UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY
KURUKSHETRA UNIVERSITY, KURUKSHETRA
('A+' Grade, NAAC Accredited)

SCHEME OF EXAMINATIONS FOR MASTER OF TECHNOLOGY IN COMPUTER ENGINEERING (W. E. F. SESSION: 2018-19)

SEMESTER-I

S. No.	Course Code	Subject	Teaching Schedule			Hours/ Week	Examination Schedule & Percentage Distribution			Duration of Exam (Hrs.)	Credit
			L	T	P		Major Test	Minor Test	Total		
1	MTCE-101	Advanced Computer Architecture and Parallel Processing	3	0	0	3	60	40	100	3	3
2	MTCE-103	Software Quality Models & Testing	3	0	0	3	60	40	100	3	3
3	*	Program Elective -I	3	0	0	3	60	40	100	3	3
4	**	Program Elective -II	3	0	0	3	60	40	100	3	3
5	MTCE-117	Software Quality Models & Testing Lab	0	0	4	4	60	40	100	3	2
6	$	Program Elective Lab-I	0	0	4	4	60	40	100	3	2
7	MTRM-111	Research Methodology and IPR	2	0	0	2	60	40	100	3	2
8	***	Audit Course-I	2	0	0	2	--	100	100	3	0
Total						**24**	**420**	**280**	**700**	**-**	**18**

*Program Elective -I		**Program Elective -II	
Course No.	**Subject**	**Course No.**	**Subject**
MTCE-105	Advanced Computer Networks	MTCE-111	Algorithm Analysis and Design
MTCE-107	Distributed Operating Systems	MTCE-113	Soft Computing
MTCE-109	Number Theory and Cryptography	MTCE-115	Speech and Language Processing

$ Program Elective Lab-I			
MTCE-119	Advanced Computer Networks Lab	MTCE-125	Algorithm Analysis and Design Lab
MTCE-121	Distributed Operating Systems Lab	MTCE-127	Soft Computing Lab
MTCE-123	Number Theory and Cryptography Lab	MTCE-129	Speech and Language Processing Lab

*** Audit Course-I	
Course No.	**Subject**
MTAD-101	English for Research Paper Writing
MTAD-103	Disaster Management
MTAD-105	Sanskrit for Technical Knowledge
MTAD-107	Value Education

Note: 1.The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

2. ***Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

SEMESTER-III

S. No.	Course Code	Subject	Teaching Schedule			Hours/Week	Examination Schedule & Percentage Distribution			Duration of Exam (Hrs.)	Credit
			L	T	P		Major Test	Minor Test	Total		
1	*	Program Elective -V	3	0	0	03	60	40	100	3	3
2	**	Open Elective	3	0	0	03	60	40	100	3	3
3	MTCE-207	Dissertation Part-I	0	0	20	20	--	100	100	--	10
Total							120	180	300		16

*Program Elective-V	
Course No.	Subject
MTCE-201	Object Oriented Software System Design
MTCE-203	Big Data Analytics
MTCE-205	Digital Image Processing

**Open Elective		
1.	MTOE-201	Business Analytics
2.	MTOE-203	Industrial Safety
3.	MTOE-205	Operations Research
4.	MTOE-207	Cost Management of Engineering Projects
5.	MTOE-209	Composite Materials
6.	MTOE-211	Waste to Energy

SEMESTER: IV

S. No.	Course Code	Subject	Teaching Schedule			Hours /Week	Examination Schedule & Percentage Distribution			Duration of Exam (Hrs.)	Credit
			L	T	P		Major Test	Minor Test	Total		
1	MTCE-202	Dissertation Part-II	0	0	32	32	200	100	300	--	16
Total						32	200	100	300		16

Total Credits – 68

Note 1: At the end of the second semester each student is required to do his/her Dissertation work in the identified area in consent of the Guide/Supervisor. Synopsis for the Dissertation Part-I is to be submitted within three weeks of the beginning of the Third Semester.

Note 2: Each admitted student is required to submit the report of his/her Dissertation Part-I as per the schedule mentioned in Academic calendar for the corresponding academic session otherwise the Dissertation Part-II cannot be continued at any level.

Note 3: Each admitted student is required to submit his/her final Dissertation Part-II as per the schedule mentioned in Academic calendar for the corresponding academic session only after the publication of two papers in a journal/International/National conference of repute like IEEE, Springer, Elsevier, ACM etc.

Note 4: The course of program/open elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

	Dissertation Part-I (MTCE-207) and Dissertation Part-II (MTCE-202)
	Course Outcomes (CO)
CO1	Ability to synthesize knowledge and skills previously gained and applied to an in depth study and execution of new technical problem.
CO2	Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
CO3	Ability to present the findings of their technical solution in a written report.
CO4	Presenting the work in International/ National conference or reputed journals.

Syllabus Contents:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following:

Relevance to social needs of society

Relevance to value addition to existing facilities in the institute

Relevance to industry need

Problems of national importance

Research and development in various domain.

The student should complete the following:

Literature survey Problem Definition

Motivation for study and Objectives

Preliminary design / feasibility / modular approaches

Implementation and Verification

Report and presentation

The dissertation part- II is based on a report prepared by the students on dissertation allotted to them. It may be based on:

Experimental verification / Proof of concept.

The viva-voce examination will be based on the above report and work.

Guidelines for Dissertation Part – I and Dissertation Part- II

As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two parts i.e. Part– I: July to December and Part– II: January to June.

The dissertation may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.

After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives.

The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing Engineering and any other related domain. In case of Industry sponsored projects, the relevant application notes, white papers, product catalogues should be referred and reported.

Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.

Part–I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper, proof of concept/functionality, part results, and record of continuous progress.

Part–I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the Part-I work.

During Part– II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.

Part–II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, and record of continuous progress.

Part-II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the Part-I work.

MTAD-110	Personality Development and Soft Skills							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Practical	Total	Time
2	0	0	0	--	100	-	100	3 Hrs.
Program Objective (PO)	To become a person with stable mind, pleasing personality and determination in order to achieve the highest goal.							
Course Outcomes (CO)								
CO1	Students become aware about leadership.							
CO2	Students will learn how to improve communication skills							
CO3	Understand the team building and conflict							
CO4	Student will learn how to manage the time.							

Unit 1

Leadership Introduction to Leadership, Leadership Power, Leadership Styles, Leadership in Administration. Interpersonal: Introduction to Interpersonal Relations, Analysis Relations of different ego states, Analysis of Transactions, Analysis of Strokes, Analysis of Life position

Unit II

Communication: Introduction to Communication, Flow of Communication, Listening, Barriers of Communication, How to overcome barriers of communication.

Stress Introduction to Stress, Causes of Stress, Impact Management Stress, Managing Stress

Unit III

Group Dynamics and team Building: Importance of groups in organization, Interactions in group, Group Decision Taking, Team Building, Interaction with the Team, How to build a good team?

Conflict: Introduction to Conflict, Causes of Conflict, Management Managing Conflict

Unit IV

Time Management: Time as a Resource, Identify Important Time Wasters, Individual Time Management Styles, Techniques for better Time Management.

Motivation: Introduction to Motivation, Relevance and types of Motivation, Motivating the subordinates, Analysis of Motivation

Suggested reading

- E.Berne, Games People Play, Grove Press Inc., 1964; Penguin, 1968.
- Hargreaves, G. Stress Management, Marshall Publishing, London 1998
- Barker D, TA and Training, Gower Publishing Company Ltd., 1982.
- Jongewardm D & Seyer P C, Choosing Success, John Wiley & Sons Inc.1978
- Arnold, JHC Feldman, D.C. Organizational Behaviour IRWIN/McGRAW-HILL 1986
- Chandan, J.S., Organizational Behaviour. Vikas Publishing House PVT LTD 1994
- Statt, D.A. Using Psychology in Management Training, Taylor and Francis Inc.2000
- Luthans F., Organisational Behaviour, IRWIN/McGRAW-HILL 1998

MTAD-106	Stress Management by Yoga						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	To achieve overall health of body and mind and to overcome stress						
Course Outcomes (CO)							
CO1	*Develop healthy mind in a healthy body thus improving social health.*						
CO2	*Improve efficiency*						
CO3	*Learn the Yog asan*						
CO4	*Learn the pranayama*						

Unit – 1

Definitions of Eight parts of yog (Ashtanga).

Unit- 2

Yam and Niyam, Do`s and Don't's in life; Ahinsa, satya, astheya, bramhacharya and aparigraha; Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.

Unit- 3

Asan and Pranayam, Various yog poses and their benefits for mind & body,

Unit- 4

Regularization of breathing techniques and its effects-Types of pranayam.

References

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

MTAD-104	Pedagogy Studies						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Review existing evidence on the review topic to inform programme design and policy making undertaken by the DFID, other agencies and researchers and Identify critical evidence gaps to guide the development.*						
Course Outcomes (CO)							
CO1	*What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?*						
CO2	*What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?*						
CO3	*How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?*						
CO4	*What is the importance of identifying research gaps?*						

Unit 1

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology , Theories of learning, Curriculum, Teacher education., Conceptual framework, Research questions. Overview of methodology and Searching. Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. , Curriculum, Teacher education.

Unit 2

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

Unit 3

Professional development: alignment with classroom practices and follow-up support, Peer support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes,

Unit 4

Research gaps and future directions: Research design, Contexts , Pedagogy, Teacher education Curriculum and assessment, Dissemination and research impact.

References

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

MTAD-102	Constitution of India						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective and to address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.*						
Course Outcomes (CO)							
CO1	*Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.*						
CO2	*Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.*						
CO3	*Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.*						
CO4	*Discuss the passage of the Hindu Code Bill of 1956.*						

Unit I

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble, Salient Features

Unit 2

Contours of Constitutional Rights & Duties: Fundamental Rights , Right to Equality , Right to Freedom , Right against Exploitation , Right to Freedom of Religion, Cultural and Educational Rights , Right to Constitutional Remedies , Directive Principles of State Policy , Fundamental Duties.

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive , President, Governor , Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications. Powers and Functions

Unit 3

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Panchayati raj: Introduction, PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit 4

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

References

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

MTAD-107	Value Education						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Understand value of education and self- development, Imbibe good values in students and Let the should know about the importance of character*						
Course Outcomes (CO)							
CO1	*Knowledge of self-development*						
CO2	*Learn the importance of Human values*						
CO3	*Developing the overall personality*						
CO4	*Know about the importance of character*						

Unit 1

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements.

