequencer, Hardwired v/s Micro-programmed Control Unit.

Unit-III

Central Processing Unit: General register organization, stack organization, instruction formats (Zero, One, Two and Three Address Instruction), addressing modes, Data transfer and manipulation, Program control. CISC and RISC: features and comparison. Pipeline and vector Processing , Parallel Processing, Flynn's taxonomy, 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, Serial communication.

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, ZvonkoVranesic and SafwatZaky, "Computer Organization", Fifth Edition, Tata McGraw Hill, 2002.

PC-CS-309L	Database Management Systems Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**4**	**2**	**40**	**60**	**100**	**3 Hours**
Purpose	**To familiarize the students with the basics of Data base management system.**						
Course Outcomes							
CO1	To understand basic DDL commands						
CO 2	To learn about DML and DCL commands						
CO 3	To understand the SQL queries using SQL operators						
CO 4	To understand the concept of relational algebra						
CO5	To learn various queries using date and group functions						
CO6	To understand the nested queries						
CO7	To learn view, cursors and triggers.						

1. Write the queries for Data Definition Language (DDL) in RDBMS.
2. Write the queries for Data Manipulation Language (DML) in RDBMS.
3. Write the queries for Data Control Language (DCL) in RDBMS.
4. To perform various integrity constraints on relational database.
5. Create a database and perform the following operations:-
   a. Arithmetic and Relational operations
   b. Group by & having clauses
   c. Like predicate for pattern matching in database
6. Write SQL queries for relational algebra
7. Write SQL queries for extracting data from more than one table
8. Write SQL queries for sub queries, nested queries
9. Concepts for ROLL BACK, COMMIT & CHECK POINTS
10. Using two tables create a view, which shall perform natural join, equi join, outer joins.
11. Write a procedure for computing income tax of employee on the basic of following conditions:-
    a. if gross pay<=40,000 then I.T rate is 0%.
    b. if gross pay>40,000 but <60000 then I.T rate is 10%.
    c. if gross pay>60,000 but <1,00,0000 then I.T rate is 20%.
    d. 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.
12. Write trigger for before and after insertion, deletion and updation process.

PC-CS-311L	Essential of Information Technology Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**4**	**2**	**40**	**60**	**100**	**3 Hrs.**
Purpose	To introduce the concepts of Advanced Java Programming						
Course Outcomes (CO)							
CO1	Study fundamental concepts of Java.						
CO2	Design of user interfaces using Java applets.						
CO3	To study and implement JDBC and Jbeans.						
CO4	To study concepts of servlets and its applications.						

1. Write a Java Package with Stack and queue classes.
2. Design a class for Complex numbers in Java .In addition to methods for basic operations on complex numbers, provide a method to return the number of active objects created.
3. Develop with suitable hierarchy, class for point, shape rectangle, square, circle, ellipse, triangle, polygenetic.
4. Design a simple test application to demonstrate dynamic polymorphism.
5. Design a java interface for ADT Stack.
6. Develop two different classes that implement this interface. One using array and other using linked list.
7. Develop a simple paint like program that can draw basic graphical primitives
8. Develop a scientific calculator using event driven programming.
9. Develop a template for linked list class along with its members in Java.
10. Write a program to insert and view data using Servlets

PE-CS-T301	Digital Data Communication						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Purpose	To provide the conceptual knowledge of data preparation and signal transmission methodologies used in data communication and networking.						
Course Outcomes							
CO 1	To study various analog communication techniques and with their characteristics.						
CO 2	To study and understand the requirements for analog/digital data to analog/digital signal conversion techniques.						
CO 3	To study the error and flow control techniques in communication and networking.						
CO 4	To study the concept of multiplexing and applied multiple access techniques specially in satellite communication.						

UNIT-1

MODULATION TECHNIQUES

Basic constituents of Communication Systems need of modulation, Amplitude modulation, spectrum of AM wave, modulation index, DSBSC modulation, SSB Modulation, vestigial side band modulation.

ANGLE MODULATION: Frequency and Phase Modulation, spectrum of FM Wave, Modulation Index and Bandwidth of FM Signal, NBFM and WBFM.

UNIT-II

DATA ENCODING

Digital data, Digital signals: Encoding schemes: NRZ-L, NRZ-I, Manchester-Diff-Manchester-encoding,Pseudoternary-Bipolar-AMI,B8ZS- HDB3 – Evaluation factors-Digital data, analog signals: Encoding Techniques –ASK-FSK-PSK-QPSK-Performance comparison-Analog data, digital signals: Quantization- Sampling theorem-PCM-Delta modulation-Errors- comparison- Analog Data, analog signals: Need for modulation -0 Modulation methods – Amplitude modulation- Angle modulation- Comparison.

UNIT-III

DIGITAL DATA COMMUNICATION TECHNIQUES

Asynchronous and synchronous transmission –Error Detection techniques: Parity checks – Cycle redundancy checks-Checksum-Error Correcting codes: Forwards and backward error corrections, Transmission media. Communication Topologies.

DTE & DCE interface: Characteristics of DTE-DCE interface. Interfaces: Rs-232-C, Rs-449/422, A/423-A.

UNIT-IV

SATELITE COMMUNICATION

Multiplexing: Advantages, Types of Multiplexing: FDM, Synchronous TDM, Statistical TDM/Asynchronous TDM, Study of their characteristics.

Satellite Communication Systems: Satellite parameters and configurations – Capacity allocation, Frequency Division FDMA; Time Division TDMA- Fixed assigned multiple access (FAMA), Demand assign multiple access (DAMA) – The concept of spread spectrum: FHSS, DSSS – CDMA – Transmission and reception.

Suggested Books

1. Forouzen, "Data Communication & Networking",Tata Mcgraw Hill
2. Proakin, "Digital Communications",Mc Graw Hill.
3. W. Stalling, "Wireless Communication and Networks" Pearson.
4. Stallings, "Data & computer Communications",PHI.
5. Roden, "Digital & Data Communication Systems",PHI.
6. Irvine, Data communications & Networks An engineering approach, wiley india
7.

