Section C

SYLLABI

APPLIED SCIENCE DEPARTMENT
M. M. M. UNIVERSITY OF TECHNOLOGY
GORAKHPUR

COURSES OFFERED

S.N.	Paper Code	Subject	Prerequisite subjects	L	T	P	Credits
		Post Graduate Programme					
1.	MAS-100	Soft Skills	-	0	0	4	2
2.	MAS-101	Numerical Methods & Engineering Optimization	-	3	1	2	5
3.	MAS-102	Business Statistics	-	3	1	0	4
4.	MAS-103	Communication for Business & Management	-	3	1	2	5
5.	MAS-104	Operations Research for Business Decisions	-	3	1	0	4
6.	MAS-105	Applied Probability & Statistics	-	3	1	0	4
7.	MAS-106	Discrete Mathematics	-	3	1	0	4
8.	MAS-107	Numerical Techniques	-	3	1	0	4
9.	MAS-108	Behavioural Psychology	-	2	1	0	3
10.	MAS-109	Foreign Language-French	-	2	1	0	3
11.	MAS-110	Foreign Language-German	-	2	1	0	3
12.	MAS-111	Foreign Language-Spanish	-	2	1	0	3
13.	MAS-112	Advanced Engineering Mathematics	-	3	1	0	4
14.	MAS-113	Probabilistic Modeling	-	3	1	2	5

SYLLABI

MAS-100 SOFT SKILLS **2 Credits (0-0-4)**

List of activities that are to be carried out:

Lab session 1 : Listening and speaking practice exercises with communicative functions.
Lab session 2 : Practice with more advanced communicative functions
Lab session 3 : Pronunciation exercises
Lab session 4 : Making an oral presentation in English.
Lab session 5 : Listening to telephone conversations in English and completing the tasks.
Lab session 6 : Giving an exposure to and practice with model group discussion and interviews.
Lab session 7 : Giving insights into the format and the task types in the IELTS (International English Language Testing System).
Lab session 8 : Understanding the format and the task types in the TOEFL (Test of English as a Foreign Language)
Lab session 9 : Administering the BEC (Business English Certificate) Diagnostic Test.
Lab session 10 : Completing the steps involved in Career, Life Planning and Change Management.
Lab session 11 : Setting goals and objectives exercises, Developing Soft Skills
Lab session 12 : Prioritizing and time planning exercises. Learning Material: Managing Time Multimedia Program CD
Lab session 13 : Personality Test through oral presentation
Lab session 14 : Critical and creative thinking exercises.
Lab session 15 : Improving body language and cross-cultural communication with pictures.

Books & References:

1. Spoken English**:** A Foundation Course- Kamalesh Sadanand and Susheela Punitha, for Speakers of Indian Languages, Part 2 Audio CD, Hyderabad (Orient Longman), 2008
2. Professional Presentations- Malcome Goodale, (VCD) New Delhi (Cambridge University Press), 2005
3. Essential Telephoning in English (Audio CD**)-** Barbara Garside and Tony Garside, (Cambridge University Press), 2002
4. How to Prepare for Group Discussion and Interview **(**Audio Cassette)-Hari Mohan Prasad and Rajnish Mohan (Tata McGraw Hill)
5. International English Language Testing System Practice Tests (CUP)
6. Business English Certificate Materials (Cambridge University Press)
7. Understanding the TOEFL**.** Educational Testing Services, Princeton, US
8. Interactive Multimedia Programs on Managing Time and Stress
9. Developing Soft Skills-Robert M. Sherfield and et al (Pearson Education), 4th edition, 2009

MAS-101 NUMERICAL METHODS & ENGINEERING OPTIMIZATION — 5 Credits (3-1-2)

UNIT I **9**

Numerical Methods: Solution of algebraic and transcendental equations by Bisection, Regula-Falsi and Newton-Raphson methods. Interpolation: Newton's forward and backward interpolation formulae, Lagrange's formula and Newton's divided difference formula. Solution of system of linear equations by Guass-Siedel method and Crout's method, Numerical Integration: Trapezoidal Rule, Simpson's one-third and three-eight rules.

UNIT II **9**

Classical Optimization Techniques: Introduction, Review of single and multi-variable optimization methods with and without constraints, Non-linear one dimensional minimization problems, Examples.

UNIT III **9**

Constrained Optimization Techniques: Introduction, Direct Methods, Cutting plane method and method of feasible directions, Indirect methods, Convex programming problems, Exterior penalty function method, Examples and problems.

UNIT IV **9**

Unconstrained optimization techniques: Introduction: Direct search method, Random, Univariate and Pattern search methods, Rosenbrock's method of Rotating co-ordinates, Descent methods, Steepest Descent methods, Quasi-Newton's and variable metric method

EXPERIMENTS

1. To implement numerical integration using Simpson's one-third and Simpson's three-eight rules.
2. To implement Gauss-Siedel method for solution of simultaneous equations.
3. To implement Relaxation method for solving simultaneous equations.
4. To implement Runge-Kutta method of order four to solve differential equations.
5. To implement Euler's method to find solution of differential equations.
6. To find optimum solution to problem parameters.
7. To find derivatives of static displacements and stresses.
8. To write Computer based algorithm and program for solution of Eigen-value problems.
9. Reduction of size of an optimization problem using Reduced basis technique.
10. To find Derivatives of Eigen-values and Eigen vectors.

Books & References:

1. Engineering Optimization - S.S. Rao (New Age International)
2. Applied Optimal Design- E.J. Haug and J.S. Arora (Wiley New York)
3. Optimization for Engineering Design- Kalyanmoy Deb (Prentice Hall of India)
4. Engineering Mathematics - H.K. Dass and Rama Verma (S. Chand and Co. Ltd., New Delhi)

MAS-102 BUSINESS STATISTICS 4 Credits (3-1-0)

UNIT I **9**

Skewness and Kurtosis: Mean, Mode and Median, Mean deviation, Standard deviation, Coefficient of variation, Skewness, Kurtosis. Types of skewness and kurtosis, measurement of skewness

UNIT II **9**

Correlation and Regression: Meaning and types of correlation, Karl Pearson and Spearman correlations. Meaning of regression equations, Regression lines and their application, Curve fitting (Straight line and parabola), Least Square method

UNIT III **9**

Probability: Addition and multiplication theorems of probability, Bay's theorem and its application, Probability distribution and their types, Binomial, Poisson and Normal Distributions and their applications

UNIT IV **9**

Sampling Theory: Sampling, Types of Sampling, Sampling methods, Formulation of hypothesis; Application of t-test, z-test, chi-square test and F-test

Books & References:

1. Business Statistics-Beri (Tata McGraw Hill), 2nd edition
2. Business Statistics-Sharma J.K. (Pearson Education), 2nd edition
3. An Introduction to Statistical methods-Gupta C.B. and Gupta V. (Vikas Publication), 23rd edition, 1995
4. Statistics for Management - Levin Rubin (Pearson, New Delhi), 7th edition, 2000

MAS-103 COMMUNICATION FOR BUSINESS & MANAGEMENT 5 Credits (3-1-2)

UNIT I **9**

The Elements of Business Communication

1. Nature of Communication
2. Elements of Communication
3. Role and Importance of Communication
4. Patterns of communication in the business world: upward, downward, horizontal, grapevine etc
5. Internal and external channels of communication; formal and informal channels
6. Cross-cultural communications
7. Avoiding gender, racial and other forms of bias in communication
8. Common forms of oral and written communication in the business world: Oral presentations and its strategies interview and group discussions Memos, reports, summaries and abstracts, e-mails
9. Seven Cs of Communication, features of business communication
10. Communication Theories and Models

UNIT II **9**

Listening, Reading and Writing Techniques

1. Listening Skills, Types of Listening, Developing Listening
2. The importance of developing reading skills
3. The sub-skills of reading:
4. Understanding the main idea and supporting details
5. Reading between the lines: inferential reading
6. Understanding the writer's point of view
7. Making predictions guessing the meanings of unfamiliar words
8. The importance of writing skills writing process: pre-writing, drafting, re-writing
9. The differences between speech and writing
10. The qualities of effective writing: coherence, cohesion, logical structuring and organization, clarity of language, stylistic variation etc.

UNIT III **9**

Business Correspondence

1. Introduction to Business Letters
2. Types of Business Letters
3. Layout of Business Letters
4. Writing Memo
5. Report, Kinds of Report, Business Report, Reporting
6. Circulars, Notices, Agenda and Minutes
7. Letters for Applying Job, C.V./Resume Writing
8. Business Proposal ,Lay out and Drafting of Proposal
9. Correspondence of a Company Secretariat, Agenda and Minutes of A Meeting, Public Notices Inviting Tenders and Bids.
10. Important Terms and Abbreviations,

UNIT IV **9**

Presentation Personality development and soft skills

1. Personality theories: Carl Rogers, Maslow, Eysenck, Murray
2. Emotional Intelligence
3. Skimming and scanning
4. Lateral thinking: Edward De Bono
5. Soft skills: becoming a good leader and team-player
6. Inter-relating soft skills and communication skills
7. Presentation Strategies
8. Speaking-Speech vs. enunciation (mind your tone)
9. Kinesics
10. Interview Skill

Books & References:

1. Business Communication Today - Bovee et. al (Pearson)
2. Business Communication & Report Writing - R.C. Sharma (TMH)
3. Personality: Classic Theories and Modern Research - H. S. Friedman and M.W. Schustack (Pearson Education)
4. Personality Theories - Barbara Engler (Houghton Mifflin Company)
5. Crash Course in Personal Development - Brian Clegg (Kogan Page)
6. Activities for Developing Emotional Intelligence - Adele B. Lynn (HRD Press)
7. Lateral Thinking - Edward De Bono (Penguin)
8. Communication for Managerial Effectiveness - Phillip G. Clampitt (SAGE Publications)
9. Business Communication - T.N. Chhabra (Sun India Publication, New Delhi)
10. Professional Presentations - Malcolm Goodale

PRACTICALS

Software to be used: Learn to Speak English and Present individually and in group

Lab 01: Introduction to vowel and consonant sound.

Lab 02: Introduction to syllable stress; noun stress.

Lab 03: Voiced and voiceless sounds.

Lab 04: Diphthongs; rate of speech.

Lab 05: Fluency Building – word match, reading aloud, recognition of attributes.

Lab 06: Parts of speech in Listening, reading and writing.

Lab 07: Group Discussion.

Lab 08: Interview skills.

Lab 09: Argumentative Skills.

Lab10: Presentation skills, Extempore (on-spot speech delivery).

Lab11: Improving body language and cross-cultural communication with pictures.

Lab12: Making an oral presentation in English.

Lab-13: Completing the steps involved in Career, Life Planning and Change Management.

Recommended Books:

1. A Manual for English Language Laboratory - Sudha Rani, Pearson.

2. English Language Communication Skill (lab),
3. Professional Presentations-Malcome Goodale, (VCD) New Delhi (Cambridge University Press), 2005
4. Developing Soft Skills- Robert M. Sherfield and et al (Pearson Education, New Delhi), 4th edition, 2009
5. Study Materials from CIEFL, Hyderabad.

MAS-104 OPERATIONS RESEARCH FOR BUSINESS DECISIONS 4 Credits (3-1-0)

UNIT I **9**

Linear Programming: Definitions and scope of Operation Research (OR), OR model, Solving OR model. Two variable Linear Programming model and graphical method of solution, Simplex method, Dual Simplex method, Special cases of linear programming

UNIT-II **9**

Transportation Problems: Types of transportation problems, mathematical models, transportation algorithms, Assignment: Allocation and assignment problems and models, processing of job through machines.

UNIT-III **9**

Network Techniques: Shortest Path model, minimum spanning tree problem, Max-Flow problem and Min-Cost problem, Project Management: Phases of Project management, guidelines for network construction, CPM and PERT.

UNIT-IV **9**

Theory of Games: Rectangular games, Minimax theorem, graphical solution of $2 \times n \ or \ m \times 2$ games, game with mixed strategies, reduction to linear programming model. Elements of Queuing model, generalized Poisson queuing model

Books & References:

1. Operation Research - Wayne L. Winston (Thomson Learning), 2003
2. Operation Research - Panneer Seevam, (PHI Learning), 2008
3. Total Quality Management - V.K. Khanna (New Age International), 2008
4. Operation Research : An Introduction - Hamdy H. Teha (Pearson Education), 2003

MAS-105 APPLIED PROBABILITY & STATISTICS 4 Credits (3-1-0)

UNIT I **9**

Probability and Distributions: Definition of probability, Addition and Multiplication Laws of probability, Conditional Probability, Baye's Theorem, Binomial Distribution, Poisson's Distribution, Normal Distribution. Problems related to Binomial, Poisson and Normal Distributions.

UNIT II **9**

Statistical Techniques I: Moments, Moment Generating function, Skewness, Types of Skewness, Measurement of Skewness, Kurtosis and its types. Curve fitting: Method of Least Squares, Fitting of Straight lines, Fitting of Parabola of second degree.

UNIT III **9**

Correlation and Regression: Correlation, Correlation coefficient, Spearman's rank correlation coefficient, Regression, Equation of regression lines, linear, non-linear and multiple regression analysis. Relation between Regression Analysis and Correlation Analysis

UNIT-IV **9**

Sampling Theory: Sampling, Tests of Significance, Chi-square test, t-test, Application to Engineering, Time series and fore casting, Statistical quality Control methods, Control charts, $\bar{x}, R, p, np \ and \ C-charts$.

Books & References:

1. Higher Engineering Mathematics - B.S. Grewal (Khanna Publishers, Delhi)
2. Engineering Mathematics - H.K. Dass and Rama Verma, Vol.III (S. Chand and Co. Ltd., New Delhi)
3. Higher Engineering Mathematics - B.V. Ramana (Tata McGraw Hill Education Pvt. Ltd., New Delhi)

MAS-106 DISCRETE MATHEMATICS 4 Credits (3-1-0)

UNIT I **9**

Set Theory, Relation and Function: Definition of sets, Countable and uncountable sets, Venn Diagrams, Proofs of some general identities on sets. Definition and types of relation, composition of relation, equivalence relation, partial order relation, Function: Definition, types of function, one to one, into and onto function, inverse function, composition of functions

UNIT II **9**

Algebraic Structures: Definition, properties and types of algebraic structures, Semi groups, Monoid, Groups, Abelian group, properties of groups, Subgroups, Cyclic groups, Cosets, Factor group, Permutations groups, Normal subgroups, Homomorphism and Isomorphism of groups, examples and standard results. Rings and fields: Definition and Standard results.