Unit 2

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism.Love for nature,Discipline

Unit 3

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

Unit 4

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

References

1.Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

MTAD-105	Sanskrit for Technical Knowledge						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Students will be able to Understanding basic Sanskrit language and Ancient Sanskrit literature about science & technology can be understood and Being a logical language will help to develop logic in students*						
Course Outcomes (CO)							
CO1	*To get a working knowledge in illustrious Sanskrit, the scientific language in the world*						
CO2	*Learning of Sanskrit to improve brain functioning*						
CO3	*Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power*						
CO4	*The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature*						

Unit –1

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

Unit – 2

Order, Introduction of roots,Technical information about Sanskrit Literature

Unit –3

Technical concepts of Engineering: Electrical, Mechanical

Unit –4

Technical concepts of Engineering: Architecture, Mathematics

References

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

MTAD-103	Disaster Management						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Develop an understanding of disaster risk reduction and management*						
Course Outcomes (CO)							
CO1	*Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.*						
CO2	*Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.*						
CO3	*Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.*						
CO4	*critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in*						

Unit 1

Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Unit 2

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit 3

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Unit 4

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival. Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation in India.

References:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep &Deep Publication Pvt. Ltd., New Delhi.

MTAD-101	English For Research Paper Writing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Student will able to understand the basic rules of research paper writing.*						
Course Outcomes (CO)							
CO1	*Understand that how to improve your writing skills and level of readability*						
CO2	*Learn about what to write in each section*						
CO3	*Understand the skills needed when writing a Title*						
CO4	*Ensure the good quality of paper at very first-time submission*						

Unit 1

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit 2

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit 3

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check. key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

Unit 4

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

References:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

MTOE-211	Waste to Energy						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	*To enable students to aware about the generation of energy from the waste.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the Classification of waste as a fuel.*						
CO2	*Students should able to learn the Manufacture of charcoal.*						
CO3	*Students should able to carry out the designing of gasifiers and biomass stoves.*						
CO4	*Student should able to learn the Biogas plant technology.*						

Unit-1

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit-2

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-3

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-4

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

MTOE-209	Composite Materials						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	*To enable students to aware about the composite materials and their properties.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the Classification and characteristics of Composite materials.*						
CO2	*Students should able reinforcements Composite materials.*						
CO3	*Students should able to carry out the preparation of compounds.*						
CO4	*Student should able to do the analysis of the composite materials.*						

UNIT–1:

INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Iso-strain and Iso-stress conditions.

UNIT – 2

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–3

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – 4

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R.
3. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

References:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

MTOE-207	Cost Management of Engineering Projects						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	*To enable students to make aware about the cost management for the engineering project and apply cost models the real world projects.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the strategic cost management process.*						
CO2	*Students should able to types of project and project team types*						
CO3	*Students should able to carry out Cost Behavior and Profit Planning analysis.*						
CO4	*Student should able to learn the quantitative techniques for cost management.*						

Unit-1

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Unit-2

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Unit-3

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Unit-4

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

MTOE-205	Operations Research						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To enable students to aware about the dynamic programming to solve problems of discreet and continuous variables and model the real world problem and simulate it.						
Course Outcomes (CO)							
CO1	*Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.*						
CO2	*Students should able to apply the concept of non-linear programming*						
CO3	*Students should able to carry out sensitivity analysis*						
CO4	*Student should able to model the real world problem and simulate it.*						

Unit -1

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit -2

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit- 3

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit -4

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

References:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

MTOE-203	Industrial Safety						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	*To enable students to aware about the industrial safety.*						
Course Outcomes (CO)							
CO1	*Understand the industrial safety.*						
CO2	*Analyze fundamental of maintenance engineering.*						
CO3	*Understand the wear and corrosion and fault tracing.*						
CO4	*Understanding that when to do periodic inceptions and apply the preventing maintenance.*						

Unit-1

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, washrooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-2

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-3

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit-4

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

MTOE-201	Business Analytics						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	The main objective of this course is to give the student a comprehensive understanding of business analytics methods.						
Course Outcomes (CO)							
CO1	*Able to have knowledge of various business analysis techniques.*						
CO2	*Learn the requirement specification and transforming the requirement into different models.*						
CO3	*Learn the requirement representation and managing requirement assests.*						
CO4	*Learn the Recent Trends in Embedded and collaborative business*						

Unit 1

Business Analysis: Overview of Business Analysis, Overview of Requirements, Role of the Business Analyst. Stakeholders: the project team, management, and the front line, Handling, Stakeholder Conflicts.
Life Cycles: Systems Development Life Cycles, Project Life Cycles, Product Life Cycles, Requirement Life Cycles.

Unit 2

Forming Requirements: Overview of Requirements Attributes of Good Requirements, Types of Requirements, Requirement Sources, Gathering Requirements from Stakeholders, Common Requirements Documents.
Transforming Requirements: Stakeholder Needs Analysis, Decomposition Analysis, Additive/Subtractive Analysis, Gap Analysis, Notations (UML & BPMN), Flowcharts, Swim Lane Flowcharts, Entity-Relationship Diagrams, State-Transition Diagrams, Data Flow Diagrams, Use Case Modeling, Business Process Modeling

Unit 3

Finalizing Requirements: Presenting Requirements, Socializing Requirements and Gaining Acceptance, Prioritizing Requirements.
Managing Requirements Assets: Change Control, Requirements Tools

Unit 4

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data Journalism.

References:

1. Business Analysis by James Cadle et al.
2. Project Management: The Managerial Process by Erik Larson and, Clifford Gray

MTCE-205	Digital Image Processing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
4	0	0	4	60	40	100	3Hrs.
Program Objective (PO)	Introduces the working knowledge of how digital image processing is implemented by using various algorithms and also the various techniques of transformation, enhancement, restoration, compression, segmentation and image morphology.						
Course Outcomes (CO)							
CO1	Knowledge in the science of images and image processing.						
CO2	To apply knowledge of mathematics, science and engineering in the area of computer vision.						
CO3	knowledge in the techniques of Digital Image Processing, including Image Enhancement in the Spatial and Frequency Domain, Compression, Morphology and Segmentation.						
CO4	Learn and apply knowledge in analyzing image segmentation, representation, description, and recognition techniques.						
CO5	Design and implement computer vision systems to detect, localize and recognize objects within images.						

Unit 1

Introduction And Digital Image Fundamentals: The origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamentals Steps in Image Processing, Elements of Digital Image Processing Systems, Image Sampling and Quantization, Some basic relationships like Neighbours, Connectivity, Distance Measures between pixels, Linear and Non Linear Operations.

Unit 2

Image Enhancement in the Spatial Domain: Some basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Basics of Spatial Filters, Smoothening and Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

Image Enhancement in the Frequency Domain: Introduction to Fourier Transform and the frequency Domain, Smoothing and Sharpening Frequency Domain Filters, Homomorphic Filtering.

Unit 3

Image Restoration:A model of The Image Degradation / Restoration Process, Noise Models, Restoration in the presence of Noise Only Spatial Filtering, Pereodic Noise Reduction by Frequency Domain Filtering, Linear Position-InvarientDedradations, Estimation of Degradation Function, Inverse filtering, Wiener filtering, Constrained Least Square Filtering, Geometric Mean Filter, Geometric Transformations.

Image Compression: Coding, Interpixel and Psychovisual Redundancy, Image Compression models, Elements of Information Theory, Error free comparison, Lossy compression, Image compression standards.

Unit 4

Image Segmentation: Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation, Motion based segmentation.

Representation and Description: Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components for Description, Introduction to Morphology, Some basic Morphological Algorithms.

Object Recoginition: Patterns and Pattern Classes, Decision-Theoretic Methods, Structural Methods.

Text Books:

1 Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", 2nd edition, Pearson Education, 2004.

2 A.K. Jain, "Fundamental of Digital Image Processing", PHI, 2003.

Reference Books:

1. Rosefield , "Digital Picture Processing", 1999.

2. W.K. Pratt, "Digital Image Processing", 2000.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-203	Big Data Analytics							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Practical	Total	Time
4	0	0	4	60	40	--	100	3 Hrs.
Program Objective (PO)	Understand big data for business intelligence. Learn business case studies for big data analytics. Understand NoSQL big data management. Perform map-reduce analytics using Hadoop and related tools							
Course Outcomes (CO)								
CO1	Understand the basics of big data							
CO2	Understand the detailed explanation of NoSQL							
CO3	Analysing the data with Hadoop and learn the MapReduce							
CO4	Description on Hbase, Pig and Hive							

Unit 1

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

Unit 2

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.

Unit 3

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures

MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats

Unit 4

Hbase, data model and implementations, Hbase clients, Hbase examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration.

Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts.

Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.

References:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging
2. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
3. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of
4. Polyglot Persistence", Addison-Wesley Professional, 2012.
5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
6. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
7. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
8. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
9. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
10. Alan Gates, "Programming Pig", O'Reilley, 2011.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-201	Object Oriented Software System Design						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	To provide the thorough knowledge to use the concepts and their design attributes for object based system design and their related paradigms to foster better communication and product quality in order to solve the real time problems by applying the object oriented pattern and visual modeling throughout the software development life cycles.						
Course Outcomes (CO)							
CO1	To learn the basic concepts of object oriented design and methods and also to get exposure of UML for analyzing and designing quality software systems.						
CO2	To explore the details of object-oriented software development methods using use cases, relations, responsibilities, interface objects, services and system design and object-oriented methodologies for choosing and designing effective and time critical software systems.						
CO3	To realize the nature of design patterns by understanding and identifying design model, components, software behavior, Methodology for Object-Oriented Design (MOOD), and reusability and Life Cycle issues to create naturalized object oriented design.						
CO4	To evaluate object oriented design processes using software maintenance process, configuration management and maintenance models to articulate better software system for performing required tasks.						

Unit 1: Introduction, Methods and Concepts

Introduction: Object oriented concepts, Object-oriented domain analysis, software reuse, software life cycle models, unified modeling language (UML).

Object-oriented methods (OOM): Overview, Goals, Concepts: Object analysis model, Information model. Behavior model, Process model, Requirements definition model, benefits and weaknesses.

Unit 2: Object-Oriented Software Development Methods and Methodologies

Object-oriented software development methods: ObjectOry: System development and analysis, use cases, entities, interface objects, services and system design, advantages, Introduction to Object-oriented structured design and application examples.