PE-CS-T303	Parallel and Distributed Computing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hrs.
Purpose	To enable students to evaluate various architectural taxonomies, design paradigms, parallelism approaches, performance measures, parallel programming models and case studies, scheduling and parallel architecture and their programming constructs.						
Course Outcomes (CO)							
CO1	Classify various synchronous and asynchronous paradigms of parallel and distributed computing as well as identify some of the taxonomies and parallel algorithms.						
CO2	Evaluate various parallel computation models and approaches and analyze different performance metrics for parallel and distributed computing.						
CO3	Analyze the importance of pipelining and superscalar techniques, parallel programming models and case studies of parallel processors.						
CO4	Examine various techniques of parallelizing loops, sequential programs and scheduling and parallel architecture for cognitive functions.						

Unit-I

Introduction: The state of computing, system attributes to performance, multiprocessors and multicomputer, multivector and SIMD computers, basics of parallel programming models, parallel algorithms and distributed processing, Conditions of parallelism: Data, control and resource dependencies, Hardware and software parallelism. Hardware Taxonomy: Flynn's classification, Shore'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, architecture development tracks, program partitioning and scheduling, program flow mechanisms. Performance metrics and measures: parallelism profile in programs, mean performance, efficiency, utilization and quality, benchmarks and performance measures.

Parallel processing applications: Massive parallelism for grand challenges, application models for parallel computing, scalability of parallel algorithms. Speedup performance laws: Amdahl's law for fixed workload, Gustafson's Law for scaled problems and memory bounded speedup model. Scalability analysis and approaches: Scalability metrics and goals, evaluation of scalable computers.

Unit-III

Pipelining and Superscalar Techniques: Linear pipeline processors, nonlinear pipeline processors, arithmetic pipeline design, and superscalar pipeline design. Parallel programming models: Shared-variable model, message-passing model, data-parallel model, object-oriented model and functional and logic models.

Case studies of parallel processors: ICL distributed array processor (DAP), ILLIAC IV Computer, Tilera's TILE64 system, Sun UltraSparc T2 processor, Intel Pentium Processors.

Unit-IV

Scheduling and parallelization: Loop parallelization and pipelining-Loop transformation theory, parallelization and wave fronting, tiling and localization, software pipelining, program partitioning and scheduling: Grain size, latency, grain packing and scheduling. Parallel Architecture for cognitive functions: Artificial neuron model (perceptron), neural network as classifiers, learning by perceptrons, supervised training of perceptron networks, SLT model and Hopfield network.

Suggested Books

1. A.Grama, A. Gupta, G.Karypis, V.Kumar, Introduction to Parallel Computing, Pearson.
2. M.R. Bhujade, Parallel Computing, New Age International Publishers.
3. Kai Hwang and Naresh Jotwani, Advanced Computer Architecture-Parallelism, Scalability, Programmability, McGraw Hill.
4. D.Sima, T.Fountain, P.Kasuk, Advanced Computer Architecture-A Design space Approach, Pearson Education, India, 2009.
5. C Lin, L Snyder, Principles of Parallel Programming, Addison-Wesley Publishing Company.
6. M.J. Quinn, Parallel Computing: Theory and Practice, Second Edition, McGraw Hill.
7. T.G.Lewis and H. El-Rewini, Introduction to parallel computing, Prentice Hall.

PE-CS-T305	Information Theory and Coding						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To introduce information theory, the fundamentals of error control coding techniques and their applications, and basic cryptography.						
Course Outcomes (CO)							
CO1	Students will be introduced to the basic notions of information and channel capacity.						
CO2	Students will be introduced to convolutional and block codes, decoding techniques.						
CO3	Students will understand how error control coding techniques are applied in communication systems.						
CO4	Students will understand the basic concepts of cryptography and able to implement cryptography to real life applications.						

Unit I : Information Theory & Source Coding

Introduction to information theory, Entropy and its properties, Source coding theorem, Huffman coding, Shannon-Fano coding, The Lempel Ziv algorithm, Run Length Encoding, Discrete memory less channel, Mutual information, Examples of Source coding-Audio and Video Compression.

Unit II : Information Capacity & Channel Coding

Channel capacity, Channel coding theorem, Differential entropy and mutual Information for continuous ensembles, Information Capacity theorem, Linear Block Codes: Syndrome and error detection, Error detection and correction capability, Standard array and syndrome decoding, Encoding and decoding circuit, Single parity check codes, Repetition codes and dual codes, Hamming code, Golay Code, Interleaved code.

Unit III : Cyclic Codes, BCH and Convolutional Codes

Galois field, Primitive element & Primitive polynomial, Minimal polynomial and generator polynomial, Description of Cyclic Codes, Generator matrix for systematic cyclic code, Encoding for cyclic code, Syndrome decoding of cyclic codes,

Binary BCH code, Generator polynomial for BCH code, Decoding of BCH code, RS codes, generator polynomial for RS code, Decoding of RS codes, Cyclic Hamming code and Golay code. Introduction of convolution code, State diagram, Tree diagram, Trellis diagram, Sequential decoding and Viterbi decoding

UNIT-V: Cryptography

Encryption, Decryption, Cryptogram (cipher text), Concept of cipher, Cryptanalysis, Keys: Single key (Secret key), Cryptography, two-key (Public key) cryptography, Single key cryptography, Ciphers, Block Cipher code, Stream ciphers, Requirements for secrecy, The data Encryption Standard, Public Key Cryptography, Diffie-Hellmann public key distribution, The Rivest- Shamin Adelman(R-S-A) system for public key cryptography, Digital Signature.

Suggested Books:

- Jorge Castiñeira Moreira, Patrick Guy Farrell , Essentials of Error-Control Coding John Wiley, 2006. ISBN: 978-0-470-02920-6
- G. A. Jones and J. M. Jones, "Information and Coding Theory," Springer ISBN 1-85233-622-6, 3rd Edition.
- Dominic Welsh, Codes and Cryptography, Oxford Science Publications, 1988
- T. M. Cover, J. A, Thomas, "Elements of information theory," Wiely Interscience, 2nd Edition, 2006/ •
- R. W. Hamming, "Coding and information theory," Prentice Hall Inc., 1980

PE-CS-T307	Advanced Algorithms						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To introduce advanced algorithm concepts and their implementation for solving complex applications.						
Course Outcomes(CO)							
CO1	Learn the basic concepts of Algorithms and their analysis.						
CO2	Study the concept of dynamic programming and various advanced data structures.						
CO3	Learn various graph algorithms.						
CO4	Study various Flow and Sorting Networks.						