UNIT III **9**

Graphs: Simple graph, multigraph, graph terminology, representation of graphs, Bipartite, regular, planar and connected graphs, connected components in a graph, Euler graphs, Hamiltonian path and circuits, graph colouring, chromatic number, chromatic polynomials. Tree: types and definition, rooted tree, properties of trees.

UNIT IV **9**

Combinatorics: Basic counting Technique, Pigeon-hole principle, Discrete Numeric function, Recurrence relations and their solution, Generating function, Solution of recurrence relations by method of generating function. Polya's counting theorem

Books & References:

1. Discrete Mathematical Structures with Applications to Computer Science- J.P. Tremblay and R. Manohar (McGraw Hill), 1975
2. Graph Theory with Application to Engineering and Computer Science – (Prentice Hall, Englewood Cliffs, N.J.), 1974
3. Combinatorics: Theory and applications - V. Krishnamurthy (East-West Press Pvt. Ltd., New Delhi)

MAS-107 NUMERICAL TECHNIQUES 4 Credits (3-1-0)

UNIT I **9**

Iterative methods and simultaneous linear equations: Solution of polynomial and transcendental equations using Bisection method, Regula-Falsi method and Newton-Raphson method, Rate of convergence, Solution of system of linear equations using Gauss-Seidel method, Jacobi's method.

UNIT II **9**

Interpolation: Finite Differences, Difference Tables, Newton's Forward and Backward interpolation formula, Gauss forward and backward formula for central differences. Interpolation with unequal intervals: Lagrange's interpolation formula, Newton's Divided difference formula

UNIT III **9**

Numerical Differentiation and Integration: Numerical differentiation, Numerical integration, Trapezoidal rule, Simpson's one-third rule, Simpson's three-eight rule, Weddle's rule. Solution of Differential Equations: Picard's method, Euler's method, Taylor's method, Runge-Kutta method of order four

UNIT IV **9**

Curve Fitting and Regression Analysis: Method of least squares, fitting of straight lines, second degree parabola, polynomial and exponential curves. Correlation coefficient, Regression, equation of regression lines, non-linear regression

Books & References:

1. Computer Oriented Numerical Methods - Ramanujan V. (PHI)
2. Numerical Methods in Engineering and Science - Grewal B.S. (Khanna Publishers, Delhi)

3. Numerical Methods for Scientific and Engineering Computations - Jain Iyenger and Jain (New Age Int.)
4. Theory and Problems in Numerical Methods - T. Veerarajan, T. Ramachandran (TMH)
5. Numerical Analysis - Francis Scheld (TMH)

MAS-108 BEHAVIOURAL PSYCHOLOGY 3 Credits (2-1-0)

UNIT I **6**

Introduction to Behavioural Psychology and its basic concepts: Nature, Importance and Scope of Behavioural Psychology, Scientific management, Time and Motion Study and human relations schools.

UNIT II **6**

Individual and Group Behaviour in Workplace: Motivation and job satisfaction, Stress management, Group structure and formation, Group influences, Organisational culture leadership and group dynamic.

UNIT III **6**

Engineering Psychology and Work Environment: Engineering Psychology, Fatigue and Boredom, Accident and Safety, Job analysis, Recruitment and selection, Psychological tests.

UNIT IV **6**

Performance Appraisal: Importance and methods of Performance appraisal, Management Development and Skill Training of the Employees

Books & References:

1. Organisational Behaviour - Fred Luthans (McGraw Hill), 11th edition, 2001
2. Organisational Behaviour - Schermerhorn, Hunt and Osborn (John Wiley), 9th edition, 2008
3. Industrial/Organizational Psychology - Miner, J. B. (McGraw Hill, NY), 1992
4. Industrial Psychology - Archana Despandey (Sun India Publications, New Delhi), 2010

MAS-109 FOREIGN LANGUAGE-FRENCH 3 Credits (2-1-0)

Prerequisites: Complete beginners with no prior knowledge of the language.

Objectives: At a time when the knowledge of a foreign language has become an indispensable tool, this course in French will give an opportunity for students of other disciplines to get a basic knowledge of a widely used European language. The course is based on a minimum vocabulary necessary and sufficient to develop elementary language skills in French.

UNIT I **6**

Alphabets and numbers, Simple Grammar: Basics of French conversation (To greet a person, Introducing oneself, Asking basic information)

UNIT II **6**

Simple Grammar: Name and locate objects, colours and simple description of people.
Simple Grammar: Asking for directions, Giving suggestions.

UNIT III **6**

Simple Grammar: Indicate date and time. Asking and giving information on one's profession and activities.

UNIT IV **6**

Simple Grammar: Use of past tense. Narrating past events, Giving one's opinion

Books & References:

1. Taxi – Guy Cappelle and Robert Menand
2. NSF I (Nouveau sans frontières) - Philippe Dominique & Jacky Girardet.
3. Nouvel Espace I - Guy Cappelle
4. Cadences I – D. Berger & L. Mérieux

MAS-110 FOREIGN LANGUAGE-GERMAN 3 Credits (2-1-0)

Prerequisites: Complete beginners with no prior knowledge of the language.

Objectives : The course in German will give an opportunity for students of other disciplines to acquire basic linguistic skills and a working knowledge of a widely used foreign language. The course is based on a minimum vocabulary necessary and sufficient to develop elementary language skills in German.

UNIT I **6**

- Alphabets and numbers (1 - 20)
- Simple Grammar: Articles (Definite, Indefinite, Negative), Nouns, Gender; Singular and plural. Conjugation of the auxiliary verb "To be" "Sein"
- Contextual Vocabulary and Dialogue: Greeting, Self Introduction, Simple questions.
- Hard Facts of Germany: (i) Fall of Berlin Wall (ii) Unification of Germany

UNIT II **6**

- Numbers (20 – 100)
- Simple Grammar: Conjugation of verbs, pronouns (personal and interrogative), Present tense, Imperative tense, auxiliary verb "To have", "Haben", Nominative and accusative cases.
- Contextual Vocabulary and Dialogue: At the Railway Station, Airport.
- Hard Facts of Germany: Education System.

UNIT III **6**

- Simple Grammar: Modal verbs, Past and perfect tenses, Dative case.
- Contextual Vocabulary and Dialogue: Idiomatic expressions, One's family and background, Reading the time, days, months and year
- Hard Facts of Germany: Germany and the European Union.

UNIT IV **6**

- Simple Grammar: Irregular verbs, Separable and inseparable verbs, Reflexive pronouns, Possessive pronouns Revision of Grammar learn so far
- Contextual Vocabulary and Dialogue: Daily life, Meals, How to place an order in a restaurant.
- Hard Facts of Germany: Presentation of topics on German Civilization discussed earlier.

Books & References:

1. Komm Mit – Level I – Holt, Rinehart & Winston
2. Moment Mall - Level I
3. Themen - Level I
4. Facts about Germany
5. Deutsch FÜr Ausländer – Schulz-Griesbach

MAS-111 FOREIGN LANGUAGE-SPANISH 3 Credits (2-1-0)

Prerequisites: Complete beginners with no prior knowledge of the language

Objectives : This course in Spanish will give an opportunity for students of other disciplines to acquire basic linguistic skills and a working knowledge of a widely used European language

UNIT I **6**

- Alphabet
- Introducing oneself
- Pronunciation
- Nouns, gender of the nouns
- Singular and plural of the nouns Articles: definite and indefinite
- Subject pronouns
- Number (1~100)
- Name of months and days

UNIT II **6**

- Present indicative of the two auxiliaries: Ser/Estar – Tener
- Hay / Están / Dónde está /están
- Adjectives
- The interrogative adjectives and pronouns (cuanto? cual?)
- Nationalities
- Idiomatic expressions with "Tener" (Tener hambre/ sed/...)
- Culture and civilization

UNIT III **6**

- Present indicative of the three conjugations (AR-ER-IR)
- Negation
- Interrogative sentences
- Present indicative of a few common irregular verbs
- Present indicative of "ir" and "venir"
- Possession (de/ de quién)
- Culture and civilization

UNIT IV **6**

- Prepositions and their combination with the articles
- Possessive adjectives and pronouns
- Use of prepositions with "ir" and "venir"
- Present indicative of the verbs. Querer- Poder- Deber/Tener que
- Asking and expressing time
- Family vocabulary (family relations)
- Culture and Civilization

Books & References:

1. Virgilio Borobio, Nuevo ELE 1, Curso de Español Para Extranjeros,2002, SM, Madrid
2. Luis Aragonés y Ramón Palencia: Gramática de uso del Español, teoría y práctica, Ed. SM, Madrid
3. Lisa Prange y Francisca Pichardo Castro: Por Turnos, Actividades para aprender español jugando, Ed. Difusión, Madrid
4. Chamorro, M. D.: Abanico, libro del alumno, Ed. Difusión, Madrid

MAS-112 ADVANCED ENGINEERING MATHEMATICS 4 Credits (3-1-0)

UNIT I **6**

Solution of Linear Simultaneous equations and Algebraic equations:

Crout's method, Gauss-Siedel iteration method, Relaxation method, Solution of Eigen value problems, smallest and largest Eigen-values. Solution of algebraic equations: Newton-Raphson method, Bisection method and Regula-Falsi method

UNIT II **6**

Interpolation and Curve Fitting: Newton's forward and backward interpolation formula for equal intervals. Lagrange's formula and Newton-divided difference formula for finite differences and unequal intervals. Curve fitting: Method of least squares, fitting of straight lines, parabola of second degree and exponential curves.

UNIT III **6**

Numerical Differentiation and Integration: Numerical differentiation using difference operators, Newton, Gauss and Bessel formulae for Derivatives. Numerical Integration: Trapezoidal Rule, Simpson's one-third rule, Simpson's three-eight rule and Weddle's rule.

UNIT IV **6**

Solution of Differential Equations and Sampling methods: Solution of Differential Equations by Euler's method, Modified Euler's method, Picard's method and Runge-Kutta method of order four, Sampling, Chi-Square Test and its use as Test of goodness of fit as well as test of independence

Books & References:

1. Numerical Methods for Scientific and Engineering Computation- M.K. Jain, S.R.K. Iyenger and R.K. Jain; (Wiley Eastern Ltd.)
2. Numerical Methods for Engineers-S.K. Gupta (Wiley Eastern Ltd.)
3. Numerical Methods-B.S. Grewal (Khanna Publication)
4. Elementary Numerical Analysis- S.D. Conte (McGraw Hill)
5. Mathematical Statistics- J.N. Kapoor (S. Chand & Co. Ltd.)
6. Fundamental of Mathematical Statistics- S.C. Gupta & V.K. Gupta (Sultan Chand & Sons)

MAS-113 PROBABILISTIC MODELLING 5 Credits (3-1-2)

Course Objectives:

This is a fast-paced, fundamental course designed to develop an understanding of uncertain phenomena using the theory of probability. The course objective is to provide students with conceptual and intuitive insights into probabilistic reasoning and the ability to understand and solve real world problems.

Learning Outcomes:

1. On satisfying the requirements of this course, students will have the knowledge and skills to:
2. Explain the fundamental concepts of probability theory and its position in modern mathematics and applied contexts;
3. Demonstrate accurate and efficient use of probability theory techniques;
4. Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts from probability theory;
5. Apply problem-solving using probabilistic methods in various situations in mathematical finance.

UNIT I **9**

Introduction to probability theory: Sample points, events and probabilities, An algebra of events, Probabilities, Conditional probability, Random variables, Distribution functions, Probability density functions, Joint distributions, Largest and smallest, Expectations and other moments, Properties of expectation, Variance and covariance, Bernoulli trials and related random variables, The geometric distribution, The binomial distribution, Sums, transforms and limits, Generating functions, Laplace transforms and characteristic functions, The normal distribution and central limit theorem

UNIT II **9**

Arrivals and services: Renewal processes, Forward and backward renewal times, The 'paradox' of residual life, The exponential distribution and its properties, First and last, The Poisson process, Properties of the Poisson process, Arrivals during a random interval, Application; AOHA and CSMA

UNIT III **9**

Queuing systems: average performance and Queuing networks

Little's theorem and applications, Utilization and response time laws, The single-class M/G/I queue, Busy periods, The M/M/I queue, Different scheduling policies, The Processor-Sharing policy, Symmetric policies and multiclass queues, Which policy is better?, Priority scheduling, Preemptive-resume priorities, Averaging and lumping job types, Optimal Scheduling policies, A conservation law for waiting times, The c/ρ rule, Optimization with preemptions, Characterization of achievable performance

Open networks, Traffic equations, Performance measures, Closed networks, Mean value analysis, Multiclass networks, Closed multiclass networks

UNIT IV **9**

Markov chains and processes and Queues in Morkovian environments

Markov chains, Steady state, A Markov chain embedded in the M/G/1 model, Markov processes, Transient behaviour, First passages and absorptions, Birth-and-Death queuing models, The M/M/n model, The M/M/n/n and M/M/∞ systems, The M/M/1/N queue, The M/M/n/. /K model

Quasi-Birth-and-Death models, The MMPP/M/1 queue, A multiserver queue with breakdowns and repairs, Manufacturing blocking, Phase-type distributions, Solution methods, Spectral expansion method, Matrix-geometric solution, Generalization

COMPUTER PROGRAMMING LAB

Developing computer program to illustrate the c concepts of probability theory and statistics, random variables, moments; multiple random variables, conditional distributions, correlation; random signals; queue; applications to engineering systems.