Object-oriented Methodologies: Classification, Rumbaugh methodology, Jacobson methodology, Booch methodology, Responsibility-Driven design, Pun and Winder methodology, Shlaer/Mellor methodology.

Unit 3: Object-Oriented Design, Reusability and Life Cycle Issues

Object-Oriented Design: Representation of design model, Identification of components, classes, inheritance and objects, Identification of software behavior, Suitability of Methodology for Object-Oriented Design (MOOD), Context of MOOD, A CASE environment for MOOD, MOOD tools.

Reusability and Life Cycle Issues: Reusability during Object-Oriented design, Object-Oriented software life cycle model, Software life cycle issues.

Unit 4: Software Maintenance Concepts and Object-Oriented Programming Languages

Software Maintenance Concepts: Software maintenance process, Reverse engineering environment, Documentation for Software maintenance, Software configuration management and Software maintenance models.

Object-Oriented Programming Languages: Simula, SmallTalk, Ada95, Object COBOL.

Text Books:

1. Jag Sodhi, Prince Sodhi, Object-Oriented Methods for Software Development, McGraw-Hill.
2. Luiz Fernando Capretz, Miriam Captrez, Object-Oriented Software: Design and Maintenance, World Scientific.
3. Luiz Fernando Capretz, Object-Oriented Design Methodologies for Software Systems, Ph.D. Thesis, University of Newcastle upon Tyne, United Kingdom, November 1991. Available Online at: https://theses.ncl.ac.uk/dspace/bitstream/10443/1967/1/Capretz,%20L.F.%201991.pdf
4. Ali Bahrami, Object Oriented Systems Development: McGraw Hill, 1999.
5. Rumbaugh *et al.*,Object Oriented Modeling and Design, PHI, 1997 .
6. Wendy Boggs, Michael Boggs, Mastering UML with Rational Rose, Sybex BPB Publications, 2007.

Reference Books:

1 Object-Oriented Analysis and Design with Applications (3rd Edition) 3rd Edition, Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Jim Conallen, Kelli A. Houston, Addison-Wesley, 2007
2. Design Patterns: Elements of Reusable Object-Oriented Software, Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, 1st Edition, Addison-Wesley, 2007
3. Refactoring: Improving the Design of Existing Code (Addison-Wesley Object Technology Series), Martin Fowler, Kent Beck, John Brant, William Opdyke, Don Roberts, Erich Gamma, Addison-Wesley, 2007
4. Object Oriented Analysis and Design: Understanding System Development with UML 2.0, Docherty, Wiley India,2010.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-132	Data Mining Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
0	0	4	2	60	40	100	3 Hrs.
Program Objective (PO)	To get awareness of data mining tools and getting knowledge of various performance metrics for evaluation of data mining techniques. To explore the different validation techniques on training data set.						
Course Outcomes (CO)							
CO1	To be able to get basic concepts of data mining.						
CO2	To get understanding of data pre-processing, generalization and data characterization techniques to provide suitable input for a range of data mining algorithms.						
CO3	Students are able to analyze and provide solutions for real world problems using mining association techniques.						
CO4	Examine the different classification & clustering techniques in data mining.						

List of practical

1. Study of Data Mining tool.
2. Develop an application to extract association mining rule.
3. Develop an application for classification of data.
4. Develop an application for one clustering technique.
5. Develop an application for implementing Naive Bayes classifier.
6. Implementation of association mining rule –Apriori algorithm.
7. Develop an application for decision tree.
8. To create a Decision tree by training data set.
9. To create a Decision tree by cross validation training data set.
10. To create a Decision tree by using Prune mode and Reduced error Pruning and show accuracy for cross validation trained data set.

MTCE-130	Embedded Systems Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
0	0	4	2	60	40	100	3 Hrs.
Program Objective (PO)	**This laboratory will develop the programming skills in the embedded systems field. Emphasis is given to interface handling; device driver and application development. Programming of mobile devices is included.**						
Course Outcomes (CO)							
CO1	To Familiarize with programming methods and tools for embedded systems.						
CO2	To Write efficient programs in C to develop embedded systems.						
CO3	To Program Device Drivers for embedded systems.						
CO4	To Program mobile devices.						

List of practical

1. Design an embedded system for traffic light controller using 8051 microcontroller.
2. Program for an embedded system in C using GNU development tools.
3. Program to demonstrate a simple interrupt handler and setting up a timer.
4. Program to create two tasks which trigger blinking of two LEDs at different timings.
5. Program to send messages to mailbox by one task and read from mailbox by another task.
6. Write an assembly program to configure and control General Purpose Input/Output (GPIO) port pins.
7. Program to imlement Buzzer interface on IDE environment.
8. To interface and convert Digital to Analog data using DAC in ARM processor.
9. To develop, code, configure and test a device driver.
10. To implement concurrency and resource management in mobile devices.

MTCE-128	Security in Computing Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
0	0	4	2	60	40	100	3 Hrs.
Program Objective (PO)	This Security in computing laboratory provide an applied understanding of the principles of network and computer security.						
Course Outcomes (CO)							
CO1	Learn about the encryption and decryption using different algorithms.						
CO2	A hands-on experience in attack execution and the use of tools in such attacks.						
CO3	Create virtual private network to evaluate response time.						
CO4	The practical knowledge to secure computers and network including the setup of policies and security assessment.						

List of practical

1. Write a program for encryption and decryption using DES algorithm in Java.

2. Write a program for encryption and decryption using AES algorithm in Java.

3. Design and implementation of a simple client/server model and running application using sockets and TCP/IP.Eavespdropping attacks and it's prevention using SSH.

4. Create a virtual private network (VPN) WAN to evaluate application response time in the presence and absence of a firewall.

5. Isolate WLAN traffic using separate Firewall for VPN connection.

6. Implement a program to manage security in a small business network.

7. Implement security and networking policies settings across the company.

8. Demonstrate intrusion detection system (IDS) using any tool (snort or any other s/w).

9. Installation of rootkits and study about the variety of options.

10. Implement the simple substitution technique named Caesar cipher using C language.

MTCE-126	Agile Software Engineering Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
0	0	4	2	60	40	100	3 Hrs.
Program Objective (PO)	This Software Laboratory focuses on to analyze, design and provide optimal solution for Computer Science & Engineering and multidisciplinary problems.						
Course Outcomes (CO)							
CO1	To Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.						
CO2	To Design solutions for complex engineering problems						
CO3	To Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools						
CO4	To demonstrate the knowledge of and need for sustainable development.						

List of practical

1. Understand the background and driving forces for taking an Agile Approach to Software Development. Study the Important Characteristics that make agile approach best suited for Software Development.

2. Understand the business value of adopting agile approach.

3. Study the Agile Process Examples
   a) SCRUM
   b) FDD
   c) Lean software development
   d) XP

3. Understand agile development practices using SCRUM

4. Drive Development with Unit Test using Test Driven Development.

5. Apply Design principle and Refactoring to achieve agility

6. To study automated build tool.

7. To study version control tool.

8. To study Continuous Integration tool.

9. Perform Testing activities within an agile project.

MTCE-124	Information Theory and Coding Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
0	0	4	2	60	40	100	3 Hrs.
Program Objective (PO)	This Information Theory and Coding Laboratory get exposure to emerging topics in information theory and coding.						
Course Outcomes (CO)							
CO1	Determine various entropies and compare channel capacity of different channels.						
CO2	Understand techniques of design &performance evaluation of error correcting codes.						
CO3	**Design and develop solutions for technical issues related to information coding.**						
CO4	Learn about syndrome calculation and design of encoder and decoder.						

List of practical

1. Write a program for determination of various entropies and mutual information of a given channel. Test various types of channel such as
a) Noise free channel
b) Error free channel
c) Binary symmetric channel
d) Noisy channel
Compare channel capacity of above channels.

2. Implement a program for generation and evaluation of variable length source coding using Huffman Coding and decoding (C/MATLAB).

3. Implement coding and decoding of Cyclic codes.

4. Implement coding and decoding of Linear block codes.

5. Implement coding and decoding of BCH and RS codes.

6. Implement coding and decoding of Convolutional codes.

7. Write a simulation program to implement source coding and channel coding for transmitting a text file.

8. Implement a program to study performance of a coded and uncoded communication system (calculate the error probability).

MTCE-122	Mobile Ad-hoc and Wireless Sensor Networks Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
0	0	4	2	60	40	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)							
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, MANET, routing protocols as to be gone through.						

List of practical

1. Create scenarios, simulate, and study the evolution of contention-oriented protocols (Aloha, Slotted Aloha, and Ethernet).
2. Implement ARP to find the medium access control address of the destination using the destination's internet protocol address.
3. Create scenarios, simulate, and study the variation of throughput and Mean Delay as the number of nodes increase.
4. Create scenarios and study the difference in performance (with respect to throughput and delay) between token ring and token bus protocols.
5. Write a program to correct error using hamming code in a data received from a network simulator, error is introduced during transmission through as simulator.
6. Simulate a network implementing X.25 protocol. Change the Automatic Repeat Request (ARQ) protocol and then compare the network's performance.
7. Create a scenario, simulate, and study the performance of the different congestion control algorithms .
8. Write a program for the flow control protocols i.e Stop and wait, Go back-N, selective repeat over UDP and verify through a simulator
9. Implement, and verify through a simulator, a program to create sub-network and assign addresses based on the number of hosts connected to the network.
10. Implement AODV routing protocol in MANET.
11. Implement DSDV routing protocol in MANET.
12. Implement DSR routing protocol in MANET.
13. Study the effect of different Routing protocols (RIP and OSPF) on network's performance through simulation.
14. Create a scenario and study the performance of MANET mobility models.

MTCE-118	Social Networks Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	This Software Laboratory focuses on accessing the dataset from social networks and then applying machine learning techniques, data cleaning and visualization of data in real time environments using Python programming and NLTK						
Course Outcomes (CO)							
CO1	To access the data from social networks						
CO2	To deign machine learning modules for efficient system						
CO3	Create the algorithms for accessing Social Media and data cleaning						
CO4	To apply testing tools for visualization of data in real time application.						