UNIT – I: Introduction

Algorithms and its complexity (Time and Space), Algorithm Analysis (Worst, Best & Average case), Pseudocode Conventions, Asymptotic Notations, Binary Search Trees.
Recurrence Relation:- Methods for solving Recurrence(Substitution, Recursion Tree , Master Theorem).

UNIT – II: Advanced Design Techniques

Dynamic Programming:- Elements, Matrix-chain multiplication, longest common subsequence.
Greedy Algorithms:- Elements, Activity Selection problem, Huffman codes, Task scheduling problem, Knapsack Problem, .
Probabilistic analysis concepts, Hiring Problem and its probabilistic analysis.

UNIT – III: Graph Algorithms

Review of Graph Algorithms:- Traversal methods(Depth first and Breadth first search), Topological sort, Strongly connected components, Minimum Spanning Trees- Kruskal and Prims, Single Source shortest path, Relaxation, Dijkstra's Algorithm, Bellman-Ford Algorithm, Single source shortest path for directed acylic graphs, All pair shortest path- Floyd Warshall Algorithm.

UNIT – IV: String Matching Algorithms

The Naïve string-matching algorithm, Rabin-Karp Algorithm, String matching with finite automata, Knuth-Morris-Pratt Algorithm.

Suggested Books:

1. L.K. Vermani, S. Vermani, An Elementary Approach to Design and Analysis of Algorithms, World Scientific, 2019
2. Cormen, Leiserson and Rivest : Introduction to Algorithms, 3/e, PHI
3. Harsh Bhaisn, Algorithms: Design And Analysis Oxford University Press,2015.
4. Aho, Hopcroft and Ullman : The Design and Analyses of Computer Algorithms. Addison Wesley.
5. R.B.Patel& M.M.S Rauthan, Expert Data Structures with C++, Khana Publications, Delhi , India, 2ndEdition 2004,ISBN : 87522-03-8.
6. Horowitz, Ellis and Sahni, Sartaj : Fundamentals of Computer Algorithms, Galgotia Publications

MC-904	ENERGY RESOURCES & MANAGEMENT						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	0	100		100	3
Purpose	To make the students conversant with the basics concepts and conversion of various form of Energy						
COURSE OUTCOMES							
CO1	An overview about Energy Resources, Conventional and Non-conventional sources						
CO2	Understand the Layout and working of Conventional Power Plants						
CO3	Understand the Layout and working of Non-Conventional Power Plants						
CO4	To understand the Energy Management, Audit and tariffs, Role of Energy in Economic development and Energy Scenario in India						

UNIT-I

Introduction: Types of energy, Conversion of various forms of energy, Conventional and Non-conventional sources, Need for Non-Conventional Energy based power generation.

UNIT-II

Conventional Energy sources: Types of Conventional Energy sources, Selection of site, working of Thermal, Hydro, Nuclear and Diesel power plants and their schematic diagrams & their comparative advantages/ disadvantages.

UNIT-III

Non-Conventional Energy sources: Types of Non-Conventional Energy sources , Basic principle, site selection of Solar energy power plant, photovoltaic technologies, PV Systems and their components, Wind energy power plant , Bio energy plants ,Geothermal energy plants and Tidal energy plants.

UNIT-IV

Energy Management: General Principles of Energy Management, Energy Management Strategy, Modern trends and developments towards Computerizations of Power System.
Energy Audit: Need, Types, Methodology and Approach.
Energy Scenario: Lay out of power system, Role of Energy in Economic development, energy demand, availability and consumption, Indian energy scenario, long term energy scenario, energy sector reforms in India, energy strategy for the future.

References:

1. Energy Studies-Wiley Dream Tech India.
2. Non-conventional energy resources- Shobhnath Singh, Pearson.
3. Electrical Power Systems : Soni, Gupta, Bhatnagar – Dhanpat Rai & Sons
4. NEDCAP: Non Conventional Energy Guide Lines
5. Non conventional energy sources : G.D. Roy
6. Non Conventional energy resources :B H Khan - McGraw Hill
7. Applied Solar Energy : Meinel A B - Addison Wesley Publications
8. Direct Energy Conversion George: Sutton -McGraw

Bachelor of Technology (Computer Science & Engineering)										
Credit-Based Scheme of Studies/Examination										
Semester VI (w.e.f. session 2020-2021)										
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	PC-CS-302	Complier Design	3:0:0	3	3	75	25	0	100	3
2	PC-CS-304	Computer Networks	3:0:0	3	3	75	25	0	100	3
3	PEC	Elective-II	3:0:0	3	3	75	25	0	100	3
4	PEC	Elective-III	3:0:0	3	3	75	25	0	100	3
5	OEC	Open Elective-I	3:0:0	3	3	75	25	0	100	3
6	PROJ – CS-302	Project-1	0:0:6	6	3	0	40	60	100	3
7	PC-CS-306L	UNIX and Linux Programming Lab	0:0:4	4	2	0	40	60	100	3
8	PC-CS-308L	Computer Networks Lab	0:0:4	4	2	0	40	60	100	3
Total				**29**	**22**	**375**	**245**	**180**	**800**	

PEC Elective-II	**PEC Elective-III**
Advanced Computer Architecture: PE-CS-S302	Simulation & Modeling: PE-CS-S310
Distributed Systems: PE-CS-S304	Mobile Computing: PE-CS-S312
Fault Tolerant Computing: PE-CS-S306	Unix & Linux Programming: PE-CS-S314
Mobile Ad-hoc and Wireless Sensor Networks: PE-CS-S308	Real Time Systems: PE-CS-S316

OEC Open Elective-I
Soft Skills and Interpersonal Communication: OE-CS-302
Management Information System: OE-CS-304
Enterprise Resource Planning: OE-CS-306

Note: Students be encouraged to go to 6-8 weeks summer internships mandatory during the summer break after the completion of sixth semester exams.

The course of both PE & OE will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.