Books & References:

1. A First Course in Probability- Sheldon Ross (Prentice Hall), 2014
2. Probabilistic Modelling - ISI Mitrani (Cambridge University Press), 2nd edition, January 13, 1998
3. Probability and Statistics with Reliability, Queuing, and Computer Science Applications -Dr. Kishor S. Trivedi (Prentice Hall), 2nd edition, Oct 26, 2000

CIVIL ENGINEERING DEPARTMENT
M. M. M. UNIVERSITY OF TECHNOLOGY
GORAKHPUR

COURSES OFFERED

Programme Core for M. Tech. (Hill Area Development Engineering)

S. No.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-101	Ecology and Eco-development	-	3	1	0	4
2.	MCE-102	Water Resources Development	-	3	1	0	4
3.	MCE-103	Hill Transportation	-	3	1	2	5
4.	MCE-104	Land Resources Development	-	3	1	0	4
5.	MCE-105	Hill Habitat, Water Supply and Sanitation	-	3	1	2	5
6.	MCE-120	Minor Project	-	0	0	8	4
7.	MCE-130	Dissertation Part-I	-	0	0	8	4
8.	MCE-140	Seminar	-	0	0	4	2
9.	MCE-150	Dissertation Part-II	Dissertation Part-I	0	0	28	14

Programme Electives (PEI)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-151	Environmental Quality Management	-	3	1	0	4
2.	MCE-152	Earth and Environment	-	3	1	0	4
3.	MCE-153	Principles of Remote Sensing	-	3	1	0	4
4.	MCE-154	Applied Geology	-	3	1	0	4

Programme Electives (PE2)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-156	Environmental Impact Assessment and Management	-	3	1	0	4
2.	MCE-157	Systems Analysis and Management	-	3	1	0	4
3.	MCE-158	Solid Waste Management	-	3	1	0	4
4.	MCE-159	Groundwater Management	-	3	1	0	4

Programme Electives (PE3)

S. No.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-161	Geo-environmental Engineering	-	3	1	0	4
2.	MCE-162	Non-conventional Sources of Energy	-	3	1	0	4
3.	MCE-163	Earthquake Resistant Design of Buildings	-	3	1	0	4
4.	MCE-164	Geo-technique of Hill Area	-	3	1	0	4

Programme Electives (PE4)

S. N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MCE-166	Water Pollution	-	3	1	0	4
2.	MCE-167	Geographic Information System Techniques	-	3	1	0	4
3.	MCE-168	Water Retaining Structures	-	3	1	0	4
4.	MCE-169	Disaster Management	-	3	1	0	4

SYLLABI

MCE-101 ECOLOGY AND ECO-DEVELOPMENT 4 Credits (3-1-0)

UNIT I **9**

Ecology Levels of organization, Subdivision of Ecology principles and concepts pertaining to Ecosystems, examples of a lake, a watershed unit, a forest, as ecosystems. Homeostasis of an ecosystem

UNIT II **9**

Principles and concepts of pertaining to flow of energy in ecosystems, principles and concepts pertaining to biogeochemical cycles, Principles pertaining to limiting factors, Development and evolution of ecosystems, Ecosystem development with regard to shifting cultivation. Fresh water ecology and terrestrial ecology of hilly regions, systems approach and mathematical modeling in ecology

UNIT III **9**

Remote sensing as a tool for the study and management of ecosystems, Eco-development, The existing trends of economic development in hill, The adverse impacts of water resources, industrial agricultural, horticultural tourist development in hills. The concept of Eco-development, Sukhomajri models

UNIT IV **9**

Socio economic development coordinated, action oriented research. Post harvest operation, Agro and plant based industries, Institutional framework, forest policy

Books & References:

1. Fundamentals of Ecology - Eugene Odum, Gary W. Bewet, Brooks Cole
2. Essentials of Ecology - Jr. G. Tylor miller, Brooks Cole
3. Elements of Ecology - Robert L. Smith, Thomas H. Smith, Graham C. Hickman, Susan M. Hickman, Benjamin Cummings
4. Ecology: Principles & Applications - J.L. Chopra & M.J. Reiss (Cambridge University Press)

MCE-102 WATER RESOURCES DEVELOPMENT 4 Credits (3-1-0)

UNIT I **9**

Benefit cost ratio, systems approach to planning projects on river systems. Fixing optimum capacities by dynamic programming, Fixing priority of projects

UNIT II **9**

Design of high dams in seismic region and their foundation problems. Design of arch and shell dams, concrete membrane dams, and rolled fill concrete dams. Hydel power and its advantages and disadvantages

UNIT III **9**

Economics of peaking power and frequency control. Different types of power plants and their planning. Layout of a hydel power station and its fixtures

UNIT IV **9**

Design of power house structures, fore bay, penstocks, spiral casing, draft tube and superstructure, foundations of a powerhouse

Books & References:

1. Irrigation Engineering & Hydraulic Structures-S.R. Sahasrabudhe (Katson Book, Delhi)
2. Irrigation Engineering & Hydraulic Structures-S.K. Garg (Khanna Publishers, Delhi)
3. Water Resources Engineering-S.R. Sahasrabudhe (Katson Books)

MCE-103 HILL TRANSPORTATION 5 Credits (3-1-2)

UNIT I **9**

Introduction: Special aspects of hill roads, preliminary investigations, Classification of hill roads, Environmental considerations and their impacts

UNIT II **9**

Alignment of Hill Roads: Basic considerations, Survey and requirements of alignments, Gradient and selection of alignments, Future traffic considerations, Cross drainage.

Geometric Design of Hills Roads: Types of hill zones and terrain, Geometric Elements, Width of formation and land, Right of way, Speed limit requirement, Camber, Gradients, Sight distances, Horizontal curves Super-elevation curves, Super-elevations, Transition curves, Pavement widening curves, Hair-pin-bends, Over-taking crossing places, Vertical curves, Minimum vertical clearance.

UNIT III **9**

Rock Blasting and Cutting Techniques: Rock cutting and blasting, Mechanism of blasting, Explosives for rock blasting and techniques for blasting, Drilling pattern.

Retaining Walls: Types of retaining walls, Stability of slopes, Backpressure on retaining walls, Design of retaining walls

UNIT IV **9**

Drainage in Hill Roads: Drainage of water form hill slope, Roadside drains, Cross drainage, sub surface drainage

Maintenance Problems of Hill Roads: Common problems and their causes, Landslide Problems, Types of Landslides, Measures to prevent landslides, Breast walls

Safety Requirements and Labour Laws: Importance of safety and Labour laws on hill roads, type of accidents, accidents during hill cutting and blasting. Accidents with machines, various safety measures, Remedial measures, Labour regulation laws

LABORATORY WORK

1. Crushing Value Test of Aggregate
2. Impact Value Test of Aggregate
3. Los Angeles Abrasion Value of Aggregate
4. Shape Test (Flakiness Index, Elongation Index) of Aggregate
5. Penetration Test of Bituminous Sample
6. Softening Point Test of Bituminous Sample
7. Stripping Test of Bituminous Sample
8. Ductility Test of Bituminous Sample
9. Flash & Fire Point Test of Bituminous Sample
10. Classified both directional Traffic Volume Study
11. Traffic Speed Study (Using Radar Speedometer or Enoscope)
12. Marshall test

Books & References:

1. Highway Engineering-S.P. Bindra (Danpat Rai Publication, New Delhi)
2. Transportation Engineering (Vol.1)-V.N. Vazirani 7 S.P. Chandola (Khanna Publications, New Delhi)
3. Highway Engineering-L.R. Kadiyali & Dr. N.B. Lal (Khanna Publications, New Delhi)

MCE-104 LAND RESOURCES DEVELOPMENT 4 Credits (3-1-0)

UNIT I **9**

Land capability classification, climate index for agricultural potential at high altitudes.

A study of crops in the hills, crop rotation, crop water and soil water relationship

UNIT II **9**

Crop yield/water use production, functions, Agriculture systems, jhum cultivation, Problems of agricultural plant resources, Terrace cultivation Economic, social and industrial aspects of the area and systems approach to optimum development of the potential.

UNIT III **9**

Hill irrigation, contour channels and diversion works, side channel spillways, lift channels. Techniques of accurate water placement trickle and sprinkler irrigation. Drainage to prevent washing away of fields crop cover effect

UNIT IV **9**

Drainage to prevent erosion by rains splash, Mathematical treatment of overland flow on surface and in drains

Books & References:

1. Irrigation & Water Power Engineering-Dr. B.C. Punamia & Dr. Pande B.B. Lal (Lakshmi Publishers, Delhi)
2. Irrigation & Water Power Engineering-B.C. Punamia, Ashok Kr Jjain, Arun Kr Jain (Lakshmi Publisher, Delhi)

MCE-105 HILL HABITAT, WATER SUPPLY AND SANITATION 5 Credits (3-1-2)

UNIT I **9**

Hill Habitats: Planning aspects, Site-selection, Orientation and General building requirements in relation to hilly settlements. Utilization of locally available materials like stones, timber, bamboo and mud etc, Precast and energy efficient construction technologies suitable for hilly settlements

UNIT II **9**

Water Supply: Sources of water supply, Water quality and impurities, Estimation of Water demand, collection and distribution techniques

UNIT III **9**

Water Conservation: Dual Water Supply systems, Concept of Domestic and Potable Water, Contour Bunds, Rain water harvesting and ground water recharge techniques

UNIT IV **9**

Sanitation: Principles of sanitation and vector control, Community sanitation. Refuse collection and disposal techniques, Low cost toilets

EXPERIMENTS

1. To estimate the hardness of the given water sample.
2. To estimate the P^H and turbidity of the given water sample.
3. To estimate the acidity of the given water sample.
4. To estimate the alkalinity of the given water sample.
5. To estimate the chloride concentration of the given water sample.
6. To estimate the total solids and total dissolved solids of the given water sample.
7. To estimate the MPN count of total coliforms in the given water sample.
8. To determine the BOD of given water sample.
9. To determine the COD of given water sample.

MCE-151 ENVIRONMENTAL QUALITY MANAGEMENT 4 Credits (3-1-0)

UNIT I **9**

Introduction, Development Needs, Environmental Impact Assessment (EIA), Environmental Statement (ES)

UNIT II **9**

Environmental Management Plan (EMP), Environmental Audit (EA), ISO-14000, Rules and Regulation for getting Consent to establish and Operate Industry

UNIT III **9**

General Provisions and salient features of Water Act, Cess Act, Air Act, EP Act, Hazardous Waste Act/Rules, Biomedical Waste Act/Rules, Noise Rules

UNIT IV **9**

Municipal Solid Waste Rules, Ozone Depleting Substances Rules, Various International Treaties Related to Environmental issues

MCE-152 EARTH AND ENVIRONMENT 4 Credits (3-1-0)

UNIT I **9**

Introduction, Biosphere and Environment, Importance of Clean Environment, Assimilation Capacity of Environment, Conservation of Environment

UNIT II **9**

Impact of Development on Environment, Thermal Pollution, Radio activate and non- radioactive pollution, Soil and Land Pollution.

UNIT III **9**

Impact of Mining and Deforestation, Green House Effect and Global Warming, Depletion of Ozone

UNIT IV **9**

Biodiversity, Sustainable Development, e-Waste, Plastic Waste

Books & References:

1. Chemistry of Environmental Engineering - C.N. Sawer, P.L. Mc Carty and G.F. Perkai (Tata McGraw Hill)
2. Environmental Chemistry - A.K. De (New Age International Pvt. Ltd., New Delhi)
3. Prospective in Environmental Studies - A. Kaushik & C.P. Kaushik (New Age International Pvt. Ltd.)

MCE-153 PRINCIPLES OF REMOTE SENSING 4 Credits (3-1-0)

UNIT I **9**

Remote sensing- Introduction, Sources of energy for remote sensing- active and passive sources, electromagnetic radiation and their characteristics, thermal emission

UNIT II **9**

Interaction of EMR with atmosphere-atmospheric windows, interaction of EMR with earth surface-spectral reflection curves. Multi concept of remote sensing, idealisms and real sequence of remote sensing, sensors and orbital characteristics

UNIT III **9**

Various sensing platforms for remote sensing, principle of Remote sensing devices(RBV, MSS, LISS), IRS and other sensing systems such as Landsat, and Spot, Remote sensing data products and their uses.

UNIT IV **9**

Digital Image Processing- Introduction, digital image representation and characterization, histograms and scatter plot, image enhancement-contrast stretching, pattern recognition and feature extraction.

Image classification- unsupervised and supervised techniques, classification accuracy assessment, NDVI, Principle component analysis

Books & References:

1. Remote Sensing & Image Interpretation - T.M. Lillesand & R.W. Kipler (John Wiley & Sons Inc. NY)
2. Introduction to Remote Sensing - James. B. Compbell (Taylor & Francis)
3. Introduction to Digital Image Processing: A Remote Sensing Perspective - John R. Jensen (Prentice Hall)
4. Remote Sensing & Geographic Information System - M. Anji Reddy (BS Publication)
5. Remote Sensing & GIS - B. Bhatta (Oxford University Press)
6. Remote Sensing & Geographic Int. System - Kalicharan Sahu (Atlantic Publishers)

MCE-154 APPLIED GEOLOGY 4 Credits (3-1-0)

UNIT I **9**

Type of mountains, The Himalayas, classification of Himalayan range, Origin of Himalayas, structure of Himalayas, otter mountain ranges of India, Tunneling in geologically weak and structurally disturbed media, Methods of tunnel excavation in rock, over break tunnel hazards,

UNIT II **9**

Geological considerations in stability and safety of spillways, dams and powerhouses and remedial measures, Problems posed by adverse geological features in alignment of hill channels and their remedial measures, Geological aspects of highway planning, Foundations of bridge piers on rocks, Stability of hill slopes and cuttings, landslides and subsidence, types, causes, signification of geological factors and control of landslides.

UNIT III **9**

Earthquakes, geological considerations for seismic design of structures, seismic zones of India, elements of earthquake forecasting, Blasting, drilling and quarrying

UNIT IV **9**

Classification of rocks, engineering properties and behavior of rocks, laboratory tests, in situ measurement techniques and instrumentation for stress and strain, creep deformation, fracture of rocks. Shear strength of rocks, rocks bolts and dowels, application of principles of rock mechanics to tunnel, apexing draft tube penstock cavities.

MCE-156 ENVIRONMENTAL IMPACT ASSESSMENT & MANAGEMENT — 4 Credits (3-1-0)

UNIT I **9**

Environmental Impact Assessment, Historical Background Global Environmental Policy Need for EIA

UNIT II **9**

Definition, Aims and Methodology of EIA, Role of EIA as a Planning Tool

UNIT III **9**

Environmental Impacts of developmental projects- Recent Case Studies

Management and Audit Traditional Approach vs. the ISO 14000 Environmental Management Systems Approach,

UNIT IV **9**

Management through Environmental Legislations Management through Awareness, Environmental Education and Incentives Environmental Audit-Definition and role of EA, Methodology of EA Current Stratus of EA.

Books & References:

1. Environmental Impact Assessment- Training Resource Manual, UNEP
2. EIA Notification - MOEP, Govt. of India
3. Environmental Science and Ecological Studies - S.K. Garg, Rajeshwari Garg and Rangini Garg

MCE-157 SYSTEM ANALYSIS AND MANAGEMENT — 4 Credits (3-1-0)

UNIT I **9**

Introduction to Computer languages, Linear, Quadratic, Geometric, Direct and Non-Linear Programming

UNIT II **9**

Concept of Optimization, Application of Optimization techniques

UNIT III **9**

Theory of random variables, Modeling and Simulation

UNIT IV **9**

Design and Management of information systems applicable in Environmental management

MCE-158 SOLID WASTE MANAGEMENT — 4 Credits (3-1-0)

UNIT I **9**

Introduction, Overview of Solid Waste Management, Types of Solid wastes, sources of Solid wastes, Properties of Solid wastes

UNIT II **9**

Solid waste Generation, On-site handling, Storage, Collection, Transfer and Transport, processing techniques

UNIT III **9**

Ultimate Disposal, Resources and Energy recovery Systems, Biomedical Waste Management

UNIT IV **9**

Introduction to hazardous Waste and Fly Ash Management, Site selection Criteria for Landfill

MCE-159 GROUNDWATER MANAGEMENT 4 Credits (3-1-0)

UNIT I **9**

Introduction, Occurrence of ground water, Hydrological Cycle, Ground water movement.