List of practical

1. Write a python program to remove an item from tuple and merge three dictionaries.
2. Write a python program to construct pyramids of stars (*) and numbers using nested for loop.
3. Write a python function to check whether a number is perfect or not and use filter function to print vowels from a given list.
4. Write a python program to estimate coefficients of an equation using linear regression model.
5. Write a python program to predict gender of a person if heigth, weight and shoe size are given using any four supervised learning algorithms.
6. Write a python program to find noun, verb and adjective in a given sentence.
7. Write a python program to calculate frequency of each word in a file after removing stopwords from it.
8. Write a program to for analyzing the behaviour (i.e. check whether a tweet is of positive, negative, or compound nature) of tweets and plot the results.
9. Write a program to sort the list of numbers using shell sort.
10. Write a python program to predict gender of a person from his/her name.
11. Write a python program to make a prediction about a movie from its review.
12. Write a program to plot the image in PNG format using matplotlib for average, max, and min of the data taken from a CSV file.
13. Write a program for classifying the text using NLTK.
14. Write a python program to guess behavior of a person.
15. Write a python program to print trending and common trends tweets in world,us and india.
16. Write a python program to use hashtag as basis of search query to fetch some tweets for further analysis.
17. Write a python program extract twitter entities such as hashtags, screen names.
18. Write a python program to clean any given dataset.
19. Write a python program to visualize a data using histogram, boxplot and scatter plot matrix.
20. Write a program for sentiment analysis of tweets (i.e. polarity and subjectivity).

MTCE-116	Data Mining						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
4	0	0		60	40	100	3 Hrs.
Program Objective (PO)	To introduce the detailed study on data mining methodology.						
Course Outcomes (CO)							
CO1	Understand the basics of data mining and data warehousing						
CO2	Understand the detailed explanation of data generalization and statistical measures						
CO3	Description of mining associations, correlations, classification and prediction						
CO4	Description on cluster analysis and mining of complex type of data like world wide web and text data base						

Unit 1

Introduction

Data Mining, Functionalities, Data Mining Systems classification, Integration with Data Warehouse System, Data summarization, data cleaning, data integration and transformation, data reduction.

Data Warehouse

Need for Data Warehousing, Paradigm Shift, Business Problem Definition, Operational and Information Data Stores, Data Warehouse Definition and Characteristics, Data Warehouse Architecture and Implementation, OLAP.

Unit 2

Data Mining Primitives, Query Language and System Architecture, Concept Description, Data generalization, Analysis of attribute relevance, Mining descriptive statistical measures in large databases.

Unit 3

Mining association rules in large databases: Association rule mining, Mining single dimensional Boolean association rules from transactional databases, mining multilevel association rules from transaction databases, Relational databases and data warehouses, correlation analysis, classification and prediction.

Unit 4

Introduction to cluster analysis, Mining complex type of data: Multidimensional analysis and descriptive mining of complex data objects, Spatial databases, Multimedia databases, Mining time series and sequence data, Mining text databases, Mining the World Wide Web, Applications and trends in data mining.

Books and References:

1 Data Mining: Concepts and Techniques; Jiawei Han and Micheline Kamber; Elsevier.
2 "Mastering Data Mining: The Art and Science of Customer Relationship Management", by Berry and Lin off, John Wiley and Sons, 2001.
3 "Data Ware housing: Concepts, Techniques, Products and Applications", by C.S.R. Prabhu, Prentice Hall of India, 2001.
4 "Data Mining: Concepts and Techniques", J.Han, M.Kamber, Academic Press, Morgan Kanfman Publishers, 2001.
5 "Data Mining", by Pieter Adrians, DolfZantinge, Addison Wesley 2000.
6 "Data Mining with Microsoft SQL Server", by Seidman, Prentice Hall of India,2001.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-114	Embedded Systems						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
4	0	0	4	60	40	100	3 Hrs.
Program Objective (PO)	To introduce the complete design of a modern embedded system with functional requirements for hardware and software components including processor, networking components, and sensors, along with applications, subsystem interfaces, networking, and middleware and to show how to understand and program such systems using a concrete platform built around.						
Course Outcomes (CO)							
CO1	Understand key concepts of embedded systems like History, definition and Classification, and characteristics of Embedded Systems						
CO2	Complete system design concepts of embedded systems for Processor and Memory Organization and peripheral devices.						
CO3	Understand the basics of Microcontrollers and assembly Language programming process.						
CO4	Become aware of interrupts and deployment of embedded processors and supporting devices in real-world applications						

Unit 1

Introduction to embedded systems: Background and History of Embedded Systems, definition and Classification, Programming languages for embedded systems: desirable characteristics of programming languages for embedded systems, low-level versus high-level languages, main language implementation issues: control, typing. Major programming languages for embedded systems. Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits.

Unit 2

Processor and Memory Organization: Structural units in processor, Processor selection for an embedded system, Memory devices, Memory selection, Allocation for memory to program segments and blocks and memory map of a system, DMA, Interfacing processor. I/O Devices -Device I/O Types and Examples? Synchronous -iso-synchronous and Asynchronous Communications from Serial Devices -Examples of Internal Serial-Communication Devices -UART and HDLC -Parallel Port Devices -Sophisticated interfacing features in Devices/Ports-Timer and Counting Device.

Unit 3

Microcontroller: Introduction to Microcontrollers, Evolution, Microprocessors vs. Microcontrollers, MCS-51 Family Overview, Important Features, Architecture.8051 Pin Functions, Architecture, Addressing Modes, Instruction Set, Instruction Types. **Programming:** Assembly Programming. Timer Registers, Timer Modes, Overflow Flags, Clocking Sources, Timer Counter Interrupts, Baud Rate Generation. Serial Port Register, Modes of Operation, Initialization, Accessing, Multiprocessor Communications, Serial Port Baud Rate.

Unit 4

Interrupts: Interrupt Organization, Processing Interrupts, Serial Port Interrupts, External Interrupts, Interrupt Service Routines. Microcontroller Specification, Microcontroller Design, Testing, Timing Subroutines, Look-up Tables, Serial Data Transmission. **Applications:** Interfacing Keyboards, Interfacing Displays, Interfacing A/D and D/A Converters, Pulse Measurement, Loudspeaker Interface, Memory Interface.

Books and References:

1. John Catsoulis, "Designing Embedded Hardware", O'reilly
2. An Embedded Software Primer", David E. Simon, Pearson Education
3. Frank Vahid, Tony Givargis, "Embedded System Design", John Wiley & Sons, Inc
4. Karim Yaghmour, "Building Embedded Linux Systems", O'reilly
5. Michael Barr, "Programming Embedded Systems", O'reilly
6. Alan C. Shaw, "Real-time systems & software", John Wiley & sons, Inc.
7. Wayne Wolf, "Computers as Components", Harcourt India Pvt. Ltd.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-112	Security In Computing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	100	50	150	3 Hrs.
Program Objective (PO)	To introduce the detailed study of Probability, Random Variables and Stochastic Processes.						
Course Outcomes (CO)							
CO1	To evaluate the risks and vulnerabilities in protocols/Standards.						
CO2	To apply number theory and algebra required for designing cryptographic algorithms.						
CO3	To Design symmetric key, asymmetric key encryption techniques, design authentication, message integrity and authenticated encryption protocols.						
CO4	To design and security analysis of systems including distributed storage and Electronic voting.						

UNIT – I

Computer Security Concept, Threats, Attacks and Assets, Security Functional Requirements, Security Architecture for Open System, Scope of Computer Security, Computer Security Trends and Strategy.
Cryptography: Terminology and Background, Substitution Ciphers, Transpositions, Cryptanalysis, Data Encryption Standard, DES & AES Algorithms and comparison, Public Key Encryption, Possible Attacks on RSA Malicious Software: Types of Malicious Software, Viruses, Virus countermeasures, Worms, Bots, Rootkits.

UNIT – II

Protection in General-Purpose Operating Systems: Security Methods of Operating Systems, Memory and Address Protection.
Designing Trusted Operating Systems: Security Policies, Models of Security, Designing of Trusted Operating System. Linux Security: Linux Security Model, Linux Vulnerabilities, Linux System Hardening, Application Security, Mandatory Access Control

UNIT – III

Database Security: Relational Database, Database Access Control, Inference, Statistical Databases, Database Encryption. Data Mining Security: Security Requirements, Reliability and Integrity, Sensitive data, Multilevel Databases, Proposal for Multilevel Security, Data Mining - Privacy and Sensitivity, Data Correctness and Integrity, Data Availability.
Trusted Computing: Concept of Trusted System, Trusted Computing and Trusted Platform Module, Common Criteria for Information Technology Security Evaluation.

UNIT – IV

Security in Networks: Threats in networks, Network security controls, Firewall and Intrusion Prevention Systems: Need, Characteristics, Types of Firewalls, Firewall Basing, Intrusion Prevention Systems. Intrusion Detection Systems.
Internet Security Protocols and Standards: Secure Socket Layer (SSL) and Transport Layer Security (TLS), IP4 and IP6 Security, Secure Email. Legal and Ethical Aspects: Cybercrime and Computer Crime, Intellectual Property, Copyrights, Patents, Trade Secrets, Privacy and Ethical Issues.

Text Books:

1. Pfleeger C. &Pfleeger S.L., "Security in Computing", 4th Ed., Pearson Education.
2. Stalling W., Brown L., "Computer Security Principles and Practice", 3rd Ed., Pearson Education.

Reference Books:

1. Schneier B., "Applied Cryptography: Protocols, Algorithms and Source Code in C", 2nd Ed., Wiley India Pvt. Ltd.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-110	Agile Software Engineering						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
4	0	0	4	60	40	100	3 Hrs.
Program Objective (PO)	Introduces the business value of adopting Agile approaches and provide complete understanding of the Agile development practices.						
Course Outcomes (CO)							
CO1	To understand the background and driving forces for taking an Agile approach to software development.						
CO2	To explore the business value of adopting Agile approaches.						
CO3	To drive development with unit tests using Test Driven Development.						
CO4	To apply design principles and refactoring to achieve Agility.						

Unit I: Fundamentals of Agile

The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools

Unit II: Agile Scrum Framework

Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum case study, Tools for Agile project management.

Unit III: Agile Testing

The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester.

Unit IV: Agile Software Design and Development

Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control.

Text Books:

1. Ken Schawber, Mike Beedle, Agile Software Development with Scrum, Pearson publications.
2. Robert C. Martin, Agile Software Development, Principles, Patterns and Practices, Prentice Hall.
3. Lisa Crispin, Janet Gregory, Agile Testing: A Practical Guide for Testers and Agile Teams, Addison Wesley.