PC-CS-302	Complier Design						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To introduce complier design concepts and their implementation						
Course Outcomes(CO)							
CO1	To understand the role and designing of a lexical analyzer.						
CO2	To analyze the role and designing of syntax analyzer or parser.						
CO3	To identify the role of semantic analyzer and intermediate code generation.						
CO4	To explore the design importance of optimization of codes and error detection						

UNIT I

Introduction to Language Processing System, Compiling Analysis of the Source Program, Phases of a Compiler, Compiler Construction Tools. Lexical Analysis –Regular Expression, Introduction to Finite Automata and Regular Expression, Conversion of Regular Expression to NFA, Role of Lexical Analyzer, Specification of Tokens.

UNIT II

Syntax Analysis: Role of the Parser, Abstract Syntax Trees, Ambiguity in Context-Free Grammars, Types of Parsing:- Top Down Parsing, Recursive Descent Parsing, LL Parser, Back Tracking, Bottom Up Parsing, SLR Parser, Canonical LR Parser, LALR Parser.

UNIT III

Semantic Analysis : Semantic Errors, Attribute Grammar, Synthesized attributes, Static Allocation, Stack Allocation, Heap Allocation, Activation Trees, Symbol Table, 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

UNIT 1V

Code Optimization and Run Time Environments, Principal Sources of Optimization, Machine-independent Optimization, Machine-dependent Optimization, Optimization of Basic Blocks, Loop Optimization , Peephole Optimization, Introduction to Global Data Flow Analysis, Storage Organization, Static Storage Management, Heap Storage management, Parameter Passing. Error Recovery, Panic mode, Statement mode, Global correction.

Suggested Book :

1. Alfred Aho, Ravi Sethi, Jeffrey D Ullman, "Compilers Principles, Techniques and Tools", Pearson Education Asia, 2018.
2. Allen I. Holub "Compiler Design in C", Prentice Hall of India, 2003.
3. C. N. Fischer and R. J. LeBlanc, "Crafting a compiler with C", Benjamin Cummings, 2003.
4. V Raghavan , " Principles of Compiler Design", Second Edition, Tata McGraw-Hill, 2018.
5. Henk Alblas and Albert Nymeyer, "Practice and Principles of Compiler Building with C", PHI, 2001.
6. Kenneth C. Louden, "Compiler Construction: Principles and Practice", Thompson Learning, 2003

PC-CS-304	Computer Networks						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To introduce the architecture and layers of computer network, protocols used at different Layers.						
Course Outcomes(CO)							
CO1	To understand the basic concept of networking, types, networking topologies and layered architecture.						
CO2	To understand data link layer and MAC sub-layer`						
CO3	To understand the network Layer functioning						
CO4	To understand the transport layer and application layer operation						

Unit -I

Introduction to Computer Networks : Data Communication System and its components, Data Flow, Computer network and its goals, Types of computer networks: LAN, MAN, WAN, Wireless and Wired networks, broadcast and point-to-point networks, Network topologies, protocols, interfaces and services, ISO- OSI reference model, TCP/IP architecture.

Physical Layer: Concept of Analog & Digital Signal, Bandwidth, Transmission Impairments: Attenuation, Distortion, Noise, Multiplexing : Frequency Division, Time Division, Wavelength Division, Transmission Media : Twisted pair, Coaxial cable, Fiber optics, Wireless transmission (radio, microwave, infrared), Switching: Circuit Switching, Message Switching ,Packet Switching & comparisons, narrowband ISDN, broadband ISDN.

Unit -II

Data link layer: Error Control, Types of errors, framing(character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back- N ARQ, sliding window protocols, Selective repeat ARQ, HDLC;

Medium access sub layer: Point to point protocol, FDDI, token bus, token ring; Reservation, polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, FDMA, TDMA, CDMA, LLC, Traditional Ethernet, fast Ethernet, Network devices-repeaters, hubs, switches, Bridges, Router, Gateway .

Unit-III

Network layer: Addressing : Internet address, sub-netting; Routing techniques, static vs. dynamic routing , routing table, DHCP, IEEE standards 802.x, Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing; Protocols: ARP, RARP, IP, ICMP, IGMP, IPV6; Unicast and multicast routing protocols, ATM.

Unit-IV

Transport layer: Process to process delivery; UDP; TCP, RPC, Congestion control algorithm: Leaky bucket algorithm, Token bucket algorithm, choke packets; Quality of service: techniques to improve QoS.

Application layer: DNS; SMTP, SNMP, FTP, HTTP & WWW; Firewalls, Bluetooth, Email, S/MIME, IMAP,

Network Security: Cryptography, user authentication, security protocols in internet, public key encryption algorithm, digital signatures

Suggested Books:

1. Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw Hill, Fourth Edition, 2011.
2. Computer Networks, 4th Edition, Pearson Education by Andrew S. Tanenbaum
1. Larry L.Peterson, Peter S. Davie, "Computer Networks", Elsevier, Fifth Edition, 2012.
2. William Stallings, "Data and Computer Communication", Eighth Edition,Pearson Education, 2007.
3. James F. Kurose, Keith W. Ross, "Computer Networking: A Top–Down Approach Featuring the Internet", Pearson Education, 2005.

PC-CS-306L	UNIX and Linux Programming Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**4**	**3.0**	**40**	**60**	**100**	**3 Hrs.**
Purpose	Experimental knowledge of programming skills with expertisation on Unix/Linux platform						
Course Outcomes(CO)							
CO1	Learning of simple and advanced commands of Unix /Linux operating systems.						
CO2	Develop shell programming using Bash or any other shell scripts.						
CO3	Develop advanced shell programming skills.						
CO4	Analyzing & evaluation of performance of various c language based programs with the help of Make file & debug utilities.						
CO5	Creation of user accounts, Learning of package installation, backup and shutdown process on Unix /Linux operating systems.						

List of Practical

1. Familiarize with Unix/Linux Log In/Log Out and various other commands & vi editor.
2. Develop simple shell programs using Bash or any other shell in Linux.
3. Develop advanced shell programs using grep, fgrep & egrep.
4. Compile and debug various C language based programs using 'makefile' & 'debug' utility.
5. Learning of installation of dual operating systems with Linux having previously installed other window based operating system. Both OSs should be in working operating mode.
6. As Supervisor create and maintain user accounts, learn package installation, taking backups, creation of scripts for file and user management, creation of startup and shutdown scripts using at, batch, cron etc.

NOTE : At least 8 to 12 more programs exercises based on Unix/Linux plateform are to be assigned by the concerned teacher.