UNITII **9**

Well Hydraulics and Water Wells, Ground Water Modeling Techniques.

UNIT III **9**

Surface and Subsurface Investigations of Ground Water.

UNIT IV **9**

Artificial discharge and Recharge of Ground Water, Ground Water management Techniques.

Books & References:

1. Ground Water Assessment Development & Management - K.R. Karanth (Tata McGraw Hill)
2. Water Resources Systems Planning & Management - M.C. Chaturvedi (Tata McGraw Hill)

MCE-161 GEO-ENVIRONMENTAL ENGINEERING 4 Credits (3-1-0)

UNIT I **9**

Waste characterization and solid waste interaction: Composition of municipal and industrial wastes, hazardous waste at municipal landfill sites, chemical and bio-chemical reactions, Solid-waste interaction, engineering properties of waste

UNIT II **9**

Application of geo-synthetics in waste contamination: Types, geo-textiles, geo-nets, geo-composite drainage nets, geo-grid, geo-synthetic, clay linear, friction tests. Low permeability linear and drainage materials

UNIT III **9**

Contaminant transport in soil: Contaminant migration, diffusion and monitoring. Sludge solidification and stabilization: Regulation, physical and chemical tests, treatment method and solidification / stabilization methods, quality control. Vertical barriers: Slurry walls, soil-slurry interaction, permeability compatibility.

UNIT IV **9**

Design of linear system for landfills, Leachate collection and removal system, Stability and settlement analysis including seismic stability and liquefaction, Special topics

MCE-162 NON-CONVENTIONAL SOURCES OF ENERGY 4 Credits (3-1-0)

UNIT I **9**

Definition of micro, mini and small hydrous, Role of micro-mini and small hydrous in power development, Their advantages and disadvantages, Problems in operation and maintenance, Planning new micro-mini and small hydrous especially in hilly tracts, Diversion works, conveyance channels appurtenant structures

UNIT II **9**

Layout of conveyance channels, Layout of power plant, design of various structures of the power plant panchakkis, Standard tubular turbines, bulb turbines, and other types of turbines, their selection and layout. Power form existing irrigation works, methods of combining several falls. Power form wind, geysers, biogas and other renewable sources

UNIT III **9**

Design of Biogas plants and windmills and their comparison with hydel power, Concept of partial benefit from diversion tunnels, Development of power from partial heads by mobile runners, Interim benefits as making available power during construction period

UNIT IV **9**

Lifting water by pumps coupled to turbines and by windmills and hydram schemes

Books & References:

1. Alternative Energy Sources - T. Negat Veziroglu (TMH)
2. Non-Conventional Sources of Energy - G.D. Roy (Khanna Publisher, New Delhi)

MCE-163 EARTHQUAKE RESISTANT DESIGN OF BUILDINGS 4 Credits (3-1-0)

UNIT I **9**

Introduction-Origin of Earthquakes, magnitude, intensity, ground motions, sensors, Strong motion characteristics

UNIT II **9**

Concepts of Earthquake Resistant Design of Reinforced Concrete Buildings- Earthquake and vibration effects on structure, identification of seismic damages in R.C. buildings, Effect of structural irregularities on the performance of R.C. buildings during earthquakes and seismo resistant building architecture

UNIT III **9**

S.D.O.F. Systems-Equation of motion, free and forced vibrations, damping, Response spectrum. M.D.O.F. Systems-

UNIT IV **9**

Two degree and multi-degree freedom systems, Seismic Analysis and Modeling of R.C. Buildings-Codal procedure for determination of design lateral loads, in-fill walls, seismic analysis of R.C. building as per IS: 1893(Part 1). Earthquake Resistant Design of Buildings-Ductility considerations, E.R.D. of R.C. building, Design of load bearing buildings, Design of shear wall.

MCE-164 GEO-TECHNIQUE OF HILL AREA 4 Credits (3-1-0)

UNIT I **9**

Retaining Walls: Type, Proportioning, Application of Lateral Earth Pressure Theories to Design, Stability Checks, Other Types of Possible Failures, Drainage, Breast Wall, Reinforced Earth Structures

UNIT II **9**

Slope Movement: Types and Processes, Recognition and Identification. Field Investigation, Methods of Stability Analysis Design and Construction of Soil Slopes, Engineering of Rock Slopes

Foundation: Capacity of Foundation on Slopes, Bearing Capacity of Foundations on Difficult Grounds e.g. Sanitary Landfills, Collapsing Soil etc.

Grouting and Underpinning: Types of Grouting Suspension Grouts, Solution Grouts, Grouting Equipment and Methods, Grouting Design and Layouts for Seepage Control, Underpinning.

UNIT III **9**

Geosynthetics: Types, Testing, Design and Application in Hilly region.

Frozen Ground: Introduction, Physical and Thermal Properties, Thaw Behaviour, Mechanical Properties of Frozen Soil, Foundations in Frozen Soils, Field investigations

Blasting Techniques: Purpose, Drilling Patterns, Type of Explosives, Safety measures

UNIT IV **9**

Rock mechanics: Introduction, Classification & Index Properties of Rocks, Rock Strength and Failure Criteria, Initial Stresses in Rocks and Their Measurement Plane of weakness and Deformability, Application in Underground Openings and Foundation Engineering.

MCE-166 WATER POLLUTION 4 Credits (3-1-0)

UNIT I **9**

Definition of pollution, Effluent Standards, Development of Water Quality Standards, Water Quality Index, River Water Classification

UNIT II **9**

Classification and impacts of Pollution Variables, Stream Surveys, Pollution zones and classification

UNIT III **9**

Physical, Chemical and Biological Water Purification Processes in Natural Systems, BOD Kinetics assimilation and DO sag, Impoundments and their effects, Pollution control strategies including legislative approach

UNIT IV **9**

Surface Water Modeling

MCE-167 GEOGRAPHIC INFORMATION SYSTEMS 4 Credits (3-1-0)

UNIT I **9**

Geographic Information System (GIS)-Introduction, Geographical concepts and terminology, Components of GIS.

UNIT II **9**

Data acquisition, Raster and vector formats, Inter-conversion between raster and vector formats, Scanners and digitizers, Methods of digitization, Data pre-processing, form conversion, Data reduction and generalization.

UNIT III **9**

Attribute database: scale and sources of inaccuracy Database structures. Conventional database management systems, Spatial database management

UNIT IV **9**

Data merging, Edge matching, registration and resampling, Data manipulation and analysis, Representation of real world problems, Problem solving and spatial modeling. Classification, Aggregation, overlay, buffers, and intervisibility, Network Analysis, Application of GIS in planning of utility lines, Water resources, Erosion modeling, Environmental Impact Assessment

Books & References:

1. Principles of Geographic Information System for Land Resources Assessment - P.A. Burrough (Oxford University Press)
2. Geographical Information System: A Management Perceptive - Stan Arnoff (WDL Publication)
3. Concept & Technique of Geographical Information System - Abbert K.W. Yeung & C.P. Lo. (PHI Learning)
4. Remote Sensing & Geographical Information System - M. Anji Redy (BS Publications)
5. Remote Sensing & GIS - B. Bhatta (Oxford University Press)
6. Remote Sensing & Geographic Int. Sstem - Kalicharan Sahu (Atlantic Publishers & Dist)

MCE-168 WATER RETAINING STRUCTURES 4 Credits (3-1-0)

UNIT I **9**

Project planning, Site Investigations, Choice of type of dams, Cost benefit studies

UNIT II **9**

Non-overflow dams: Gravity, Arch and Buttress, Rock-fill and Earthen Dams, their Design. Different types of Spillways and Energy Dissipations, their design

UNIT III **9**

Preparation and Protection for dams, Model analysis of hydraulic structures, Instrumentation in Dams, Temperature control in Concrete Dams

UNIT IV **9**

Water Harvesting: Types of storage Structures, Water Yield from Catchments, Runoff diversion; Ponds and Reservoirs; Earth Embankments

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MCE-169 DISASTER MANAGEMENT **4 Credits (3-1-0)**

UNIT I **9**

Type of disasters, Accent on land slides, earthquakes flashflood, avalanches, snow blizzards. Causes, consequences and mitigation techniques, Flashfloods their management and relief, Contingency planning for dam failures

UNIT II **9**

Characteristics of glaciers and protection of important monuments from glacial flow

UNIT III **9**

Land slides, their classification, causes, & preventive measures. Concept, growth presents trends status in India and concept of contingency planning and systems approach of disaster management. Sociology of disasters, Human and media response and role

UNIT IV **9**

Disaster prevention techniques, Disaster legislation, Disaster prone area building codes, Vulnerability analysis, Health and sanitation aspects, Relief administration in India and role of engineers in disaster mitigation

CIVIL ENGINEERING DEPARTMENT
M. M. M. UNIVERSITY OF TECHNOLOGY
GORAKHPUR

COURSES OFFERED

Programme Core for M. Tech. (Environmental Engineering)

S. N.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-201	Environmental Chemistry and Microbiology	-	3	1	0	4
2.	MCE-202	Water Treatment and Distribution	-	3	1	0	4
3.	MCE-203	Wastewater Treatment	-	3	1	2	5
4.	MCE-204	Air and Noise Pollution and Control	-	3	1	2	5
5.	MCE-158	Solid Waste Management	-	3	1	0	4
6.	MCE-220	Minor Project	-	0	0	8	4
7.	MCE-230	Dissertation Part-I	-	0	0	8	4
8.	MCE-240	Seminar	-	0	0	4	2
9.	MCE-250	Dissertation Part-II	Dissertation Part-I	0	0	28	14

Programme Electives (PEI)

S. No.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-151	Environmental Quality Management	-	3	1	2	5
2.	MCE-152	Earth and Environment	-	3	1	0	4
3.	MCE-153	Principles of Remote Sensing	-	3	1	2	4
4.	MCE-252	Systems Analysis and Management	-	3	1	2	4

Programme Electives (PE2)

S. N.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-156	Environmental Impact Assessment and Management	-	3	1	0	4
2.	MCE-256	Environmental Sanitation and Ecology	-	3	1	0	4
3.	MCE-258	Environmental Geology	-	3	1	0	4
4.	MCE-259	Rural Environmental Technology	-	3	1	0	4

Programme Electives (PE3)

S. N.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-161	Geo-environmental Engineering	-	3	1	0	4
2.	MCE-162	Non-conventional Sources of Energy	-	3	1	0	4
3.	MCE-261	Ground Water Management	-	3	1	0	4
4.	MCE-262	Building Environmental and Services	-	3	1	0	4

Programme Electives (PE4)

S. N.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-167	Geographic Information System	-	3	1	0	4
2.	MCE-169	Disaster Management	-	3	1	0	4
3.	MCE-267	Hazardous Waste Management	-	3	1	0	4
4.	MCE-268	Industrial Wastewater Treatment	-	3	1	0	4

SYLLABI

MCE-201 ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY 5 Credits (3-1-0)

UNIT I **9**

Introduction, basic Concept from General Chemistry, Colloidal Chemistry

UNIT II **9**

Environmental Biochemistry, Physico-Chemical and Biological examination of Water and Wastewater

UNIT III **9**

Thermodynamic of Microbiological systems

UNIT IV **9**

Mass and energy Balance of Microbial Process, Aerobic and Anaerobic Microbial growth

MCE-202 WATER TREATMENT AND DISTRIBUTION 4 Credits (3-1-0)

UNIT I **9**

Introduction and Sources of Water, Population Forecasting and Water Requirement.

UNIT II **9**

Physical, Chemical and biological Water Quality Parameters

UNIT III **9**

Solid Separation, Settling Operation, Coagulation, Softening, Filtration, Disinfection, Desalination, Dissolved Solids Removal, Adsorption and Ion Exchange, Electrolysis, Osmosis.

UNIT IV **9**

Special Treatment, Pumping and Distribution Systems

Book & References:

1. Water Work Engineering - S.R. Qasim, E.M. Motley and Guang Zhu (Prentice Hall of India, New Delhi)
2. Water Supply Engineering - S.K. Garg (Khanna Publication, New Delhi)

MCE-203 WASTEWATER TREATMENT 5 Credits (3-1-2)

UNIT I **5**

Overview of Wastewater Engineering, Terminology in Wastewater Treatment

UNIT II **7**

Wastewater Flow rates, Wastewater Characteristics, Water Born Disease

UNIT III **15**

Physical and Chemical Unit Operations, Biological Unit Processes including Kinetics of Biological growth, Sludge Thickening, Digestion, Disposal and Nutrient removal, Self Purification of Streams.

UNIT IV **9**

Advanced Treatment Processes, Wastewater Collection, Disposal and Reuse, Introduction to generation of Industrial Wastewater

EXPERIMENTS

1. To estimate the hardness of the given water sample.
2. To estimate the pH and turbidity of the given water sample.
3. To estimate the acidity of the given water sample.
4. To estimate the alkalinity of the given water sample.
5. To estimate the chloride concentration of the given water sample.
6. To estimate the total solids and total dissolved solids of the given water sample.
7. To determine the MPN count of total coliforms in the given water sample.

8. To determine BOD of given wastewater sample
9. To determine the COD of the given wastewater sample.

Book & References:

1. Environmental Engineering - Peavey, Rowe and Technologies (McGraw Hill Co. Ltd.)
2. Wastewater Engineering - Metcalf and Eddy (McGraw Hill Co. Ltd.)
3. Sewage Disposal and Air Pollution Engineering (Environmental Engineering), Vol.-II - S.K. Garg (Khanna Publication, New Delhi)

MCE-204 AIR AND NOISE POLLUTION AND CONTROL 5 Credits (3-1-2)

UNIT I **9**

Introduction, Classification, Sources, Effects, Air Quality Standards, Role of Meteorology and Natural Purification Processes

UNIT II **10**

Sampling, Measurement and Analysis, Control Devices for Particulate and Gaseous Contaminants

UNIT III **7**

Industrial and Vehicular Pollution, Indoor Air Pollution

UNIT IV **10**

Physics of Sound, Noise-Sources and Standards, Measurement and Control of Noise Pollution

EXPERIMENTS

1. Monitoring of ambient air quality for total suspended particulate matter and respirable SPM (OM_{10}).
2. Measurements of CO and HC in tailpipe exhaust emission of petrol vehicles (two wheelers).
3. Measurements of CO and HC in tailpipe exhaust emission of petrol vehicles (four wheelers).
4. Measurements of smoke density in tailpipe exhaust emission of diesel vehicles.
5. Measurements of SO_2 in ambient air.
6. Measurements of NO_2 in ambient air.
7. Measurements of levels of noise pollution in residential, commercial, industrial and silence zones.
8. Comparison of energy equivalent noise levels in indoor and outdoor environments.