Reference books:

1. Alistair Cockburn, Agile Software Development: The Cooperative Game, Addison Wesley.
2. Mike Cohn, User Stories Applied: For Agile Software, Addison Wesley.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-108	Information Theory and Coding						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3Hrs.
Program Objective (PO)	The objective of this course is to introduce the basic concepts of information theory and coding, including information, source coding, channel model, channel capacity, channel coding in an exemplary way.						
Course Outcomes (CO)							
CO1	To understand and explain the basic concepts of information theory, source coding, channel and channel capacity, channel coding and relation among them.						
CO2	To describe the real life applications based on the fundamental theory and to apply convolution codes for performance analysis & cyclic codes for error detection and correction.						
CO3	To calculate entropy, channel capacity, bit error rate, code rate and steady-state probability.						
CO4	To implement the encoder and decoder of one block code or convolutional code using any program language.						

Unit 1

Overview; Basic Concepts - Entropy and Mutual information; Lossless Source Coding – Source entropy rate; Kraft inequality; Huffman code; Asymptotic equipartition property; Universal coding; Noisy Channel Coding - Channel capacity; Random channel codes; Noisy channel coding theorem for discrete memory-less channels; Typical sequences; Error exponents; Feedback; Continuous and Gaussian channels; Lossy Source Coding - Rate- Distortion functions; Random source codes; Joint source-channel coding and the separation theorem.

Unit 2

Source coding- Text, Audio and Speech: Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm – Audio: Perceptual coding, Masking techniques, Psychoacoustic model, MEG Audio
layers I,II,III, Dolby AC3 - Speech: Channel V coder, Linear Predictive Coding Source coding- Image and Video: Image and Video Formats – GIF, TIFF, SIF, CIF, QCIF –Image compression: READ, JPEG – Video Compression: Principles-I,B,P frames, Motion estimation, Motion compensation, H.261, MPEG

Unit 3

Standard Error control coding- Block codes: Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes -Linear block codes,

Unit 4

Cyclic codes - Syndrome calculation, Encoder and decoder – CRC Error control coding- convolution codes: code tree, trellis, state diagram - Encoding – Decoding:
Sequential search and Viterbi algorithm – Principle of Turbo coding

Text Books:

1. Mark Kelbert(Author), Yuri Suhov, Information Theory and Coding by Example, Cambridge University Press, 2013.

Reference Books:

1. Simon Haykin and Michael Moher, Communication Systems, 5th Edition, Wiley, 2010
2. T.M. & Thomas, J.A. (2006). Elements of Information Theory. New York: Wiley.
3. Jiri Adamek, Foundations of coding, Wiley Interscience, 1991.
4. T. M. Cover and J. A. Thomas, Elements of information theory, Wiley, 1991.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-106	Mobile Ad-hoc and Wireless Sensor Networks							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Practical	Total	Time
3	0	0	3	60	40	-	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 1

Mobile Ad hoc Networks (MANET) – Mobility Management, modeling distributed applications for MANET, MAC mechanisms and protocols.

Unit 2

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 3

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 4

MAC layer and routing protocols in WSN
Data Retrieval Techniques in WSN – Sensor databases, distributed query processing, Data dissemination and aggregation schemes, Operating Systems for WSN, Security issues in WSN.

Books and References:

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.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-104	Advanced Database System Design						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	This course is designed to recognize data storage in DBMS, data representation using ER and EER modelling, query processing techniques , recovery management, data base security using firewall and digital signature						
Course Outcomes (CO)							
CO1	Understand the basics of DBMS architecture and data storage mechanism						
CO2	Depiction of various levels in database designing and database representation mechanism.						
CO3	To know the concepts of query processing, transition management and recovery management						
CO4	Explanation of database security techniques such as Firewalls, proxy servers, SSL and digital signatures						

Unit 1

Introduction: Overview of DBMS and its internal Architectural, Data Storage and representation in DBMS: Memory Hierarchy, Secondary storage mechanism and reliability improvement through mirroring and RAID, Recovery from disk crashes, Representing Relational data elements with records (fixed and variable) use of page and block formats, Heap, sorted and clustered file organization.

Unit 2

Indexing in DBMS: Clustered, primary, secondary, dense and Sparse indexing, Hash and Tree based index structures, ISA and B+ tree data structures, bit map indexing, R-indexing.

Database Design: Three steps of Conceptual, logical and Physical design, and methodology for design, Overview of E-R and Extended E-R Modeling and conversion to logical tables and normalization, Physical database design and tuning – overview of tasks involved and methodology, Guidelines for index selection, Clustering, Demoralization and view definitions, Tuning of Queries with Explain PLAN.

Unit 3

Query Processing and Transaction management in DBMS: Query processing architecture in DBMS, relational operations and implementation techniques, Algorithms for Selection, Projection and Join, Query optimization, Query tree and optimization using Relational equivalences, Transaction Management DBMS: Transaction and ACID Properties, schedules and serializability, Concurrency control techniques – locking timestamps and Optimistic Concurrency control, Concept of Recovery management, Buffer and Recovery management structures in DBMS, Deferred update and ARIES algorithm for recovery with an example.

Unit 4

Database Security: Access Control mechanisms in DBMS, GRANT and REVOKE of VIEWS, Security for Internet applications through Encryption Firewalls, proxy servers, SSL and digital signatures.

Reference Books

1. Gracia-Mlina, Ullman and Widom, "Database System Implementation",(2001)-Pearson Education.
2. Connolly &Begg, "Database Systems", Third Edition (2002)-Pearson Publication.
3. Raghu Ramkrishnan&Gehrke, "Database Management Systems", Third Edition McGraw Hill Publications (2003).

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-102	Social Networks						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	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 hidden relationships, tracking the flow of information and to recognize data patterns in social networks by using graph, matrix, relationships, clustering, and equivalence between users.						
Course Outcomes (CO)							
CO1	To understand the essentials of social networks by learning different types of entities and relationships as nodes, edges within the graph and represent these information as relational data to determine the relative importance of a vertex to find the design levels						
CO2	To explore the detailed explanation of data generalization and mining from Twitter, Facebook and LinkedIn in well informed and efficient manner.						
CO3	To describe the semantic web using mining associations, correlations, classification, betweenness, centrality, equivalence relation, centralization, clustering coefficient and structural cohesion to generate visualizations and perform empirical investigations of network data.						
CO4	To interpret and synthesize the results with respect to collated datasets by using structural equivalence, automorphic equivalence and regular equivalence for interpreting quality factors and mining of complex type of data to execute better recommendation.						

Unit: I: Social Networks and Related Concepts

Introduction to Social Networks: Introduction, uses, examples and types of social networks, Social and economic networks, Opportunities and challenges in social networks, Social structure in social networks, Properties of social networks, algorithmic and economic aspects of social networks

Social Network Data: Nodes, Edges, Relationship, Graphs, Samples and Boundaries, Formal methods, Adjacency Matrix for undirected and directed networked graphs and using matrices to represent social relations, Random graphs, Properties of random graphs, Percolations, Branching processes, Growing spanning tree in random graphs.

Level in Social Networks: Ego networks, partial networks, complete or global networks, social networks methods including binary or valued, directed or undirected.

Unit: II Mining the Social Web

Mining Twitter: Fundamental Twitter Terminology, creating a Twitter API Connection, Exploring Trending Topics, searching for Tweets, extracting Tweets entities, analyzing Tweets and Tweet entities with frequency analysis, computing the lexical diversity of Tweets, Examining patterns in Retweets, Visualizing frequency data with histograms.

Mining Facebook: Understanding the social graph API, Understanding the open graph protocol, Analyzing social graph connections

Mining LinkedIn: Making LinkedIn API requests, Downloading LinkedIn connections as a CSV file, Clustering, normalizing data for analysis, measuring similarity, and clustering algorithms.

Unit: III Mining Web pages and Semantic Web

Mining Web pages: Scraping, Parsing and Crawling the Web, Discovering semantics by decoding syntax, Entity-Centric analysis: A paradigm shift, Quality of analytics for processing human language data.

Mining the Semantically Marked-Up Web: Microformats: Easy-to-implement Metadata, Semantics markup to semantic Web: A brief interlude, The semantic Web: An evolutionary revolution.

Social Network Analysis: Introduction, History, Metrics in social network analysis (Betweenness, Centrality, Equivalence relation, Centralization, Clustering coefficient and Structural cohesion).

Unit IV: Equivalence in Social Networks

Structural equivalence, Automorphic equivalence and Regular equivalence

Text Books:

1. Matthew A. Russell, "Mining the Social Web", O'Reilly and SPD, Second edition New Delhi, 2013.
2. Hanneman, R. A., & Riddle, M., "Introduction to social network methods, Riverside, California: University of California, Riverside. Available at: http://faculty.ucr.edu/~hanneman/nettext/.
3. "Social network analysis: Theory and applications". A free, Wiki Book available at: http://train.ed.psu.edu/WFED-543/SocNet_TheoryApp.pdf.

Reference Books:

1. Lon Safko, "The Social Media Bible: Tactics, Tools, and Strategies for Business Success", Wiley 3rd Ed., 2012.
2. Peter K Ryan, "Social Networking", Rosen Publishing Group, 2011.
3. John Scott, Peter J. Carrington, "Social Network Analysis", SAGE Publishing Ltd., 2011.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTRM-111	Research Methodology and IPR						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	2	60	40	100	3 Hrs.
Program Objective (PO)	*To enable students to Research Methodology and IPR for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.*						
Course Outcomes (CO)							
CO1	Understand research problem formulation.						
CO2	Analyze research related information						
CO3	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.						
CO4	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.						

Unit 1

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2

Effective literature studies approaches, analysis, Plagiarism, Research ethics, Effective technical writing, how to write report, Paper.Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

Unit 3

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

Unit 4

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

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

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'.
2. C.R. Kothari, "Research Methodology: Methods & Techniques, 2nd edition or above, New Age Publishers.
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2 nd Edition , "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

MTCE-129	Speech and Language Processing Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
0	0	4	2	60	40	100	3 Hrs.
Program Objective (PO)	This Software Laboratory focuses on study of speech and the process of natural language in forms of token and tag some words to make meaningful. This also extracts information and measure the semantic similarity of sentences.						
Course Outcomes (CO)							
CO1	To process the basic text in form of Tokenization and Stemming						
CO2	To study distributional properties in large samples of language data						
CO3	To implement and find semantics based on lexical semantics						
CO4	To extract information based on relation						

Case Study 1
Take a sample of sentences and process the text in form of tokenization and normalize this data using stemming

Case Study 2
Take a file of size less than 50MB and then select some word and convert these words to N-grams.