PC-CS-308L	Computer Networks Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**4**	**2**	**40**	**60**	**100**	**3 Hour**
Purpose	**To explore networking concepts using Java programming & networking tools.**						
Course Outcomes (CO)							
CO1	Do Problem Solving using algorithms.						
CO2	Design and test simple programs to implement networking concepts using Java.						
CO3	Document artifacts using applied addressing & quality standards.						
CO4	Design simple data transmission using networking concepts and implement.						

COMPUTER NETWORKS LAB

1. Create a socket for HTTP for web page upload and download.
2. Write a code simulating ARP /RARP protocols.
3. Study of TCP/UDP performance.
4. Performance comparison of MAC protocols
5. Performance comparison of routing protocols.
6. Write a program:
    a. To implement echo server and client in java using TCP sockets.
    b. To implement date server and client in java using TCP sockets.
    c. To implement a chat server and client in java using TCP sockets.
7. Write a program:
    a. To implement echo server and client in java using UDP sockets
    b. To implement a chat server and client in java using UDP sockets.
    c. To implement a DNS server and client in java using UDP sockets.
8. To flood the server from a spoofed source address leading to a DoS attack.
9. To sniff and parse packets that pass through using raw sockets.
10. To implement simple calculator and invoke arithmetic operations from a remote client.
11. To implement bubble sort and sort data using a remote client.
12. To simulate a sliding window protocol that uses Go Back N ARQ.

PE-CS-S302	Advanced Computer Architecture						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To enable students to learn various computational models, design paradigms of advanced computer architecture, parallelism approaches and techniques for static and dynamic interconnections.						
Course Outcomes (CO)							
CO1	Classify and interpret various paradigms, models and micro-architectural design of advanced computer architecture as well as identify the parallel processing types and levels for achieving optimum scheduling.						
CO2	Identify the roles of VLIW & superscalar processors and branch handling techniques for performance improvement.						
CO3	Analyze and interpret the basic usage of various MIMD architectures and relative importance of various types of static and dynamic connection networks for realizing efficient networks.						
CO4	Examine the various types of processors and memory hierarchy levels and cache coherence problem including software and hardware based protocols to achieve better speed and uniformity.						

Unit-I

Computational Model: Basic computational models, evolution and interpretation of computer architecture, concept of computer architecture as a multilevel hierarchical framework, classification of parallel architectures, Relationships between programming languages and parallel architectures.

Parallel Processing: Types and levels of parallelism, Instruction Level Parallel (ILP) processors, dependencies between instructions, principle and general structure of pipelines, performance measures of pipeline, pipelined processing of integer, Boolean, load and store instructions, VLIW architecture, Code Scheduling for ILP Processors - Basic block scheduling, loop scheduling, global scheduling.

Unit-II

Superscalar Processors: Emergence of superscalar processors, Tasks of superscalar processing – parallel decoding, superscalar instruction issue, shelving, register renaming, parallel execution, preserving sequential consistency of instruction execution and exception processing, comparison of VLIW & superscalar processors.

Branch Handling: Branch problem, Approaches to branch handling – delayed branching, branch detection and prediction schemes, branch penalties, multiway branches, guarded execution.

Unit-III

MIMD Architectures: Concepts of distributed and shared memory MIMD architectures, UMA, NUMA, CCNUMA & COMA models, problems of scalable computers.

Static connection networks: Linear array, ring, chordal ring, barrel shifter, star, tree, mesh and torus, fat Tree, systolic array, barrel shifter, hypercubes and Cube connected cycles.

Dynamic interconnection networks: single shared buses, comparison of bandwidths of locked, pended & split transaction buses, arbiter logics, crossbar networks, multistage networks, omega networks, butterfly.

UNIT – IV

Processors and Memory Hierarchy: Advanced processor technology, memory hierarchy technology and virtual memory technology. Cache Coherence and Synchronization Mechanisms: Cache coherence problems, hardware based protocols – snoopy cache protocols, directory schemes, hierarchical cache coherence protocols, software based protocols.

Suggested Books

1. D.Sima, T.Fountain, P.Kasuk, Advanced Computer Architecture-A Design Space Approach, Pearson Education.
2. Kai Hwang and Naresh Jotwani, Advanced Computer Architecture-Parallelism, Scalability, Programmability, McGraw Hill.
3. M.J. Quinn, Parallel Computing: Theory and Practice, Second Edition, McGraw Hill.
4. J. L. Hennessy and D. A. Patterson, Computer Architecture: A Quantitative approach, Morgan Kaufmann/Elsevier.
5. T.G.Lewis and H. El-Rewini, Introduction to parallel computing, Prentice Hall.
6 Nicholas Carter, Computer Architecture, McGraw Hill.

PE-CS-S304	Distributed Systems						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hrs.
Purpose	To impart knowledge of distributed systems and process management in distributed systems using various techniques.						
Course Outcomes(CO)							
CO1	Understand foundations of Distributed Systems.						
CO2	Introduce the idea of peer to peer services and file system.						
CO3	Understand in detail the system level and support required for distributed system and able to apply remote method invocation and objects.						
CO4	The student should be able to design process and resource management systems.						

UNIT: I INTRODUCTION

Examples of Distributed Systems–Trends in Distributed Systems – Focus on resource sharing – Challenges. Case study: World Wide Web.

UNIT II: COMMUNICATION IN DISTRIBUTED SYSTEM

System Model – Inter process Communication – the API for internet protocols – External data representation and Multicast communication. Network virtualization: Overlay networks. Case study: MPI Remote Method Invocation and Objects: Remote Invocation – Introduction – Request-reply protocols – Remote procedure call – Remote method invocation. Case study: Java RMI – Group communication – Publish-subscribe systems – Message queues – Shared memory approaches – Distributed objects – Case study: Enterprise Java Beans -from objects to components.

UNIT III: PEER TO PEER SERVICES AND FILE SYSTEM

Peer-to-peer Systems – Introduction – Napster and its legacy – Peer-to-peer – Middleware – Routing overlays. Overlay case studies: Pastry, Tapestry- Distributed File Systems –Introduction – File service architecture – Andrew File system. File System: Features-File model -File accessing models – File sharing semantics Naming: Identifiers, Addresses, Name Resolution – Name Space Implementation – Name Caches – LDAP.