Book & References:

1. Environmental Engineering - Peavey, Rowe and Technologies (McGraw Hill Co. Ltd.)
2. Environmental Noise Pollution - Patrick D. Cunniff (McGraw Hill Co. Ltd.)

MCE-252 SYSTEM ANALYSIS AND MANAGEMENT 4 Credits (3-1-0)

UNIT I **9**

Introduction to Computer languages, Linear, Quadratic, Geometric, Direct and Non-Linear Programming

UNIT II **9**

Concept of Optimization, Application of Optimization techniques

UNIT III **9**

Theory of random variables, Modeling and Simulation

UNIT IV **9**

Design and Management of information systems applicable in Environmental management

Book & References:

1. Optimization Theory - S.S. Rao (Khanna Pub., New Delhi)
2. Theory of System Engineering & Optimization - Brind. K (McGraw Hill Co. Ltd)

MCE-256 ENVIRONMENTAL SANITATION AND ECOLOGY 4 Credits (3-1-0)

UNIT I **9**

Introduction and terminology, Pollution types and Sources, Health hazards

UNIT II **9**

Water Supply and Sanitary Installations in Buildings, Ecology and Environment

UNIT III **9**

Principles of Ecology, Ecosystems, Energy Flow, Trophic Level

UNIT IV **9**

Food chain and Food Web, Eco-cycles of Pollutants and Species

Book & References:

1. Water Supply Engineering - S.K. Garg (Khanna Pub. Pvt Ltd, New Delhi)
2. Ecology- E.P. Oduni

MCE-258 ENVIRONMENTAL GEOLOGY 4 Credits (3-1-0)

UNIT I **9**

Each science and its application in environmental engineering, interior of the earth, Character and capabilities of the terrain.

UNIT II **9**

Geological work of streams, wind and glacier and its significance, Soil erosion and conservation, rock weathering, Conservation of Mineral resources and Environmental Impact of Mining, Desertification: Its causes and method of combating the desertification problems.

UNIT III **9**

Geological consideration for the suitable sites for dams and resiovers, roads, tunnels and bridge and their environmental impact

UNIT IV **9**

Movement of surface and underground water, water-logging and its impact on environmental and remedial measures. Natural hazards such as like earthquake, landslides, floods, cyclones, their effects , cause and migration, Geological consideration for site selection for disposal of waste and pollutant

Book & References:

1. Engineering Geology - Praveen Singh (Khanna Publishers, New Delhi)
2. Environmental Engineering - K.S. Valdiya (Vikas Publications Co. Ltd., New Delhi)

MCE-259 RURAL ENVIRONMENTAL TECHNOLOGY 4 Credits (3-1-0)

UNIT I **9**

General: Concept of environment and scope of sanitation in rural areas. Magnitude of problems of rural water supply and sanitation, Population to be covered, difficulties, National policy, Water Supply Design population and demand loads. Various approaches of planning of water supply schemes in rural areas. Development of preferred sources of water springs

UNIT II **9**

Wells, infiltration wells, radial wells and infiltration galleries, collection of raw water from surface source. Specific problems in rural water supply and treatment, Improved methods and compact systems of treatment of surface and ground waters for rural water supply such as multi bottom settlers (MBS), diatomaceous earth filter, cloth filter, slow sand filter, chlorine diffusion cartridges

UNIT III **9**

Pumps, pipe materials, appurtenances and improved devices for use in rural water. Planning of distribution system in rural areas, Treatment and Disposal of waste water, Various methods of collection and disposal of night soil. Community and sanitary latrines

UNIT IV **9**

Compact and simple waste-water treatment units and systems in rural areas such as stabilization ponds, septic tanks, imhoff tank, soak pit etc. Disposal of waste water-soakage pits and trenches, Disposal of solid wastes composting, land filling, incineration. Biogas plants

Book & References:

1. Water Supply Engineering - S.K. Garg (Khanna Pub. Pvt. Ltd.)
2. Water Supply Engineering - B.C. Punamia and A.K. Jain (Laxmi Publications)

MCE-261 GROUND WATER MANAGEMENT 4 Credits (3-1-0)

UNIT I **9**

Introduction, Occurrence of ground water, Hydrological Cycle

UNIT II **9**

Ground water movement, Well Hydraulics and Water Wells

UNIT III **9**

Ground Water Modeling Techniques, Surface and Subsurface Investigations of Ground Water

UNIT IV **9**

Artificial discharge and Recharge of Ground Water, Ground Water management Techniques

Book & References:

1. Ground Water Assessment. Development and Management - K. R. Karanth (Tata McGraw Hill, New Delhi)
2. Water Resource System Planning and Management- M.C. Chaturvedi (Tata McGraw Hill, New Delhi)

MCE-262 BUILDING ENVIRONMENTAL AND SERVICES 4 Credits (3-1-0)

UNIT I **9**

Acoustics material properties, reverberation, acoustical design of assembly hall building, noise and its control. Ventilation, health and comfort ventilation, ventilation systems, natural and artificial ventilation for tropic regions

UNIT II **9**

Electrical wiring systems in domestic and commercial buildings, conductors, cables and conduits. Communications, intercommunication systems, sound amplification equipments. Fire protection and equipments, code provisions from NBC. Illumination, artificial lighting, day lighting, laws and principles of illumination. Design of lighting systems, flood lighting, relevant IS Codes.

UNIT III **9**

Elevators, escalators and conveyors. Thermal environment inside a building and its control, factors affecting inside conditions, heat transfer through building fabric, steady state and periodic heat transfer, thermal properties of building materials and insulation materials for building. Thermal responding of building cooling and heating loads. Air – conditioning systems, types, design, installation and maintenance costs. Energy conservation in buildings.

UNIT IV **9**

Water supply to building, systems of water supply, appurtenances, and difficulties encountered in water supply to high rise building systems suggested hot water and fire water systems. Drainage of buildings, systems of drainage from buildings, appurtenances, choice of systems, solid waste disposal from buildings

MCE-267 HAZARDOUS WASTE MANAGEMENT 4 Credits (3-1-0)

UNIT I **9**

Hazardous Waste, Regulatory Process, Process Fundamentals, fate and Transport of Contaminants, Toxicology.

UNIT II **9**

Environmental Audits, Pollution Prevention, facility Development and Operations

UNIT III **9**

Physico – Chemical Treatment Process, Biological Treatment Methods, Stabilization and Solidification, Thermal Treatment Methods

UNIT IV **9**

Land Disposal, Quantitative Risk Assessment

Book & References:

1. Hazardous Waste Management- Lagrega, Buckingham & Evans (McGraw Hill, N.Y.)
2. Hazardous Material and Waste Management- Cheremisinoff & Cheremisinoff (Elsevier)
3. Toxic & Hazardous Waste - La Grega & Hendrian (Butterworth Publications)

MCE-268 INDUSTRIAL WASTEWATER TREATMENT 4 Credits (3-1-0)

UNIT I **9**

Scenario of Industrial Pollution, Capabilities and Constraints of Industries for Pollution Control, Impact of Pollution Control on Project Coast.

UNIT II **9**

Typical Industrial Wastes Characteristics and Treatment Planning of Sugar Industry, Distillery, Tannery, Electroplating Industry, Petroleum Industry, Pesticide and Fertilizer Industry, Pharmaceutical Industry, Textile Industry, Pulp and Paper Industry.

UNIT III **9**

Chlor-Alkali Industry, Soap and Detergent Industry, Atomic Power Plants, dairy, Steel, Thermal Power Plants.

UNIT IV **9**

General Standards for Disposal of Effluents, Concept of Common Effluent Treatment Plant

Book & References:

1. Industrial Pollution and Control - G.N. Pandey (Vikas Pub. Pvt. Ltd., New Delhi)
2. Industrial Pollution and Control - K.N. Rao (CRC Press, Hyderabad)

CIVIL ENGINEERING DEPARTMENT
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Programme Core for M. Tech. (Structural Engineering)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-301	Advanced Structural Analysis	-	3	1	2	5
2.	MCE-302	Concrete Structures	-	3	1	2	5
3.	MCE-303	Prestressed Concrete	-	3	1	0	4
4.	MCE-304	Analysis and Design of Dynamic Effects	-	3	1	2	5
5.	MCE-305	Metal Structures	-	3	1	0	4
6.	MCE-320	Minor Project	-	0	0	8	4
7.	MCE-330	Dissertation Part-I	-	0	0	8	4
8.	MCE-340	Seminar	-	0	0	4	2
9.	MCE-350	Dissertation Part-II	Dissertation Part-I	0	0	28	14

Programme Electives (PEI)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-351	Maintenance and Rehabilitation of Structures	-	3	1	0	4
2.	MCE-352	Pre-cast and Composite Structures	-	3	1	0	4
3.	MCE-353	Rock Engineering	-	3	1	0	4
4.	MCE-354	Continuum Mechanics	-	3	1	0	4

Programme Electives (PE2)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-356	Retrofitting of Buildings	-	3	1	0	4
2.	MCE-357	Hydraulic Structures	-	3	1	0	4
3.	MCE-358	Machine Foundations	-	3	1	0	4
4.	MCE-359	Finite Element Method	-	3	1	0	4

Programme Electives (PE3)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-361	Nonlinear Analysis of Structures	-	3	1	0	4
2.	MCE-362	Earth & Rock fill Dam	-	3	1	0	4
3.	MCE-363	Project Planning and Control	-	3	1	0	4
4.	MCE-364	Soil Structure interaction	-	3	1	0	4

Programme Electives (PE4)

S. N.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-366	Design of Plates and Shells	-	3	1	0	4
2.	MCE-367	Industrial Structures	-	3	1	0	4
3.	MCE-368	Bridge Engineering	-	3	1	0	4
4.	MCE-369	Ground Improvement Techniques	-	3	1	0	4

SYLLABI

MCE-301 ADVANCED STRUCTURAL ANALYSIS 5 Credits (3-1-2)

UNIT I **9**

Static and kinematic indeterminacies stiffness and flexibility matrices, force & displacement methods

UNIT II **9**

Stiffness matrices for prismatic and non- prismatic members, solution techniques, substructure analysis techniques, application to plane and space frame analysis.

UNIT III **9**

Organization of computation, programming considerations, applications to practical problems

UNIT IV **9**

Techniques of non-linear structural analysis, material and geometrically non- linear problems, incremental and iterative procedures, convergence criteria

EXPERIMENTS

1. Modeling of a Pin jointed Plane Frame Via STAAD Pro
2. Modeling of a Rigid Jointed Plane Frame through STAAD Pro
3. Modeling of a Bridge by STAAD Pro
4. Modeling of a Multi Story Building for Earthquake Load

Books & References:

1. Matrix Method of Structural Analysis - Madhu B. Kanln (Willey Eastern Limited, New Delhi)
2. Matrix Structural Analysis-William Mc Guire Richard, H. Gallghare, Ronald D. Ziemian (Willey International)

MCE-302 CONCRETE STRUCTURES 5 Credits (3-1-2)

UNIT I **9**

Limit state design philosophy

UNIT II **9**

Redistribution of moments in continuous span beams, plastic hinge concept, and rotation capacity of sections and detailing for ductility, Beam column joints

UNIT III **9**

Yield line theory for slabs, equilibrium and virtual work methods.

UNIT IV **9**

Shrinkage and creep, Building frames, box frames

EXPERIMENTS

1. High performance Concrete Mix design.
2. Design and testing of R.C.C. beam for Two Points loading.
3. Design & Testing of a one way slab.
4. Design & Testing of a two slab.

Books & References:

1. Limit State Method of Design - Dr. B.C. Purnia, Ashok Kumar Jain and Arun Jain (Lakshmi Publication)
2. IS 456:2000

MCE-303 PRESTRESSED CONCRETE 4 Credits (3-1-0)

UNIT I **9**

General principles of prestressing- Materials for prestressing, Prestressing systems

UNIT II **9**

Losses of prestress, Load balancing concept

UNIT III **9**

Partial prestressing, Circular prestressing, Prestressed Concrete Beams, End Blocks

UNIT IV **9**

Prestressed concrete pipes and poles

Books & References:

1. Prestressed Concrete - N. Rajgopalan (Narosa)
2. NBC: 2005.

MCE-304 ANALYSIS AND DESIGN OF DYNAMIC EFFECTS 5 Credits (3-1-2)

UNIT I **9**

Single degree freedom systems, damping, impact, earthquake and blast loads

UNIT II **9**

Duhamel integral, Rayleigh method, Green's function, elastic response spectra, Fourier series, Fast Fourier Transform, complex frequency response function, response of SDF system in frequency domain, time history analysis of SDF system

UNIT III **9**

New mark method and Wilson theta method for linear problems, convergence criteria. Multi degree of freedom systems, application to multistory buildings, SRSS and CQC mode superposition techniques

UNIT IV **9**

Introduction to computer program(s) on dynamics, vibration of continuous systems including axial effects, lumped and consistent mass matrix, introduction to inelastic response spectra, design specifications in IS:875(Pt.3)

EXPERIMENTS

1. Earthquake resistant detailing of Non-Engineered Buildings
2. Earthquake resistant detailing of Brick Masonry Buildings
3. Earthquake resistant detailing of R.C.C. Buildings
4. Modelling, Design & Detailing of a moment resisting frame

Books & References:

1. Structural Dynamics - Mario Paz (CBS Publishers)
2. Earthquake Resistant Design of Structure - Pankaj Agrawal, Manish Snikhande (PHI Pvt Ltd.)

MCE-305 METAL STRUCTURES 4 Credits (3-1-0)

UNIT I **9**

Limit State Design Philosophy- Overview of IS 800- 2007 Codal provisions for Welded and Bolted Connections, Slip resistant connections. Defects in welds

UNIT II **9**

Beam Column joints- Eccentric Connections, Seat connections, Flexible connections, Splices in Beams and columns.