Case Study 3
A part-of-speech tagger, or POS-tagger, processes a sequence of words, and attaches a part of speech tag to each word. Take some adjective of English language and tag it.

Case Study 4
To Measure Semantic Similarity between sentences like sentence of "Harry is running fast" and "Harry is Sprinting"

Case Study 5
To associate each word with a word sense disambiguator to select the right meaning among all possible senses for each word.

Case Study 6
Build a system that will extract structured data, such as tables, from unstructured text and use them for training and evaluating models?

Case Study 7
Develop a Model Building in which a machine learning model is trained on a labeled dataset and Improve Performance of Text Classifier

MTCE-127	Soft Computing Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
0	0	4	2	60	40	100	3 Hrs.
Program Objective (PO)	To get awareness of Neural Network based learning and training; and getting knowledge of various Neural Network training based learning techniques. To explore the knowledge through implementation the Evolutionary approaches like Genetic and Differential Evolution.						
Course Outcomes (CO)							
CO1	To be able to get basic concepts of Neural Networks.						
CO2	To get understanding of designing and training various Neural Networks like AND, OR, X-OR Logic.						
CO3	Students are able to analyse and provide solutions for real world problems using Soft Computing techniques.						
CO4	Implementation of stochastic population-based Genetic and Differential Evolutionary approaches.						

List of Practical

1. Study of different types of Neural Networks.
2. To design and train AND gate using neural network training.
3. To design and train OR gate using neural network training.
4. To design and train X-OR gate using neural network training.
5. To design and train AND gate using Back propagation (BPN).
6. To design and train OR gate using Back propagation.
7. To design and train X-OR gate using Back propagation.
8. To implement Genetic Algorithm using soft computing approach.
9. To implement Differential Evolutionary approach for solving stochastic problems.
10. To solve real-world problems using population-based Genetic and Differential Evolutionary approaches.

MTCE-125	Algorithm Analysis and Design Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
0	0	4	2	60	40	100	3 Hrs.
Program Objective (PO)	The student will learn how to design the algorithm techniques, become familiar with the different algorithm design techniques and improve the efficiency of existing algorithms.						
Course Outcomes (CO)							
CO1	The student should be able to Design algorithms for real time problems						
CO2	The student should be able to Analyse the time and space complexity of algorithms.						
CO3	Students will be able to learn how lo improve the efficiency of algorithms.						
CO4	To apply testing tools for designing the test case to test the real time application.						

List of Practical

1. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
2. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
3. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm, implement it using Open and determine the speed-up achieved.
4. Implement 0/1 Knapsack Problem using Dynamic Programming.
5. Print all the nodes reachable from a given starting node in a digraph using BFS method.
6. Implement Huffman code using Greedy approach.
7. Implement Naïve String matching technique to match the string.
8. Implement N Queen's problem using Back Tracking.
9. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
10. Implement longest common subsequence.

MTCE-123	Number Theory and Cryptography Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
0	0	4	2	60	40	100	3 Hrs.
Program Objective (PO)	To be able to implement and analyze algorithms for different encryption techniques. Applications to cryptography are explored including symmetric and public-key cryptosystems. To be able to implement different methods of attacks on data.						
Course Outcomes (CO)							
CO1	To understand mathematics behind cryptography.						
CO2	Students will be able to implement algorithms of cryptography, including encryption/decryption and hash functions.						
CO3	Students will be able to implement various network security practice applications.						
CO4	Identify various attacks and formulate defense mechanism.						

List of Practical

1. Write a program to implement encryption using binary/byte addition.
2. Write a program to implement encryption using binary Exclusive-OR (XOR).
3. Write a program to implement Triple DES with CBC mode and Weak DES keys.
4. Write a program to implement RSA Encryption and Factorization Attacks.
5. Write a program to implement Attack on RSA encryption with short RSA modulus.
6. Write a program to implement hash generation and sensitivity of hash functions to plaintext modifications.
7. Write a program to implement Digital Signature Visualization.
8. Write a program to implement RSA Signature.
9. Write a program to implement Attack on Digital Signature/Hash Collision.
10. Write a program to implement Firewalls and IDS.

MTCE-121	Distributed Operating System Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
0	0	4	2	60	40	100	3 Hrs.
Program Objective (PO)	**To get awareness of Distributed Operating System and getting knowledge of various design aspects of operating system.**						
Course Outcomes (CO)							
CO1	Understand the design aspects of operating system						
CO2	Exposure on usage of various operating systems.						
CO3	Design modern distributed system components.						

List of Practical

1. Simulate the following CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority
2. Simulate all file allocation strategies a) Sequential b) Indexed c) Linked
3. Implement process strategies: creation of Child, Zombie, and Orphan process
4. Implement file organization strategies a) Single level b) Two level c) Hierarchical
5. Simulate Bankers Algorithm for Dead Lock Avoidance
6. Simulate Bankers Algorithm for Dead Lock Prevention
7. Simulate all page replacement algorithms a) FIFO b) LRU c) LFU
8. Implement shared memory and semaphore concepts for Inter process communication

MTCE-119	Advanced Computer Networks Lab							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Practical	Total	Time
3	0	0	3	60	40	-	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)								
CO1	To classify traditional networks and discuss various wireless networking standards, compare and contrast various IEEE wireless LAN and Ethernet standards.							
CO2	To describe cellular architecture and IPv4 and IPv6 header formats has to be discussed along with mobile IP.							
CO3	To deploy high performance computing standards, VPN and routing protocols.							
CO4	To get familiar with various security and privacy standards/tools.							

List of Practical

1. Configuration and logging to a CISCO Router and introduction to the basic user Interfaces. Introduction to the basic router configuration and basic commands.
2. Configuration of IP addressing for a given scenario for a given set of topologies.
3. Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default gateway and a default DNS address. Integrate the DHCP server with a BOOTP demon to automatically serve Windows and Linux OS Binaries based on client MAC address.
4. Configure, implement and debug the following: Use open source tools for debugging and diagnostics.

a. ARP/RARP protocols
b. RIP routing protocols
c. BGP routing
d. OSPF routing protocols
e. Static routes (check using netstat)

5. Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverse DNS and forward DNS, using TCP dump/Wireshark characterise traffic when the DNS server is up and when it is down.
6. Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client characterise file transfer rate for a cluster of small files 100k each and a video file of 700mb.Use a TFTP client and repeat the experiment.
7. Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java client to send and receive mails.
8. Implement AODV routing protocol in MANET.
9. Implement DSDV routing protocol in MANET.
10. Implement DSR routing protocol in MANET.
11. Study the effect of different Routing protocols (RIP and OSPF) on network's performance through simulation.
12. Create a scenario and study the performance of MANET mobility models.

Calculate expected output for the model. Run the test cases. Compare the actual output with the expected output. Any model-based technique can be used for building the test model.

MTCE-117(Contd...)

CASE STUDY 7
Study and implementation of

- Mutation test
- Slice based test

- **CASE STUDY 8**

Introduction to any two open source testing tool:

- Study of any testing tool (e.g. Win runner)
- Study of any web testing tool (e.g. Selenium)
- Study of any bug tracking tool (e.g. Bugzilla, bugbit)
- Study of any test management tool (e.g. Test Director)
- Study of any open source-testing tool (e.g. Test Link)

CASE STUDY 9
Web Application Testing for Student Grade System

With educational organizations under increasing pressure to improve their performance to secure funding for future provision of programmes, it is vital that they have accurate, up-to-date information. For this reason, they have MIS systems to record and track student enrolment and results on completion of a learning programme. In this way they can monitor achievement statistics. All student assignment work is marked and recorded by individual module tutors using a spreadsheet, or similar, of their own design. In the computing department these results are input into a master spreadsheet to track a student's overall progress throughout their programme of study. This is then made available to students through the web portal used in college. Perform web application testing for this scenario.

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MTCE-117	Software Quality Models & Testing Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
0	0	4	2	60	40	100	3 Hrs.
Program Objective (PO)	This Software Laboratory focuses on test case generation on testing different kinds of software and to provide the in-depth coverage of software quality models and software testing strategies.						
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	Create a test plan document of real time applications.						
CO4	To apply testing tools for designing the test case to test the real time application.						

CASE STUDY 1

Write the test cases for the largest of three number based on:

- Boundary value analysis test
- Robustness based testing
- Equivalence class partitioning test
- Decision table based test

CASE STUDY 2

Cause Effect Graph Testing for a Triangle Program

Perform cause effect graph testing to find a set of test cases for the following program specification: Write a program that takes three positive integers as input and determine if they represent three sides of a triangle, and if they do, indicate what type of triangle it is. To be more specific, it should read three integers and set a flag as follows:

If they represent a scalene triangle, set it to 1.
If they represent an isosceles triangle, set it to 2.
If they represent an equilateral triangle, set it to 3.
If they do not represent a triangle, set it to 4.

CASE STUDY 3

Boundary Value Analysis for a Software Unit

The following is a specification for a software unit. The unit computes the average of 25 floating point numbers that lie on or between bounding values which are positive values from 1.0 (lowest allowed boundary value) to 5000.0 (highest allowed boundary value). The bounding values and the numbers to average are inputs to the unit. The upper bound must be greater than the lower bound. If an invalid set of values is input for the boundaries an error message appears and the user is reported. If the boundary values are valid the unit computes the sum and the average of the numbers on and within the bounds. The average and sum are output by the unit, as well as the total number of inputs that lie within the boundaries. Derive a set of equivalence classes for the averaging unit using the specification, and complement the classes using boundary value analysis. Be sure to identify valid and invalid classes.

Design a set of test cases for the unit using your equivalence classes and boundary values. For each test case, specify the equivalence classes covered, input values, expected outputs, and test case identifier. Show in tabular form that you have covered all the classes and boundaries. Implement this module in the programming language of your choice. Run the module with your test cases and record the actual outputs. Save an uncorrected version of the program for future use.

Case Study 4:

Write the test cases for any known application (e.g. banking application) using
I) Basis path testing
II) Component testing
III) Data flow analysis test

Case Study 5:

Create a test plan document for any application (e.g. Library Management System)

CASE STUDY 6

Model Based Testing

Design and develop a scientific calculator program using various GUI components and events. Build the test model for the same. Determine the inputs that can be given to the model.