UNIT IV: SYNCHRONIZATION, REPLICATION AND PROCESS MANAGEMENT

Introduction – Clocks, events and process states – Synchronizing physical clocks- Logical time and logical clocks – Global states – Coordination and Agreement – Introduction – Distributed mutual exclusion – Elections – Transactions and Concurrency Control– Transactions -Nested transactions – Locks – Optimistic concurrency control – Timestamp ordering – Atomic Commit protocols -Distributed deadlocks – Replication – Case study – Coda.

Process Management: Process Migration: Features, Mechanism – Threads: Models, Issues, Implementation. Resource Management: Introduction- Features of Scheduling Algorithms –Task Assignment Approach – Load Balancing Approach – Load Sharing Approach.

BOOKS:

1. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.
   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-CS-S306	Fault Tolerant Computing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To learn and implement fault tolerant computing						
Course Outcomes(CO)							
CO1	To Understand the importance of fault tolerance and reliability						
CO2	To learn the design and testing techniques of fault tolerant system						
CO3	To recognize the fault tolerance in real time and distributed systems.						
CO4	To analyze dependability evaluation techniques						

UNIT I

Introduction to Fault Tolerant Computing, Dependability concepts: dependable system, techniques for achieving dependability, dependability measures, fault, error, failure, faults and their manifestation, classification of faults and failures.

Fault tolerant strategies: Fault detection, masking, containment, location, reconfiguration, and recovery.

UNIT II

Fault tolerant design techniques: Hardware redundancy, software redundancy, time redundancy, and information redundancy.

Testing and Design for Testability. Self-checking and fail-safe circuits.

UNIT III

Information Redundancy : coding techniques, error detection and correction codes, burst error detection and correction, unidirectional codes..

Fault tolerance in distributed systems: Byzantine General problem, consensus protocols, check pointing and recovery, stable storage and RAID architectures, and data replication and resiliency.

UNIT 1V

Dependability evaluation techniques and tools: Fault trees, Markov chains.

Analysis of fault tolerant hardware and software architectures.

System-level fault tolerance and low overhead high-availability technique

Fault tolerance in real-time systems: Time-space tradeoff, fault tolerant scheduling algorithms.

Suggested Books:

1. Fault Tolerant Computer System design by D. K. Pradhan, Prentice Hall.
2. Reliable Computer Systems: Design and Evaluation by D. P. Siewiorek and R. S. Swarz, Digital Press.
3. Design and Analysis of Fault Tolerant Digital Systems by B.W. Johnson, Addison Wesley
4. Fault Tolerance in Distributed Systems, Pankaj Jalote, PTR Printice Hall.

PE-CS-S308	Mobile Ad-hoc and Wireless Sensor Networks						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Program Objective (PO)	To enable students to describe and deal with computer communication and networking, various reference models and architectures along with implemented wireless communication techniques and various security and privacy parameters are also studied.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Classify traditional networks and discuss various wireless networking standards, compare and contrast various IEEE wireless LAN and Ethernet standards.						
CO2	Describe cellular architecture and IPv4 and IPv6 header formats has to be discussed along with mobile IP.						
CO3	Recently deployed high performance computing standards, VPN, routing protocols as to be gone through.						
CO4	Various security and privacy standards/tools to be described.						

Unit I

Introduction to Mobile Ad hoc Networks (MANET) – Mobility Management, Characteristics and Attributes related to MANETs, Modeling distributed applications for MANET, MAC mechanisms and protocols.

Unit II

MANET Routing Protocols: Ad hoc network routing protocols, destination sequenced distance vector algorithm, cluster based gateway switch routing, global state routing, fish-eye state routing, dynamic source routing, ad hoc on-demand routing, OLSR & TORA routing, location aided routing, zonal routing algorithm.

Unit III

Ad-Hoc Network Security: Link layer, Network layer, Trust and key management. Self policing MANET – Node Misbehaviour, secure routing, reputation systems.
Wireless Sensor Networks (WSN) : Design Issues, Clustering, Applications of WSN.

Unit IV

MAC layer and Routing Protocols in WSN
Data Management: Retrieval Techniques in WSN, Sensor databases, distributed query processing, Data dissemination and aggregation schemes, Operating Systems for WSN, Security issues in WSN.

Suggested Books:

1 C. Siva Ram Murthy & B.S. Manoj, Mobile Ad hoc Networks – Architectures & Protocols, Pearson Education, New Delhi, 2004
2 C M Cordeiro& D.P. Agrawal, Adhoc & Sensor Networks – Theory and Applications, ISBN 981256-682-1, World Scientific Singapore, 2006
3 C. S. Raghvendra, Wireless Sensor Networks, Springer-Verlag, 2006.

PE-CS-S310	Simulation and Modeling						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hour**
PO	To introduce the principles and paradigms of Computer Modeling and Simulation for solving a wide variety of problems. And how to use simulator to simulate the live systems.						
Course Outcomes (CO)							
CO 1	To introduce the basic concepts of System, System Modeling, types of Models, simulation and need of simulation.						
CO 2	To introduce the simulation of continuous and discrete systems with the help of different examples.						
CO 3	To introduce the concept of generation of uniformly and non-uniformly distributed random numbers.						
CO 4	To introduce the concept of simulation of live systems and PERT.						
CO5	To introduce the concept of simulation of inventory control systems and simulation languages.						

Unit-I

Modeling: System Concepts, continuous and discrete systems, system boundaries, system modeling, types of Models, model validation, Principles & Nature of Computer modeling.

Simulation: Introduction, Basic nature of simulation, When to simulate, Pros and cons of simulation, concepts of simulation of continuous and discrete system with the help of example.

Unit-II

Continuous System Simulation: Analog vs. digital simulation, continuous simulation vs. numerical integration, simulation of a chemical reactor, simulation of a water reservoir system.

Discrete system simulation: Fixed time-step vs. event-to-event model, Monte-Carlo computation vs. stochastic simulation, generation of random numbers, generation of non-uniformly distributed random numbers.

Unit -III

Simulation of the Live systems: Simulation of queuing Systems: basic concepts of queuing theory, simulation of single server, two server and more general queuing system.

Simulation of PERT network: Network model of a project, analysis of an activity network, critical path computation, uncertainties in activity durations, simulation of an activity network.