UNIT III **9**

Light gauge structures

UNIT IV **9**

Tubular structures

Books & References:

1. IS:800 2007
2. Limit State Design of Steel Structure - Dr. S.K. Duggal (TMH)

MCE-351 MAINTENANACE AND REHABILITATION OF STRUCTURES **4 Credits (3-1-0)**

UNIT I **9**

Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration

UNIT II **9**

Quality assurance for concrete construction concrete properties- strength, permeability, thermal properties and cracking - Effects due to climate, temperature, chemicals, corrosion - design and construction errors - Effects of cover thickness and cracking

UNIT III **9**

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, Sulphur infiltrated concrete, ferro cement and polymers coating for rebars loadings from concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels and cathodic protection

UNIT IV **9**

Repair of structures distressed due to earthquake – Strengthening using FRP -Strengthening and stabilization techniques for repair, Engineered demolition techniques for structures - case studies

Books & References:

1. Concrete Structures, Materials, Maintenance and Repair- Denison Campbell, Allen and Harold Roper, (Longman Scientific and Technical, UK), 1991
2. Repair of Concrete Structures -Allen R.T and Edwards S.C. (Blakie and Sons, UK), 1987
3. Learning from Failures, Deficiencies in Design, Construction and Service- Raikar, R.N., RandD Centre (SDCPL), Raikar Bhavan, Bombay, 1987.
4. Concrete Technology - Santhakumar A.R.(Oxford University Press), 2007, Printed in India by Radha Press, New Delhi
5. Concrete Repair and Maintenance Illustrated -Peter H. Emmons (Galgotia Publications Pvt. Ltd.), 2001
6. Maintenance and Durability of Concrete Structures - Dayaratnam. P and Rao. R (University Press), 1997.

MCE-352 PRECAST AND COMPOSITE STRUCTURES **4 Credits (3-1-0)**

UUNIT I **9**

Precast and cast in situ concrete structures

UNIT II **9**

Prestressed and cast in situ concrete structures, Steel and concrete Composite structures

UNIT III **9**

Encased beams and columns

UNIT IV **9**

Applications to bridge decks, girders and precast building systems Pre-Engineered Buildings

Books & References:

1. Advances in Building Materials & Construction, CBRI Roorkee
2. Precast Concrete Structures - Habber Benchmann & Altreid Stainle (Wille VCH)

MCE-353 ROCK ENGINEERING 4 Credits (3-1-0)

UNIT I **9**

Introduction, Geological considerations, Index properties and rock mass classifications

UNIT II **9**

Strength and failure criteria for rocks and rock masses, Insitu stresses in rocks and their measurement. Strength and deformation behaviour of discontinuities in rocks

UNIT III **9**

Deformation behaviour of rocks and rock masses, Time dependent behaviour of rocks

UNIT IV **9**

Application of Rock mechanics to Underground Structures, Slopes and Foundations, Improving the properties of insitu rock masses

MCE-354 CONTINUUM MECHANICS 4 Credits (3-1-0)

UNIT I **9**

Vectors and tensors, analysis for stresses, principal stresses and principal planes, stress invariants, equations of equilibrium, octahedral stresses, Analysis of strains, principal strains, octahedral strains, large deformations and finite strains

UNIT II **9**

Elgerian, Lagrangian and Almansi, Green's and Cauchy's strain tensors Compatibility equations, elastic stress strain equations, generalized Hookean Law, principle of virtual work, nonlinear constitutive laws, hypo and hyper elastic solids, linearised theory of elasticity, two dimensional plane stress, plane strain and axi-symmetric formulations

UNIT III **9**

Cartesian and polar coordinate systems, three dimensional elasticity formulation for isotropic and anistropic solids, boundary Value problems Torsion and bending theory Material yield criteria- Von Mises, Tresca, Mohr-Coulomb, Drucker-Prager etc.

UNIT IV **9**

Isotropic and kinematic hardening, normality principle, plastic flow rule, Plastic Potential, Elasto-plastic Stress strain relations- Prandtl- Rauss equations, Levy-Meses Relations, Hardening Modulus, Generalised elasto-plastic stress-strain relations

Books & References:

1. Continuum Mechanics for Engineers - G. Thoma Mase (CRC Press)
2. Tensor & Tensor Algebra for Engineers - Mikhail Ibkov (Springer Publication)

MCE-356 RETROFITTING OF BUILDINGS 4 Credits (3-1-0)

UNIT I **9**

Seismic Hazard Evaluation, Methodologies for seismic evaluation, Components of seismic evaluation Methodology, seismic evaluation of RC Columns, Beams, Joints and Slabs, Non destructive evaluation techniques, Principles of Repair and Retrofitting.

UNIT II **9**

Terminology in Repair, Restoration, Strengthening and Rehabilitations, Criteria for Repair

UNIT III **9**

Restoration and Retrofitting; Repair Materials; In-situ testing methods for RC and masonry structure; Techniques of repair and retrofitting of masonry buildings

UNIT IV **9**

Techniques of Repair and Retrofitting in RC buildings; Retrofitting of buildings by seismic base isolation and supplemental damping; Retrofitting of heritage structures; Retrofitting of bridges; Case studies in retrofitting

Books & References:

1. Retrofitting Design for Building Structures-Xin Lin Lu (CRC Press)
2. Earthquake Resistant Design of Structures- Pankaj Agrawal, Mainsh Shikhande (PHI Pvt Ltd.)

MCE-357 HYDRAULIC STRUCTURES 4 Credits (3-1-0)

UNIT I **9**

Types of Head works: Component parts of a diversion headwork, Failure of hydraulic structures founded on permeable foundations, Principles of design, Bligh's Theory, Khosla's theory for determination of pressure and exit gradient.

Regulation Works: Falls, Classification, Introduction to design principle of falls, Design of Sarda type and straight glacis tall.

Principle and design of Distributory head regulatior and cross regulator.

UNIT II **9**

Canal head works: Functions, Location, Layout of head works. Weir and Barrage, Canal head Regulator, Introduction to the design principles of Weirs on permeable foundations, Design of vertical drop and sloping glacis weir.

Cross drainage works: Necessity and types. Aqueduct, Siphon Aqueduct, super passage, canal siphon, level crossing, Introduction to design principles of cross drainage works

UNIT III **9**

Dams: classification and selection criteria.

Earth Dams: Classification, causes of failure Phreatic line, and its determination

Introduction to stability analysis

Gravity dams: Forces method of analysis, modes of failure and factor of safety, Elementary profile, stability analysis, galleries, joints, control of cracks.

UNIT IV **9**

Spillways: Spillway capacity, types of spillways, Design of ogee spillway, Energy dissipation below spillway, Design criteria for Hydraulic Jump type stilling basins with horizontal and sloping aprons, spillway gates.

Hydro-Electric Power: assessment of potential specially in reference to India, classification of power plants, important terms, types of turbines and their suitability. Power House layout and important structures of a powerhouse

Books & References:

1. Irrigation, Water Resources and Hydraulic Structures -S.K. Garg (Khanna Publication, New Delhi)
2. Water Resources and Irrigation Engineering - G.H. Asawal (New Age International Pvt. Ltd., New Delhi)

MCE-358 MACHINE FOUNDATIONS 4 Credits (3-1-0)

UNIT I **9**

Dynamic Properties of soils, various types of machine foundations, factors affecting the resonant frequency and amplitudes of vibrations

UNIT II **9**

Foundations under reciprocating machine; behaviour and design of block foundations, framed foundations, advantage for high speed machines, design principles

UNIT III **9**

Vibration Isolation, IS Code of Practice, critical review

UNIT IV **9**

Structural design; general principles of design, construction aspects, case histories of failures o machine foundations

Books & References:

1. Handbook of Machine Foundation - Srinivaslu & Vandyanathan (McGraw Hill)
2. Theory of Vibrations - Shabana A. (Springer)
3. Vibration of Soil & Foundation - Hall & Wood (Prentice Hall)
4. Foundation of Machines: Analysis & Design - Shamsher Prakash (John Wiley, N.Y.)

MCE-359 FINITE ELEMENT METHOD 4 Credits (3-1-0)

UNIT I **9**

Introduction to Finite: Element Model-concept of nodes and elements, Formulation of stiffness and transformation matrices, Implementation details

UNIT II **9**

Basic equations of elasticity Finite element formulations, Isoparametric elements, Formulation of mass and damping matrices, Dynamic equilibrium equation and methods of solution for seismic loading

UNIT III **9**

Accuracy and mesh-locking aspects in plane strain and plane stress analysis

UNIT IV **9**

Brief introduction to Fourier analysis of folded plates, geometric and material non-linearity; Node numbering; Plate and shell elements, soil structure interaction; Modelling of unbounded media and singularities;

Books & References:

1. Finite Element Procedure - K.O. Bathe (Prentice Hall)
2. Finite Element Method: Its Basics & Fundamentals - O.C. Zienkiewicz & R.l. (Taylor Pus: Elsevier BH)

MCE-361 NONLINEAR ANALYSIS OF STRUCTURES 4 Credits (3-1-0)

UNIT I **9**

Introduction to nonlinear mechanics; statically determinate and statically indeterminate flexible bars of uniform and variable thickness

Inelastic analysis of uniform and variable thickness members subjected to small deformations; inelastic analysis of flexible bars of uniform and variable stiffness members with and without axial restraints

UNIT II **9**

Vibration theory and analysis of flexible members; hysteretic models and analysis of uniform and variable stiffness members under cyclic loading

UNIT III **9**

Elastic and inelastic analysis of uniform and variable thickness plates

UNIT IV **9**

Nonlinear vibration and Instabilities of elastically supported beams

Books & References:

1. Non Linear Mechanics- Delmetor E. Firtis (CRC, Press)
2. Non Linear Modelling & Analysis of Solids & Structures - Stein Krak (CRC Press)

MCE-362 EARTH & ROCK FILL DAM 4 Credits (3-1-0)

UNIT I **9**

Performance of earth and rockfill dams during past earthquakes, Homogenous and non-homogenous dams, zoned dams, Dams with upstream impervious linings, composite dams, seepage in earth and rockfill dams, flow net, piping and liquefaction

UNIT II **9**

Stability analysis, effective and total stress methods, analysis by Fellinius, Moregenstern-Price, Carter, Spencer and Bishop methods

UNIT III **9**

Pseudo-static analysis, Shear beam analysis using Bellel's function. Design criteria for Earth Dams.

UNIT IV **9**

Selecting a suitable Preliminary Section for an Earth Dam, Stability of the foundation against shear, Seepage control in earth dams, Seepage control through foundations

Books & References:

1. Irrigation and Water Resources Engineering - B.C. Punamia & Pande B.B. Lal (Luxmi Publications)
2. Water Resources and Hydraulic Structures - S.K. Garg (Khanna Publications)

MCE-363 PROJECT PLANNING AND CONTROL 4 Credits (3-1-0)

UNIT I **9**

Work-study, work breakdown structure, Time estimates, Applications of CPM/PERT, statistical concepts, Man-Material-Machinery money optimization, scheduling, monitoring, updating.

UNIT II **9**

Cost functions, time-cost trade off, resource planning-leveling and allocation.

UNIT III **9**

Resources - based networks, crashing, master networks, interface activities and dependencies, line of balancing techniques, application of digital computers.

UNIT IV **9**

Material management- purchases management and inventory control, ABC analysis. Human Resource management

Books & References:

1. PERT & CPM - B.C. Punamia (Luxmi Publications)
2. Construction Planning & Management - P.K. Bhatnagar

MCE-364 SOIL STRUCTURE INTERACTION 4 Credits (3-1-0)

UNIT I **9**

Definition of soil- foundation interaction, soil- foundation-structure interaction, soil-fluid-structure interaction, idealization of soil by linear and non-linear Winkler model, elastic continuum model (isotropic and anistropic), two parameter elastic models-heteny model, pastemak model, reissner model, soil-parameters; Interpretation of parameters elastic and elastic-continuum models, experimental investigations, finite beams on elastic foundation: finite beams on Winkler model

UNIT II **9**

Finite beams on two parameter elastic medium, finite beams on two parameter elastic medium, finite beams on homogeneous, isotsropic elastic continuum, finite difference solution to problems of beams on linear and non-linear Winkler models

UNIT III **9**

plates on elastic foundation: rectangular and continuous plates on elastic foundation, plates carrying rows of equidistant columns, rectangular and circular plates on Winkler medium, two parameter elastic medium and no elastic continuum, finite difference solution of problems of rectangular plates on linear and non-linear elastic foundation, soil-structure interaction in framed structures: structures with isolated foundations- spring analog

approach, determination of spring parameters, structures with continuous beams and rafts as foundation-finite element modeling, sub-structure technique of analysis.

UNIT IV **9**

Concept of relative stiffness, interactive behaviour of some framed structures, soil-pile interaction: laterally loaded single piles-concept of coefficient of horizontal subgrade reaction, finite difference and finite element solutions, soil-structure interaction of framed structures with pile foundations, interaction of other structures with soil-foundation system: tanks with annular ring foundation, chimneys, silos, cooling towers, underground subways and tunnels, introduction to dynamic soil-structure interaction, as well as non-linear soil/concrete behavior.

MCE-366 DESIGN OF PLATES AND SHELLS 4 Credits (3-1-0)

UNIT I **9**

Classification of plates, governing equations, boundary conditions, analysis of rectangular and circular plates, buckling of plates, design criteria and code specifications.

UNIT II **9**

Classification of shells, membrane theory for shells of revolution with axi-symmetric and non-symmetric loading, bending analysis of shells of revolution for axi-symmetric loadings

UNIT III **9**

Membrane and bending theories of cylindrical shells, theory of edge beams, doubly curved shells, membrane theory and design of hyperbolic shells, buckling of shells, design applications

UNIT IV **9**

Analysis and design of folded plates, codal specifications, practical considerations, computer applications

Books & References:

1. Design & Construction of Concrete shell Roof - G.S. Ramaswammy (CBS. Publisher)
2. Reinforced Concrete Structures - B.C. Purnmia, Volume-II (Lakshmi Publications)

MCE-367 INDUSTRIAL STRUCTURES 4 Credits (3-1-0)

UNIT I **9**

Planning of industrial structures

UNIT II **9**

Design of single and multibay industrial structures in steel and concrete, Bunkers and silos

UNIT III **9**

Pressure vessels and chimneys, Cooling towers

UNIT IV **9**

Large span roof structures, Suspension roof structures. Structural aspects of machine foundations

Books & References:

1. IS: 800 2007
2. Limit State Design of Steel Structures - S. K. Duggal (TMH)
3. Reinforced Concrete Structure, Volume II - B.C. Purnima (Lakshmi Publications)

MCE-368 BRIDGE ENGINEERING 4 Credits (3-1-0)

UNIT I **9**

General Considerations- Types of Bridges, Economic Spans

UNIT II **9**

Suitability of different types of Bridges, Design loads for highway and Railway Bridges.