MTCE-115	Speech and Language Processing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3Hrs.
Program Objective (PO)	This subject covers the overview and description of automatic speech recognition system.						
Course Outcomes (CO)							
CO1	To learn the concepts in mechanics of speech						
CO2	To understand the spectral analysis of the speech signal and noise reduction methodology.						
CO3	To implement and use of the statistical approaches for the design and development of Automatic Speech Recognition (ASR).						
CO4	Understand the formal language theory of language processing and complexity measures.						

Unit I

Mechanics of Speech: Speech Production Mechanism, Nature of Speech Signal, Discrete Time Modeling of Speech Production, Representation of Speech Signals, Classification of Speech Sounds, Phones, Phonemes, Phonetics, IPA and Phonetic Alphabets, Articulatory Features, Auditory Perceptions, Anatomical Pathways from Ear to the Perception of Sound Peripheral Auditory System.

Unit II

Spectral Analysis of Speech Signal: Time Domain Parameter of Speech Signal, Methods of Extracting The Parameters: Energy Filter bank Analysis, Short Time Fourier analysis, Formant Extraction, Pitch Extraction; Noise Reduction Techniques, Spectral Estimation, Feature Analysis: MFCC, PLP, RASTA, PLP-RASTA; TRAP.

Unit III

Statistical Framework of ASR: Probability, Bayes Theorem, Covariance and Correlation, Gaussian Mixture Model, ASR Framework: Feature Extraction, Acoustic Model, Pronunciation Model, Language Model, Decoder; Unit Selection, Limitation of Basic HMM and Applications, Advanced HMM, Refinement of HMM, Hybrid HMM/ANN.

Unit IV

Language Processing: Formal Language Theory: Chomsky Hierarchy, Chart Parsing for Context Free Grammars, Stochastic Language Models: Probabilistic Context-Free Grammar, N-gram Language Models, Complexity measure of Language Models: N-Gram Smoothing, Deleted Interpolation Smoothing, Backoff Smoothing, Class n-grams, Performance of N-gram Smoothing, Adaptive Language Models: Cache Language Models, Topic-Adaptive Models, Maximum Entropy Models.

References:

1. Speech and language processing, Daniel Jurafsky and James H. Martin, University of Colorado, Boulder.
2. Fundamentals of Speech Recognition, Lawrence Rabiner, Biing Hwang Juang and B.Yegnarayana, Pearson Edition
3. Speech Recognition – Theory and C++ Implementation, Claudio Becchetti, KlucioPrinaRicotti, Fondazione Ugo Bordoni, Rome, Italy.
4. Spoken Language Processing – A Guide to Theory, algorithm and system development, X.Huang, A. Acero, H. W. Hon.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-113	Soft Computing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
4	0	0	4	60	40	100	3 Hrs.
Program Objective (PO)	To introduce the detailed study on Soft Computing with Neural Networks, Fuzzy Logic, Optimization & Regression and Genetic algorithms approaches.						
Course Outcomes (CO)							
CO1	Understand various types of Neural Networks.						
CO2	Understand the detailed explanation of Fuzzy Logic with fuzzy sets.						
CO3	Description of optimization, regression methods and Genetic Algorithms for solving engineering problems						
CO4	Understanding all concepts of Soft Computing for problem solving.						

Unit 1

Neural Networks: History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

Unit 2

Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation, Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations, Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations, Introduction of Neuro-Fuzzy Systems, Architecture of Neuro Fuzzy Networks, Applications.

Unit 3

Regression and Optimization: Least-Squares Methods for System Identification -System Identification: An Introduction, Basics of Matrix Manipulation and Calculus, Least-Squares Estimator, Geometric Interpretation of LSE, Recursive Least-Squares Estimator, Recursive LSE for Time-Varying Systems, An introduction to LSE for Nonlinear Models, Derivative-based Optimization-Descent Methods, The Method of Steepest Descent, Newton's Methods, Step Size Determination, Conjugate Gradient Methods, Analysis of Quadratic Case, Nonlinear Least-squares Problems, Incorporation of Stochastic Mechanisms, Derivative-Free Optimization.

Unit 4

Genetic Algorithm: An Overview of GA, GA operators, GA in problem solving, Implementation of GA.

Text Books:

1. "Introduction to the Theory of Neural Computation", Hertz J. Krogh, R.G. Palmer, Addison-Wesley, California, 1991.
2. "Fuzzy Sets & Fuzzy Logic", G.J. Klir& B. Yuan, PHI, 1995.
3. "Neuro-fuzzy and Soft Computing", by J.-S.R. Jang, C.-T. Sun, and E. Mizutani, PHI.
4. "An Introduction to Genetic Algorithm", Melanie Mitchell, PHI, 1998.
5. "Soft computing and Intelligent System Design", F. O. Karray and C. de Silva, Pearson, 2009.

Reference Books:

1. "Neural Networks-A Comprehensive Foundations", Prentice-Hall International, New Jersey, 1999.
2. "Neural Networks: Algorithms, Applications and Programming Techniques", Freeman J.A. & D.M. Skapura, Addison Wesley, Reading, Mass, (1992).

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-111	Algorithm Analysis and Design						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To Apply important Algorithmic design paradigms & methods of analysis & to Synthesize efficient Algorithms in common engineering design situations.						
Course Outcomes (CO)							
CO1	To prove the correctness & analyse the asymptotic performance of Algorithms.						
CO2	To know various Number Theoretic Algorithms & Graph Algorithms.						
CO3	To Analyse various Geometric Algorithms.						
CO4	Understand NP-completeness & identify different NP-complete problems.						

Unit 1

Introduction:

Algorithm concepts, Analyzing and design, Pseudocode conventions, asymptotic efficiency of algorithms, asymptotic notations and their properties.

Analysis Techniques:

Growth Functions, Recurrences and Solution of Recurrence equation-, Amortized Analysis, Aggregate, Accounting and Potential Methods, Probabilistic analysis concepts, hiring problem and its probabilistic analysis, String Matching: naive string Matching, Rabin Karp, and String matching with finite Automata, KW and Boyer – Moore algorithm.

Unit 2

Number Theoretic Algorithms:

Elementary notions, GCD, Modular Arithmetic, Solving modular linear equations, The chines remainder theorem, Powers of an element, RSA cryptosystem, Primality testing, Integer factorization, Polynomials. Huffman Codes: Concepts, construction, correctness of Huffman's algorithms; Representation of polynomials, DFT, FFT, Efficient implementation of FFT, Graph Algorithm, Bellman Ford Algorithm, Single source shortest paths in a DAG Johnson's Algorithm for sparse graph, Flow networks & Ford fulkerson Algorithm, Maximum bipartite matching.

Unit 3

Computational Geometry:

Geometric structures using C++: Vectors, points, Polygons, Edges: Geometric Objects in space: Finding the intersection of a line & triangle, Finding star shaped polygons and convex hull using incremental insertion.

Unit 4

NP-completeness Concepts:

Polynomial time verification, NP-completeness and reducibility, showing problems to be NP-complete like Clique problem, vertex cover problem etc. Approximation algorithms of these problems.

Reference Books

1 T. H Cormen, C E Leiserson.R L Rivest& C Stein, "Introduction to algorithms", 2nd Edition, PHI.
2 Michael J Laszio, "Computational Geometry and Computer Graphics in C++", PHI. India 1996.
3 Brassard, Bratley, "Fundamentals of algorithms", Prentice Hall of India.
4 Knuth, "The Art of Computer Programming", Vol I-III, Pearson Education.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-109	Number Theory and Cryptography						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
4	0	0	4	60	40	100	3Hrs.
Program Objective (PO)	To introduce the concepts and methodology used in the Number Theory and Cryptography.						
Course Outcomes (CO)							
CO1	To introduce the mathematical fundamentals involve in cryptography.						
CO2	To describe the process of primality testing and factorization						
CO2	To understand the strength and weakness of cryptosystems						
CO3	To introduce the elliptic curve cryptography.						

Unit I

Elementary Number Theory: Divisibility, Division Algorithm, Euclidean Algorithm; Congruences, Complete Residue systems, Reduced Residue systems; Fermat's little theorem, Euler's Generalization, Wilson's Theorem; Chinese Remainder Theorem, Generalized Chinese Remainder Theorem-Euler Phi-function, multiplicative property; Finite Fields, Primitive Roots; Quadratic Residues, Legendre Symbol, Jacobi Symbol; Gauss's lemma, Quadratic Reciprocity Law.

Unit II

Primality Testing and Factorization: Primality Tests; Pseudo primes, Carmichael Numbers; Fermat's pseudoprimes, Euler pseudo primes; Factorization by Pollard's Rho method; Simple Continued Fraction, simple infinite continued fractions; Approximation to irrational numbers using continued fractions; Continued Fraction method for factorization.

Unit III

Public Key Cryptosystems: Traditional Cryptosystem, limitations; Public Key Cryptography; Diffie Hellmann key exchange; Discrete Logarithm problem; One-way functions, Trapdoor functions; RSA cryptosystem; Digital signature schemes; Digital signature standards; RSA signature schemes; Knapsack problem; El Gamal Public Key Cryptosystem; Attacks on RSA cryptosystem: Common modulus attack; Homomorphism attack, timing attack; Forging of digital signatures; Strong primes, Safe primes, Gordon's algorithm for generating strong primes.

Unit IV

Elliptic Curve Cryptography: Cubic Curves, Singular points, Discriminant; Introduction to Elliptic Curves, Geometry of elliptic curves over reals; Weier strass normal form, point at infinity; Addition of two points; Bezout's theorem, associativity; Group structure, Points of finite order; Elliptic Curves over finite fields, Discrete Log problem for Elliptic curves; Elliptic Curve Cryptography; Factorization using Elliptic Curve; Lenstra's algorithm; ElGamal Public Key Cryptosystem for elliptic curves.

Reference Books:

1. A Course in Number Theory and Cryptography, Neal Koblitz, (Springer 2006).
2. An Introduction to Mathematical Cryptography, Jill Pipher, Jeffrey Hoffstein, Joseph H.Silverman (Springer, 2008).
3. An Introduction to theory of numbers, Niven, Zuckerman and Montgomery, (Wiley 2006).
4. Elliptic curves: Number theory and cryptography, Lawrence C. Washington, (Chapman & Hall/CRC 2003).
5. An Introduction to Cryptography, R.A. Mollin (Chapman & Hall, 2001).
6. Rational Points on Elliptic Curves, Silverman and Tate (Springer 2005).
7. Guide to elliptic curve cryptography Hankerson, Menezes, Vanstone (Springer, 2004).
8. Elementary Number Theory, Jones and Jones (Springer, 1998).