Unit-IV

Simulation of inventory control systems: Elements of inventory theory, inventory models, generation of Poisson and Erlang variates, simulator for complex inventory systems,

Variance reduction techniques and validation.

Simulation Languages: Continuous and discrete simulation languages, factors in selection of a discrete system simulation languages.

Suggested Books:

1. Gordon G.: System simulation, Prentice-Hall of India Pvt. Ltd. New Delhi 1993
2. Narsingh Deo: System Simulation with Digital Computer, PHI New Delhi, 1993
3. Neelankavil Frances: Computer Simulation and Modelling, John Wiley & Sons, NewYork, 1987.
4. Payne, James A.: Introduction to simulation: Programming Techniques and Methods of Analysis, McGraw-Hill International Editions, Computer Science services, New York (1998).

PE-CS-S312	Mobile Computing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	0	0	3	75	25	100	3 Hrs.
Purpose	To impart knowledge of mobile and wireless computing systems and techniques.						
Course Outcomes(CO)							
CO1	Describe the concepts of mobile computing and cellular networks.						
CO2	Learn the basic concepts of wireless networks.						
CO3	Study of various issues of mobile computing and basics of cloud computing.						
CO4	Description and applications of Ad hoc networks.						

UNIT – I

Introduction, Issues in mobile computing, Overview of wireless telephony: cellular concept- Cell, Co-Channel Interference, Frequency reuse, HLR-VLR, handoffs, channel allocation in Cellular systems, Mobile computing Architecture, Design considerations for mobile computing, Mobile Computing through Internet, Making existing applications mobile enabled, 3G, 4G.

UNIT – II

Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802.11, Bluetooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP : Architecture, Traditional TCP, Classical TCP, improvements in WAP, WAP applications.

UNIT – III

Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment.

Cloud Architecture model, Types of Clouds: Public Private & Hybrid Clouds, Resource management and scheduling, Clustering, Data Processing in Cloud: Introduction to Map Reduce for Simplified data processing on Large clusters.

UNIT – IV

Ad hoc networks, Manet's & its Applications, Routing & Routing protocols- Global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad Hoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), Fish eye routing protocol, QoS in Ad Hoc Networks.

Suggested Books:

1. Rajkamal, Mobile Computing, 2/E Oxford University Press,2011.
2. J. Schiller, Mobile Communications, Addison Wesley
3. Yi Bing Lin, Wireless and Mobile Networks Architecture , John Wiley.
4. M. V. D. Heijden, M. Taylor, Understanding WAP, Artech House.
5. Charles Perkins, Mobile IP, Addison Wesley.
6. Charles Perkins, Ad hoc Networks, Addison Wesley.
7. Judith Hurwitz, Robin Bllor, Marcia Kaufmann, Fern Halper, Cloud Computing for Dummies, 2009.

PE-CS-S314	UNIX and Linux Programming						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	Expertisation in computational programming skills on Unix/Linux Environment.						
Course Outcomes(CO)							
CO1	Learning of simple & advanced commands with features and characteristics of Unix /Linux Systems.						
CO2	Exploring knowledge of programming development skills using Shell, Filters, editors and other utilities.						
CO3	Analyzing the programming behaviour based on programming development/management on Unix /Linux Systems.						
CO4	Developing creativity as system administrative with networking expertisation in Unix /Linux Systems.						

UNIT I : Unix/Linux Commands with Usages

History of Unix, Structure of Unix System & its environment, Unix/Linux Startup, User accounts, accessing Linux – starting and shutting processes, Logging in and Logging out, various types of Unix Commands, zip, unzip, compress, uncompress, pack, unpack, various types of shells, shell programming, Unix file system, Mounting & Unmounting File System, Linux/Unix files, i-nodes, files system related commands, shell as command processor, shell variables, scripting, Unix architecture, Handling ordinary files, General purpose utilities and advanced Unix Commands.

UNIT II : Filters and File Compression

Regular Expression and Filters : Introducing regular expression patterns, syntax, character classes, Quantifiers, Bourne Shell Programming, shell scripting, grep : searching pattern, egrep : searching extended regular expression, Editors in Unix/Linux : Stream Editor, Visual Editor, Emac Editor, programming with AWK and PERL, File compression techniques, delta compression, parallel compression with Xdelta utility, data similarities elimination for data reduction.

UNIT III : Program Development Tools

The C Environment : C language programming in Unix/Linux using vi editor & C compiler, various modes of vi editor, C compiler options, C Shell operators, C Shell Script & programming, Program Development Tools, MakeFile Utility for keeping program up-to-date & its use for dependency calculations, dynamic linking and loading of libraries modules, static and shared libraries, dynamic loader, debugging tools like gdb for handling errors, Memory management and managing large projects in Unix programming environment.

UNIT IV : System Administration and Networking

Processes in Linux : Processes, starting and stopping processes, initialization of processes, rc and init files, job control – at, batch, cron, time, network files, security, authentication, password administration, signals handlers, threading, Linux I/O system, Networking tools : Ping, Telnet, FTP, Router, Firewalls, Backup and Restore tar, cpio, dd utility, mail command, Unix Network Security.

Case Study : LINUX Operating System as open source free software.

Suggested Books :

1. Sumitbha Das : Unix – Concept and Applications, Fourth Edition TMH, 2015
2. B.M Harwani, Unix and Shell Programming, Oxford University Press, 2013
3. Neil Matthew, Richard Stones : Beginning Linux Programming, 4th. Edition, Wrox-Shroff, 2011.
4. Welsh & Kaufmann : Running Linux, O' Reiley & Associates, 2013.

PE-CS-S316	Real Time Systems						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	Purpose Student will be able to understand the basic concepts of Real time systems and structure, performance measures, real time databases and understand the real time operating systems.						
Course Outcomes (CO)							
CO1	To introduce the real time systems and performance measures for real time systems.						
CO2	To understand the scheduling algorithms for real time systems.						
CO3	To analyze real time system databases and memory management.						
CO4	To familiarize the real time operating systems and system integration tools.						

Unit I

Definition, Issues in Real time computing, structure of a real time system.

Task classes and timing parameters, common myths about real time systems, characteristics and applications of Real time systems.

Performance measures for real time systems: Traditional performance measurement, Performability, cost functions and hard deadlines.