UNIT III **9**

Solid slab bridge, Slab and beam bridge

UNIT IV **9**

Lattice girder Bridge Plate girder bridge

Bridge substructure and bearings

Note: Detailed design shall be worked out for at least one concrete bridge and one steel bridge

Books & References:

1. Introduction to Bridge Engineering-Victor Jophn Streeter
2. Bridge Engineering - Ponnwwami.

MCE-369 GROUND IMPROVEMENT TECHNIQUES 4 Credits (3-1-0)

UNIT I **9**

Introduction, Review of compaction theory, effect of compaction on surface behaviour, Field methods of compaction, Quality Control, Design of soil-lime, soil-cement, soil-bitumen and soil-lime-flyash mixes.

UNIT II **9**

In-situ densification methods in granular soils, Deep compaction: Introduction, Terra-Probe, Vibroflotation techniques, Ground Suitability for Vibroflotation, Advantages, Mueller Resonance Compaction, Dynamic Compaction, Depth of Improvement

In-situ densification methods in cohesive soil: Introduction, Pre-loading and de-watering, Vertical drains, Electrical method, Thermal method

UNIT III **9**

Grouting: introduction, suspension grout, solution grout, grouting equipments and methods, Grouting design and layout

UNIT IV **9**

Geotextiles: types, functions, specifications, precautions in transportation and storage.

Fiber- Reinforcement, Advantage, Applications

Books & References:

1. Ground Improvement Techniques – Raj. P (Farewall Media)
2. Ground Improvement Technique – Patre (Vikas Publisher)
3. Geosynthetic World - Mandel J. N. (Wiley Eastern)

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Programme Core for M. Tech. (Earthquake Engineering and Seismic Design)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-301	Advanced Structural Analysis	-	3	1	2	5
2.	MCE-401	Seismology & Tectonics	-	3	1	0	4
3.	MCE-402	Geotechnical Earthquake Engineering	-	3	1	2	5
4.	MCE-403	Structural Dynamics	-	3	1	0	4
5.	MCE-404	Earthquake Resistant Design of structures	-	3	1	0	4
6.	MCE-420	Minor Project	-	0	0	8	4
7.	MCE-430	Dissertation Part-I	-	0	0	8	4
8.	MCE-440	Seminar	-	0	0	4	2
9.	MCE-450	Dissertation Part-II	Dissertation Part-I	0	0	28	16

Programme Electives (PEI)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-351	Maintenance and Rehabilitation of Structures	-	3	1	0	4
2.	MCE-352	Pre-cast and Composite Structures	-	3	1	0	4
3.	MCE-353	Rock Engineering	-	3	1	0	4
4.	MCE-354	Continuum Mechanics	-	3	1	0	4

Programme Electives (PE2)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-356	Retrofitting of Buildings	-	3	1	0	4
2.	MCE-357	Hydraulic Structures	-	3	1	0	4
3.	MCE-358	Machine Foundations	-	3	1	0	4
4.	MCE-359	Finite Element Method	-	3	1	0	4

Programme Electives (PE3)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-361	Nonlinear Analysis of Structures	-	3	1	0	4
2.	MCE-363	Project Planning and Control	-	3	1	0	4
3.	MCE-364	Soil Structure Interaction	-	3	1	0	4
4.	MCE-461	Random Vibrations	-	3	1	0	4

Programme Electives (PE4)

S. N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MCE-366	Design of Plates and Shells	-	3	1	0	4
2.	MCE-367	Industrial Structures	-	3	1	0	4
3.	MCE-368	Bridge Engineering	-	3	1	0	4
4.	MCE-369	Ground Improvement Techniques	-	3	1	0	4

SYLLABI

MCE-401 SEISMOLOGY & TECTONICS 4 Credits (3-1-0)

UNIT I **9**

Propagation of elastic waves, body and surface waves, Seismic Method for subsurface exploration, internal structure of the earth, Seismicity of the earth, important Indian earthquakes, plate tectonics, causes of earthquakes.

UNIT II **9**

Magnitude, energy, intensity, acceleration, return period and frequency of earthquakes. Earthquake recording instruments, Seismographs

UNIT III **9**

Interpretation of earthquake data, determination of magnitude, epicenter, epicentral distance, focal depth, Seismic hazard and risk, seismic zoning map of India; Introduction to earthquake prediction

UNIT IV **9**

Plate tectonics, plate boundaries, ridges, trenches and rifts, Gravity and magnetic field of Earth and its tectonic implications. Faults, major, minor, active, dormant. Fault movement, slip, creep. Fault models rupture, source zones, Seismotectonic units, Current seismic activity.

MCE-402 GEOTECHNICAL EARTHQUAKE ENGINEERING 5 Credits (3-1-2)

UNIT I **9**

Introduction, Seismology and earthquakes, ground motion

UNIT II **9**

Seismic Hazard Analysis Wave Propagation, Dynamic soil properties.

UNIT III **9**

Liquefaction Dynamic Earth pressure Seismic design, Seismic slope stability

UNIT IV **9**

Remediation of Seismic Hazards

EXPERIMENTS

1. Wave propagation Test
2. Refraction survey method
3. Spectral Analysis of surface waves
4. Block Vibration Test
5. Cyclic Plate Lode Test
6. Liquefaction potential evaluation using SPT
7. Liquefaction potential evaluation using CPT
8. Electric Resistivity Test
9. Cyclic Trioxide Test
10. Cross Hole Seismic survey techniques.

Books & References:

1. Geotechnical Earthquake Engineering -Towhate, I. (Springer)
2. Geotechnical Earthquake Engineering - Kramer, S.L. (Prentice Hall)
3. Basic Geographic Earthquake Engineering - Kamleshwar, K. (New Age International)
4. Earthquake Geotechnical Engineering - Mangen & Soccdate (CRC Press)

MCE-403 STRUCTURAL DYNAMICS 4 Credits (3-1-0)

UNIT I **9**

Sources of vibration, Digress of freedom, Single degree of freedom systems: Free vibrations of undamped and viscously damped systems.

UNIT II **9**

Response to harmonic excitations; Vibration Isolation, Force transmissibility and base motion, Response of an undamped SDOF to short duration impulse; Duhamel Integral method, Response spectra, Frequency domain analysis

UNIT III **9**

Multiple degree of Freedom Systems, Response to harmonic excitation, mode superposition method Lagranges' equations, Eigen value problems; iteration methods

UNIT IV **9**

Vibrations of Continuous Systems, Earthquake response of systems

Books & references:

1. Structural Dynamics - Mario Paz (CBS Publisher)
2. Earthquake Resistance Design of Structures - Pankaj Agrawal, Manish Shrikhande (PHI)

MCE-404 EARTHQUAKE RESISTANT DESIGN OF STRUCTURES 4 Credits (3-1-0)

UNIT I **9**

Idealization of structures, Response spectrum analysis, Equivalent lateral force concepts, Torsionally coupled systems, Orthogonal effects, Nonlinear Pushover and Time history analyses, Effects of soil- structure interaction.

UNIT II **9**

Philosophy of earthquake Characteristics of earthquakes, Design response spectrum, Site effects, Earthquake response of structures resistant design, Ductility

UNIT III **9**

Redundancy & Overstrength, Damping, Supplemental Damping, Base Isolation, Codal Provisions, Seismic behaviour of concrete, steel and masonry structures

UNIT IV **9**

Material properties and analysis of members under cyclic loads, Detailing provisions

Books & references:

1. Structural Dynamics - Mario Paz (CBS Publisher)
2. Earthquake Resistance Design of Structures - Pankaj Agrawal, Manish Shrikhande (PHI, Pvt. Ltd.)

MCE-461 RANDOM VIBRATIONS 4 Credits (3-1-0)

UNIT I **9**

Basic Theory of probability, events, random variables, discrete and continuous distribution, expectations, characteristic functions, orthogonality principles, sequence of random variables

UNIT II **9**

Stochastic process, Markov chain, Gaussian process, filtered point process, Markov process and non-stationary Gaussian process.

UNIT III **9**

Correlation and power spectrum, Threshold crossing, Random vibration of systems

UNITIV **9**

Single degree and multi-degree of freedom system, continuous system and nonlinear system-equivalent linearization and Gaussian closure technique

COMPUTER SCIENCE & ENGINEERING DEPARTMENT
M. M. M. UNIVERSITY OF TECHNOLOGY
GORAKHPUR

COURSES OFFERED

Program Core for M.Tech. (Computer Science & Engineering)

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MAS-113	Probabilistic Modelling	-	3	1	2	5
2.	MCS-101	Advanced Computer Networks	-	3	1	0	4
3.	MCS-102	Advanced Database Theory and Applications	-	3	1	2	5
4.	MCS-103	High - Performance Computer Architectures	-	3	1	0	4
5.	MCS-104	Advance Concepts in Operating Systems	-	3	1	2	5
6.	MCS-105	System Simulation & Modelling	-	3	1	0	4
7.	MCS-120	Minor Project	-	0	0	8	4
8.	MCS-130	Dissertation Part-I	-	0	0	8	4
9.	MCS-140	Seminar	-	0	0	4	2
10.	MCS-150	Dissertation Part-II	Dissertation Part-I	0	0	28	14

Programme Electives for M. Tech (Computer Science & Engineering)

S.N.	Paper Code	Subject Name	Prerequisite Subject	L	T	P	Credit
		PE1 & PE2 (II Semester)					
1.	MCS-151	Foundation of Programming Languages	-	3	1	0	4
2.	MCS-152	Functional Programming	-	3	1	0	4
3.	MCS-153	Formal Aspects of Programming Languages and Methodology	-	3	1	0	4
4.	MCS-154	Advanced Topics in Programming Languages	-	3	1	0	4
5.	MCS-155	Advanced Digital Image Processing	-	3	1	0	4
6.	MCS-156	Real Time Systems	-	3	1	0	4
7.	MCS-157	Embedded Computing	-	3	1	0	4
8.	MCS-158	Mobile Database Systems	-	3	1	0	4
9.	MCS-159	Advanced Parallel Programming	-	3	1	0	4
10.	MCS-160	Cloud Computing	-	3	1	0	4
		PE3 & PE4 (III Semester)					
11.	MCS-161	Advanced Web Technology/ Advanced Internet Programming	-	3	1	0	4
12.	MCS-162	Network Programming	-	3	1	0	4
13.	MCS-163	Natural Language Interface	-	3	1	0	4
14.	MCS-164	LINUX Networking and Security	-	3	1	0	4
15.	MCS-165	Internetworking Architectures and Protocols	-	3	1	0	4
16.	MCS-166	Current Trends In Computer Graphics & Multimedia Technology	-	3	1	0	4
17.	MCS-167	Computational Neuroscience	-	3	1	0	4
18.	MCS-168	Transaction Processing	-	3	1	0	4
19.	MCS-169	Machine Learning for Big Data	-	3	1	0	4
20.	MCS-170	Advanced Compiler Optimization	-	3	1	0	4

Subjects for other Departments

S.N.	Paper Code	Subject Name	Prerequisite Subject	L	T	P	Credit
1.	MCS-176	Information System & data Management	-	3	1	0	4

SYLLABI

MCS-101 ADVANCED COMPUTER NETWORKS 4 Credits (3-1-0)

Course Objectives:

1. To study the problematic of service integration in TCP/IP networks focusing the protocol design, implementation and performance issues.
2. To debate the current trends and leading research in the computer networking area.
3. To understand the recent advancement in networking.

Learning Outcomes:

1. To gain a thorough understanding of the design of modern computer networks and protocols, including the Internet.
2. To understand the workings of at least one actual TCP/IP Stack and will be able to apply this understanding in modifying it or implementing additional protocols.

UNIT I **9**

Introduction: Overview of computer networks, seven-layer architecture, TCP/IP suite of protocols, Review of Physical and Data link layers, MAC protocols for high-speed LANS, MANs, DQDB, FDDI, HIPPI, Gigabit Ethernet, Wireless Ethernet.

UNIT II **9**

Network Layer: Internet Architecture and addressing, Routing Protocols- OSPF, RIP, BGP, IPv6- basic protocol, extensions and options, support of QoS, security, etc. Mobility in networks, Mobile IP, Multicast routing protocols

UNIT III **9**

Transport Layer: Design Issues, Connection management, Transmission Control Protocol (TCP), User Datagram Protocol (UDP), TCP extensions for high-speed networks, SCTP protocol, Wireless TCP, RTP, RTCP, and Introduction to Socket programming.

UNIT IV **9**

Application Layer: Principles of Network Applications, The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, Domain Name System, P2P File Sharing.

Books & References:

1. Data Communications and Networking - Behrouz A. Forouzan, (Tata McGraw Hill), 4th edition 2007.
2. Data Communications - W. Stallings, , PHI Publication.
3. TCP/IP Illustrated, Volume 1: The Protocols - W.R. Stevens (Addison Wesely), 1994
4. An Engineering Approach to Computer Networking - S. Keshav (Pearson Education)
5. Computer and Communication Networks - Nader F. Mir (Pearson Education), 2007.
6. Computer Networking: A Top-Down Approach Featuring the Internet - James F. Kurose, Keith W. Ross, (Pearson Education), 3rd edition, 2007.
7. The Internet and Its Protocols - A. Farre (Elsevier)

MCS-102 ADVANCED DATABASE THEORY AND APPLICATIONS 5 Credits (3-1-2)

Course Objectives: This course is about major advanced concepts in the field of databases. Being an advanced course, it will involve a considerable amount of research work as embodied by the projects required to complete the course.

Learning Outcomes: Upon successful completion of this course, the student will be able to:

1. know the in depth knowledge of new database architectures
2. grasp the query optimization concepts and detailed theoretical and practical knowledge of how database management systems understand the logical semantics of SQL queries, and how SQL is a implementation of the relational algebra, and how SQL queries may be rewritten and executed in different operational ways whilst preserving their logic semantics.
3. understand how distributed databases are implemented, and how applications can be designed for those distributed databases, scaling up to Big Data sized databases.