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-107	Distributed Operating Systems						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	This course is planned to understand the basics of distributed systems, and various issues in distributed operating systems. The focus is on distributed system models , distributed architecture, synchronization, process allocation methods and memory sharing techniques.						
Course Outcomes (CO)							
CO1	Understand basics of distributed system and architecture with related factors.						
CO2	Recognize the synchronization concepts, transactions processing and deadlock issues.						
CO3	Explanation of fault tolerance, real time system and distributed file system.						
CO4	To know the concepts of consistency, shared memory and description of distributed operating systems.						

Unit 1

Introduction: Distributed system, goals, Hardware and Software concepts, Fundamental Issues in Distributed Systems, Distributed System Models and Architectures.

Communication in distributed systems: Layered protocols, client-server model.RPC, Group communication.

Unit 2

Synchronization in distributed Systems: Clock synchronization, Clock synchronization Algorithms, Mutual Exclusion and its algorithms, Election algorithms: Bully algorithm, Ring algorithm, Atomic transactions, Transaction models, Deadlocks: Distributed deadlock detection and prevention.

Unit 3

Process management: Threads, System models, processor allocation, scheduling algorithms, fault tolerance, real-time distributed systems

Distributed File System: Design and implementation of distributed file system, scalability and mobility issues, fault tolerance.

Unit 4

Distributed Shared Memory: Shared memory, consistency models, Page-based distributed shared memory

Case Studies: AMOEBA, MACH

1 Distributed Operating Systems; Andrew S Tanenbaum, Pearson Ed.
2 Distributed Systems: Concepts and Design; G Colouris, J Dollimore, T Kindberg 3/e Pearson Ed. 2002.
3 Principles of Distributed Systems, VK Garg, Kluwer Academic Publishers, 1996.
4 Distributed Systems and Algorithmic Approach by Su Kumar Boss, Chamal& Hall.
5 Principles of Distributed Computing by V K Garg, IEEE Press.
6 Distributed Computing by A D KshemKalyani&MukeshSingha.
7 Distributed Algorithms by Nancy Lynch, Morgan Kaufmann Press.
8 Introduction to Distributed Algorithms by G Tel, Cambridge University.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-105	Advanced Computer Networks							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Practical	Total	Time
3	0	0	3	60	40	-	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)								
CO1	To classify traditional networks and discuss various wireless networking standards, compare and contrast various IEEE wireless LAN and Ethernet standards.							
CO2	To describe cellular architecture and IPv4 and IPv6 header formats has to be discussed along with mobile IP.							
CO3	To deploy high performance computing standards, VPN and routing protocols.							
CO4	To get familiar with various security and privacy standards/tools.							

Unit 1

MAC Protocols for high speed and wireless networks -IEEE 802.3 standards for fast Ethernet, gigabit Ethernet, 10G, and 100VG-AnyLAN, IEEE 802.11, 802.15, and 802.16 standards for Wireless PAN, LAN, and MAN

Unit 2

IPv6: IPv4 versus IPv6, basic protocol, Header-extensions and options, support for QoS, security, etc., neighbour discovery, auto-configuration, DHCPv6, IPv6 Routers and Routing.

Mobility in networks – Mobility Management: Cellular architecture, Mobility: handoff, types of handoffs; location management, HLR-VLR scheme, Mobile IP and IPv6.

Unit 3

IP Multicasting. Multicast routing protocols, address assignments, session discovery, etc. IPsec protected channel service, virtual private network service, multiprotocol label switching, MPLS VPN

Traffic Types, TCP extensions for high-speed networks, transaction-oriented applications. Other improvements in TCP, Performance issues, TCP Congestion Control – fairness, scheduling and Delay modeling, QoS issues, differentiated services.

Unit 4

Network security at various layers. Security related issues in mobility. Secure-HTTP, SSL, Message digests, Key distribution protocols. Digital signatures and digital certificates.

Books and References:

1 W. R. Stevens. TCP/IP Illustrated, Volume 1: The protocols, Addison Wesley, 1994.
2 G. R. Wright. TCP/IP Illustrated, Volume 2: The Implementation, Addison Wesley, 1995.
3 W. R. Stevens. TCP/IP Illustrated, Volume 3: TCP for Transactions, HTTP, NNTP, and the Unix Domain Protocols, Addison Wesley, 1996.
4 W. Stallings. Cryptography and Network Security: Principles and Practice, 2nd Edition, Prentice Hall, 1998.
5 C. E. Perkins, B. Woolf, and S. R. Alpert Mobile IP: Design Principles and Practices, Addison Wesley, 1997.
6 J.F. Kurose and K.W. Ross, Computer Networking – A Top-down Approach Featuring the Internet, Pearson Education, New Delhi, 2004.
7 N. Olifer & V. Olifer, Computer Networks: Principles, Technologies, and Protocols for network Design, Wiley-Dreamtech Low Price, New Delhi

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

selecting one question from each unit. A question paper template will also be provided.

MTCE-103	Software Quality Models & Testing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
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 configuration management activities and testing object oriented software by using different testing methods.						
CO4	To apply testing principles for Testability, observability, controllability and software refactoring to achieve Agility.						

UNIT – I

Overview of SQM: Concepts of Software Quality, Quality Attributes, Software Quality Models: McCall, Boehm, ISO-9000, CMM.

Software testing principles: Need for testing, Psychology of testing, Testing economics, White box, Black box, Grey box testing, Software Development Life Cycle (SDLC) and Testing, Software Verification& Validation, Weyuker's adequacy axioms.

UNIT – II

Testing strategies: White box testing techniques: Control Flow based testing - Statement coverage, Branch Coverage, Path Coverage; Data flow based testing, Mutation testing, Automated code coverage analysis, Black box testing techniques: Boundary value analysis, Equivalence partitioning, Cause-effect graphing, Robustness testing, Levels of testing - Unit, Integration and System Testing; Acceptance testing: α, β, and γ testing.

UNIT – III

Configuration Management: Maintaining Product Integrity, Components, configuration items, change Management, Version Control, Configuration accounting, Reviews, Walkthrough, Inspection, and Configuration Audits.

Testing object oriented software: Challenges, Differences from testing non-Object Oriented Software, Class testing strategies, Class Modality, State-based Testing.

UNIT – IV

Testability and related issues: Design for Testability, Observability & Controllability, Design by Contract, Precondition, Post condition and Invariant, Regression Testing, Challenges, test optimization.

Miscellaneous topics: Stress Testing, Testing web-enabled applications, Ad hoc testing: Buddy testing, pair testing, Exploratory testing, Agile and extreme testing.

Text Books:

1. Jorgensen P. C., "Software Testing - A Craftman's Approach", 2nd Ed., CRC Press.
2. Glenford J. Myers, "The Art of Software Testing", 3rd Ed., Wiley India Pvt. Ltd.

Reference Books:

1. Mathur P. Aditya, "Foundations of Software Testing", 2nd Ed., Pearson Education.
2. Robert V. Binder, "Testing Object-Oriented Systems: Models Patterns and Tools", Pearson Education.
3. Limaye G. M., "Software Testing – Principles, Techniques, and Tools", Tata McGraw Hill.
4. Boris Beizer, "Black-Box Testing: Techniques for Functional Testing of Software and Systems",1st Ed., Wiley India Pvt Ltd.
5. William E. Perry, "Effective Methods for Software Testing", 3rd Ed., Wiley India Pvt Ltd.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-101	Advanced Computer Architecture and Parallel Processing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	To enable students to describe and compare different parallel computers, processor architectures and various techniques to improve processor performance.						
Course Outcomes (CO)							
CO1	Classify parallel computers based on different criteria and compare various program flow mechanisms.						
CO2	Contrast various processor architectures and solve problems of routing in various interconnection networks.						
CO3	Explain various instruction pipeline design techniques, memory hierarchy concepts and identify ways to reduce miss penalty and miss rate.						
CO4	Describe and distinguish various cache coherence protocols used in various shared memory architectures.						

Unit 1

Parallel computer models: The state of computing, Classification of parallel computers, Multiprocessors and multicomputer, Multivector and SIMD computers.

Program and network properties: Conditions of parallelism, Data and resource Dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain Size and latency, Program flow mechanisms, Control flow versus data flow, Data flow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms

Unit 2

System Interconnect Architectures: Network properties and routing, Static interconnection Networks, Dynamic interconnection Networks, Multiprocessor system Interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network.

Advanced processors: Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors

Unit 3

Pipelining: Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction, Arithmetic Pipeline Design, Computer arithmetic principles, Static Arithmetic pipeline, Multifunctional arithmetic pipelines

Memory Hierarchy Design: Cache basics & cache performance, reducing miss rate and miss penalty, multilevel cache hierarchies, main memory organizations, design of memory hierarchies.

Unit 4

Multiprocessor Architectures: Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, cache coherence protocols (MSI, MESI, MOESI), scalable cache coherence, overview of directory based approaches, design challenges of directory protocols, memory based directory protocols, cache based directory protocols, protocol design trade-offs, synchronization,

Enterprise Memory subsystem Architecture: Enterprise RAS Feature set: Machine check, hot add/remove, domain partitioning, memory mirroring/migration, patrol scrubbing, fault tolerant system.

Text Books:

1. Kai Hwang, "Advanced computer architecture"; TMH. 2000
2. Patterson and Hennessey, "Computer organization and design", Morgan Kaufmann, 2nd Ed. 2002

Reference Books:

1. Harvey G.Cragon,"Memory System and Pipelined processors"; Narosa Publication. 1998.
2. V.Rajaranam&C.S.R.Murthy, "Parallel computer"; PHI. 2002.
3. R.K.Ghose, RajanMoona&Phalguni Gupta, "Foundation of Parallel Processing", Narosa Publications, 2003
4. Stalling W, "Computer Organisation & Architecture", PHI. 2000
5. D.Sima, T.Fountain, P.Kasuk, "Advanced Computer Architecture-A Design space Approach,"Addison Wesley,1997.
6. M.J Flynn, "Computer Architecture, Pipelined and Parallel Processor Design"; Narosa Publishing. 1998
7. Patterson, Hennessy, "Computer Architecture: A quantitative approach"; Morgan Kauffmann, February, 2002.
8. Hwan and Briggs, "Computer Architecture and Parallel Processing"; MGH. 1999.

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