Unit-II

Task Assignment and scheduling: Introduction, various types of scheduling algorithms: Cyclic, deterministic, capacity based Dynamic priority, Value function. Scheduling Real time tasks in multiprocessors, fault tolerant scheduling.

Unit-III

Real time memory management: Process Stack management, dynamic allocation, static system.

Real time databases: Introduction, Real time databases and general purpose databases, Main memory databases, concurrency control issues, databases for hard real time systems.

Unit-IV

Real time Operating system : Introduction, features, UNIX and windows NT as RTOS, Comparison of UNIX and Windows NT as RTOS.

Hardware software Integration: Goals of real time system integration tools, methodology.

Suggested books:

1. Real Time Systems: Liu; Pearson Education
2. Real Time Systems: satinder Bal Gupta & Yudhvir Singh; University Science Press
3. Real Time Systems Design and analysis: An Engineer's Handbook Philp A. Laplante,2nd Edition, PHI

OE-CS-302	Soft Skills & Interpersonal Communication						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3Hrs.**
	Course Outcomes (CO)						
CO1	Develop basic understanding of Communication.						
CO2	Understand the process of communication and speaking.						
CO3	Develop the Personality concepts and its implementation.						
CO4	Develop the basic of group Discussion and interview.						

UNIT-I

Communication: Introduction Verbal, Types of communication, extra personal communication, inter personal communication, intrapersonal communication, mass communication, Creativity in communication, Role of communication, flow of Communications and its need, Speaking Skills, Main features of speaking skills.

UNIT-II

Barriers in the way of communication, noise, inter personal barriers, intrapersonal barriers, organizational barriers, Extra personal barriers, **Basics of communication:** importance of communication, process of communication, objectives and characteristics of communication.

UNIT-III

Personality Development, what is personality? Role of personality, Heredity, Environment, situation, Basics of personality, **Soft skills:** Need and training. Activity in soft skills, **Organizational skill:** introduction and its need, basics principles for organization skills.

UNIT-IV

Group discussion: Group discussion, form of group discussion, strategy for group discussion, discussing problem and solution, Oral presentation, introduction, planning, Occasion, purpose, Modes of delivery, **Resume making:** Purpose of Resume, Resume design and structure, contents in Resume, types of Resume, job interview, introduction, objective of Interview, types of interview, stages of interview, Face to face interview and campus interview.

Suggested Books:

1. Technical Communication Principles and Practice by Meenakshi Raman and Sangeeta Sharma by Oxford Publication.
2. Personality Development and soft skills by Barun K. Mitra ,Oxford Publication.
3. Communication Skills For Engineers by C. Muralikrishna and Sunita Mishra , Pearson Pub.

OE-CS-304	Management Information System						
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						
CO1	Understand and articulate fundamental concepts of information technology management.						
CO2	Assess and apply IT to solve common business problems.						
CO3	Suggest and defend effective solutions to business problems, and design a database application to solve a business problem.						
CO4	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

Technical Foundation of Information System: Computers and information processing, Computer Hardware, Computer software, Managing data resources, Telecommunication, Enterprise: wide computing and networking.

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.

Suggested Books:

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

OE-CS-306	Enterprise Resource Planning						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	Classify different processes of the organization and relationship among all processes and examine systematically the planning mechanisms in an enterprise, and identify all components in an ERP system and the relationships among the components.						
Course Outcomes (CO)							
CO1	With the basic concepts of ERP systems for manufacturing or service companies, and the differences among MRP, MRP II, and ERP systems						
CO2	Apply the principles of ERP systems, their major components, and the relationships among these components						
CO3	With the knowledge of typical ERP systems, and the advantages and limitations of implementing ERP systems						
CO4	To comprehend the technical aspects of ERP systems						

Unit I

Introduction to Enterprise Resource Planning

Introduction of the term Business Process Reengineering(BPR) ,BPR Methodology, Current BPR Tools ,Introduction to material requirement planning (MRP), Definition of Enterprise Resource Planning (ERP); Evolution of ERP; Characteristics, Features, Components and needs of ERP; ERP Vendors; Benefits & Limitations of ERP Packages.

Unit II

Enterprise Modelling and Integration of ERP

Need to focus on Enterprise Integration/ERP; Information mapping; Role of common shared Enterprise database; System Integration, Logical vs. Physical System. Integration, Benefits & limitations of System Integration, ERP's Role in Logical and Physical Integration

Unit III

ERP Architecture and Implementation Methodology of ERP

Generic Model of ERP system; Core Modules functionality; Types of ERP architecture, Client Server Architecture, Web-based Architecture, Service Oriented. Architecture (SOA) ; Difficulty in selecting ERP, Approach to ERP selection, Request for Proposal approach, Proof-of-Concept approach; General Implementation. Methodology of ERP, Vanilla Implementation; Evaluation Criteria of ERP packages; Project Implementation Team Structure

Unit IV

Introduction to SAP , Oracle APPS

SAP, Integrated SAP Model, SAP Architecture, SAP R/3 System & mySAP, SAP Modules; Oracle Apps, Oracle AIM Methodology, Oracle Fusion Modules; ERP for Supply Chain Management and Customer Relationship Management : Supply Chain Management and ERP, Definition of Supply Chain Management (SCM); Supply Chain Council's SCOR Model; Stevens Model of Supply Chain Management; Aims of SCM; SCM Key Drivers; Collaborative Design & Product Development; Benefits of SCM; ERP Vs SCM; Key SCM Vendors Customer Relationship Management and ERP,

Suggested books

- Enterprise Systems for Management, Luvai F. Motiwalla, Jeff Thompson, Pearson Education., 2nd Ed., 2011. ISBN-10: 0132145766 | ISBN-13: 978-0132145763
- Enterprise Resource Planning, Ravi Shankar, S.Jaiswal, Galgotia Publication Pvt. Ltd., 1st Ed., 1999. ISBN 81-203-0417-9
- CRM at the speed of Light : Social CRM strategies, tools and techniques for engaging your customers : 4th edition by Paul Greenberg , McGraw Hill ,2009
- Supply Chain Management Casebook : The Comprehensive Coverage and Best Practices in SCM , by Chuck Munson , Pearson FT Press 2013, ISBN-13: 978-0-13-336723-2