UNIT I **9**

Serializability Theory, Two-phase locking, Evaluation of Global Locking Policy, Non-blocking Schedules, Multi-version Locking Methods, Multi-version Time Stamp Ordering Methods, Validation Methods, Multi-version Validation Methods, Query Processing and Optimization for advanced Database System

UNIT II **9**

Design, Development, Implementation, and Administration of Large Database Systems at the Enterprise Level, including Logical Data Models, Data Security and Assurance, Concurrent Processing, Data Distribution, Database Architectures, Replicated Database Approach, Transaction Work Flows

UNIT III **9**

Transaction Management and Concurrency Control- Properties and Types of Transactions, Concurrency Control Algorithms and Commit Procedure, ACID in depth, Weak and Strong Consistency for Distributed Transaction, Predictability and Consistency in Transaction Processing, Transaction Integrity, Transactional Communications

UNIT IV **9**

Multi-database Systems- Problems in Heterogeneous Multi-database Systems, Database Integration Strategies, Multi-database System Architectures, Centralized and Distributed Recovery and Atomicity, Buffer Management, Parallel and Distributed Databases, WEB Database, XML Databases, Commercial Systems, Overview of emerging database applications and challenges

COMPUTER PROGRAMMING LAB

1. Implementation of 2PL, OCC, Multiversioning Concurrency Control Algorithms.
2. Implementation of various Distributed Deadlock Detection and Handling Strategies.
3. Simulation of various CPU scheduling algorithms in database environment.
4. Implementation of various commit protocols

Books & References:

1. Fundamentals of Database Systems -Elmarsi, Navathe, Somayajulu, Gupta, (Pearson Education), 4th edition, 2007
2. Database Systems: The Complete Book - Garcia-Molina H., Ullman J.D. and Widom J. (Pearson Education), 2nd edition, 2009.
3. Strategic Database Technology: Management for the Year 2000 - Simon AR (Morgan Kaufmann), 1995
4. Concurrency Control and Recovery in Database Systems - Bernstein, P. A., V. Hadzilacos, N. Goodman, (Addison-Wesley), 1987.
5. An Introduction to Database Systems - Date C.J. (Addison-Wesley), 8th edition, 2003
6. Transaction Processing: Concepts and Techniques - Gray J. and Reuter A. (Morgan Kaufmann), 1993
7. Various journal and conference articles, research reports, and book excerpts as appropriate.

MCS-103 HIGH-PERFORMANE COMPUTER ARCHITECTURES 4 Credits (3-1-0)

Course Objectives:

1. To understand the fundamental knowledge in architecture design, pipelined processor design, and their impacts on performance

2. To understand the fundamental knowledge in memory hierarchy
3. To assess the communication and the computing possibilities of parallel system architecture

Learning Outcomes: Ability to understand parallelism both in terms of a single processor and multiple processors Technical understanding of parallel hardware constructs

UNIT I **9**

Parallel computer models - Flynn's classification - Parallel and vector computers - System, implicit and explicit parallelism - Multi-vector and SIMD computers - PRAM and VLSI models

UNIT II **9**

Program and network properties - Data and control dependence - Hardware and software parallelism - Partitioning and scheduling - Interconnection architectures

UNIT III **9**

Performance laws - Metrics and measures - Amdahl's law for fixed workload - Bounded speed-up model - Scalability analysis and approaches, Symbolic Processors- CISC and RISC architectures - Super scalar processors and their features - Memory hierarchy

UNIT IV **9**

Linear Pipeline Processors - Basic considerations - Basics of non-linear pipeline processors - Design of pipelined architecture - Recent trends and developments.

Books & References:

1. Advanced Computer Architecture - K. Hwang, Parallelism, Scalability, Programmability (McGraw Hill), New York, 1993
2. Computer Architecture: A Quantitative Approach -D. A. Patterson and J. L. Hennessy, Harcourt Asia (Morgan Kaufmann), 1999

MCS-104 ADVANCE CONCEPTS IN OPERATING SYSTEMS 5 Credits (3-1-2)

Course Objectives:

1. To study the characteristics of OS for Multiprocessor and Multicomputer.
2. To learn the issues related to designing DOS.
3. To have a broad and up-to-date coverage of the principles and practice in the area of Distributed Systems.
4. To understand the heterogeneous systems such as computers, mobile phones, other devices and Internet) and their functionalities.

Learning Outcomes:

1. Knowledge about advanced concepts in OS
2. Developing skill set in developing a distributed system.
3. Designing and evaluation of algorithms and protocols for various distributed systems

UNIT I **9**

Process Synchronization, Synchronization Mechanism, Process Deadlock, Architectural of Distributed system, Theoretical foundations: logical and vector clocks, causal ordering of messages, Chandy lamport global state recording algorithms, cuts of distributed computation, termination detection. Distributed Mutual Exclusion: Classification of distributed mutual exclusion, requirement of mutual exclusion theorem, performance metric for distributed mutual exclusion algorithms

UNIT II **9**

Distributed Deadlock Detection: deadlock handling strategies in distributed systems, Issues in deadlock detection & resolution, control organization for distributed dead lock detection, centralized dead lock detection algorithms, distributed dead lock detection algorithms, hierarchical dead lock detection algorithms.

Agreement Protocols: system model, classification of agreement problem, Solution to Byzantine Agreement problem, Application of Agreement algorithms.

UNIT III **9**

Distributed Resource Management: distributed file system, mechanism for building distributed file systems, design issues, sun network file system, sprite file system, log-structured file system, disk space management,

system, Distributed shared memory: Algorithm for implementing DSM, Memory coherence, coherence protocols and design issues, Distributed Scheduling

UNIT IV **9**

Failure recovery and Fault tolerance: backward and forward error recovery check pointing and recovery, recovery in concurrent systems, consistent set of checkpoints, synchronous check pointing and recovery, and asynchronous check pointing and recover. Fault tolerance: voting protocols, dynamic voting protocols, dynamic vote reassignment protocols.

COMPUTER PROGRAMMING LAB

1. Implementation of Lamport global state recording algorithms.
2. Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
3. Implementation of various Distributed Deadlock Detection and Handling Strategies.
4. Simulation of various CPU scheduling algorithms.
5. Developing Application using Inter Process Communication (using shared memory, or message queues)
6. Implement the Producer Consumer problem using semaphores (using UNIX system calls)
7. To implement Banker's algorithm for a multiple resources.
8. To study of Inter Process Communication (IPC) using Pipes.
9. Implement Memory management schemes like First fit, Best fit and Worst fit.
10. Implementation of Fault tolerant voting protocols.

Books & References:

1. Advanced Concept in Operating Systems-Singhal & Shivaratri (McGraw Hill)
2. Distributed Operating Systems and Algorithm Analysis - Randy Chow & Theodore Johnson (Pearson Education)
3. Distributed System: Concepts and Design - Coulouris, Dollimore, Kindberg (Pearson Education)
4. Distributed Algorithms - Gerald Tel (Cambridge University Press)

MCS-105 SYSTEM SIMULATION & MODELLING 4 Credits (3-1-0)

Course Objectives: The objective of this course is to teach students methods for modeling of systems using discrete event simulation. Emphasis of the course will be on modeling and on the use of simulation software. The students are expected to understand the importance of simulation in IT sector, manufacturing, telecommunication, and service industries etc. By the end of the course students will be able to formulate simulation model for a given problem, implement the model in software and perform simulation analysis of the system.

Learning Outcomes: In order to pass, the student must be able to

- List and define the fundamental concepts of simulation and modelling
- Simulate the given problem

UNIT I **9**

Introduction to Simulation and Modeling: Simulation – introduction, appropriate and not appropriate, advantages and disadvantage, application areas, history of simulation software, an evaluation and selection technique for simulation software, general – purpose simulation packages. System and system environment, components of system, type of systems, model of a system, types of models and steps in simulation study.

Manual Simulation of Systems: Simulation of Queuing Systems such as single channel and multi channel queue, lead time demand, inventory system, reliability problem, time-shared computer model, job-shop model.

UNIT II **9**

Discrete Event Formalisms: Concepts of discrete event simulation, model components, a discrete event system simulation, simulation world views or formalisms, simulation of single channel queue, multi channel queue, inventory system and dump truck problem using event scheduling approach.

Statistical Models in Simulation: Overview of probability and statistics, useful statistical model, discrete distribution, continuous distribution, empirical distribution and Poisson process.

Queuing Models: Characteristics of queuing systems, queuing notations, long run measures of performance of queuing systems, Steady state behavior of Markovian models (M/G/1, M/M/1, M/M/c) overview of finite capacity and finite calling population models, Network of Queues

UNIT III **9**

Random Number Generation: Properties of random numbers, generation of true and pseudo random numbers, techniques for generating random numbers, hypothesis testing, various tests for uniformity (Kolmogorov-Smirnov and chi-Square) and independence (runs, autocorrelation, gap, poker).

Random Variate Generation: Introduction, different techniques to generate random variate:- inverse transform technique, direct transformation technique, convolution method and acceptance rejection techniques.

Input Modeling: Introduction, steps to build a useful model of input data, data collection, identifying the distribution with data, parameter estimation, suggested estimators, goodness of fit tests, selection input model without data, covariance and correlation, multivariate and time series input models.

UNIT IV **9**

Verification and Validation of Simulation Model: Introduction, model building, verification of simulation models, calibration and validation of models: - validation process, face validity, validation of model, validating input-output transformation, t-test, power of test, input output validation using historical data and Turing test.

Output Analysis: Types of simulations with respect to output analysis, stochastic nature of output data, measure of performance and their estimation, output analysis of terminating simulators, output analysis for steady state simulation.

Simulation of Computer Systems and CASE Studies: Simulation Tools – Model Input – High level computer system simulation – CPU –Memory Simulation – Comparison of systems via simulation – Simulation Programming techniques - Development of Simulation models.

Books & References:

1. Discrete Event System Simulation - Jerry Banks and John Carson (PHI), 4th edition, 2005
2. System Simulation-Geoffrey Gordon (PHI), 2nd edition, 2006
3. Discrete Event System Simulation - Banks J., Carson J. S., Nelson B. L. and Nicol D. M., (Pearson Education),3rd edition, 2001
4. System Modeling and Simulation-Frank L. Severance (Wiley), 2001
5. Simulation Modeling and Analysis - Averill M. Law and W. David Kelton (McGraw Hill), 3rd edition, 2006
6. Handbook of Simulation: Principles, Methodology, Advances, Applications and Practice- Jerry Banks (Wiley), 1998
7. Various Journal and conference articles, research reports, and book experts as appropriate

MCS-151 FOUNDATION OF PROGRAMMING LANGUAGES 4 Credits (3-1-0)

Course Objectives: This course will cover a broad spectrum of approaches, including type systems, dataflow analysis, model checking, theorem proving, and dynamic analysis, as well as their combinations. Both the principles underlying these approaches and hands-on experience with using and implementing tools that realize these approaches will be covered. A mix of basic and advanced topics will be covered.

Learning Outcomes: The course is intended for students who would like to:

1. prepare for research in the specializations of programming languages, compilers, and software engineering;
2. pursue research in other specializations of computer science (e.g., information security or systems) that may involve applying program analysis to problems in their domain; and
3. become more productive software engineers in industry.

UNIT I **9**

Formal Description of Programming Languages and Semantics, Operational Semantics vs. Denotation Semantics

UNIT II **9**

Parameter Passing Modes, Functional Programming - Theory, Usage and Implementation Issues

UNIT III **9**

Modelling control: Continuations - Continuation passing interpreters, Logic Programming -- Theory and Usage

UNIT IV **9**

Emerging Language Paradigms: Coordination languages, Concurrent constraint programming, Post object-oriented languages (Aspect-Oriented Programming, Subject-Oriented Programming, Feature-Oriented Programming, Component-Based Programming, etc.)

Books & References:

1. Essentials of Programming Languages - Daniel P. Friedman, Mitchell Wand, and Christopher T. Haynes, (MIT Press), 2nd edition, ISBN 0-262-06217-8, 2001
2. The Formal Semantics of Programming Languages: An Introduction - Glynn Winskel (MIT Press), ISBN 0-262-23169-7.
3. Semantics of Programming Languages: Structures and Techniques - Carl A. Gunter (MIT Press), ISBN 0-262-07143-6.
4. Advanced Topics in Types and Programming Languages - Benjamin C. Pierce (MIT Press), ISBN 0-626-16228-8.
5. Various Journal and conference articles, research reports, and book experts as appropriate.

MCS-152 FUNCTIONAL PROGRAMMING 4 Credits (3-1-0)

Course Objectives: Upon successful completion of the course, students

1. know and understand the fundamental concepts, techniques, and terminology of the functional programming paradigm, including functional abstraction, recursive functions, higher-order functions, lists, and user-defined types,
2. know and understand the basic syntax, semantics, and pragmatics of the polymorphically statically typed, lazily evaluated, purely functional programming language Haskell,
3. can analyze problems and apply functional programming concepts and techniques to develop appropriate Haskell programs to solve the problems,
4. can evaluate alternative Haskell programs to determine which are better according to selected criteria,
5. know and understand the basic features of Haskell monads and input/output,
6. are able to reason about and manipulate Haskell programs mathematically.

Learning Outcomes: In order to pass, the student must be able to

1. list and define the fundamental concepts of functional programming.
2. manually execute a given (simple) functional program.
3. manually infer the type of a given (simple) functional program.
4. implement (simple) algorithms and data structures as functional programs.
5. design (large) functional programs that are modular and have reusable components.
6. explain on a simple problem how functional programming differs from imperative and object-oriented programming.

UNIT I **9**

Introduction to Functional programming: Principles of functional programming: expressions, evaluations, functions. Why SML, Getting started in SML; Expressions ; Constants, Arithmetic Operators, String Operators , Comparison Operators , Combining Logical Values, If-Then-Else Expressions , Environments.

UNIT II **9**

Types and Buit-in Types, Type Inferencing: Types definition, user defined types, type inconsistencies, data types, semantic rules for type inferencing. Case studies on binary tree data types.

UNIT III **9**

Functions: Recursive Functions, Patterns in Function Definitions, Local Environments Using let, Case Study: Linear-Time Reverse, Case Study: Polynomial Multiplication

UNIT IV **9**

Input, Out and Advance Concepts in Functions: Simple Output, Reading Input From a File, Output to Files, Case Study: Summing Integers, Matches and Patterns, Exceptions, Polymorphic Functions, Higher-Order Functions, Curried Functions, Built-In Higher-Order Functions, Case Study: Parsing Expressions

Books & References:

1. ML for the working programmer - L. C. Paulson (Cambridge University Press), 2nd edition, 1996, ISBN 0-521-56543-X.
2. Programming in Standard ML – Robert Harper, Carnegie Mellon University, 2005
3. Elements of ML Programming (ML 97 Ed.) - J. D. Ullman (Prentice Hall), 1998, ISBN 0-13-790387-1.
4. Why Functional Programming Matters, John Hughes
5. FP Tutorial (ps) (pdf)-Benjamin Goldberg, PLDI-94
6. The Semantic Elegance of Applicative Languages - David Turner (Proceedings of the 1981 conference on Functional programming languages and computer architecture), pp. 85-92, 1981.
7. The Standard ML Basis Library, Edited by Emden R. Gansner, John H. Reppy (Cambridge University Press), 2004
8. Various journal and conference articles, research reports, and book excerpts as appropriate

Software:

Standard Meta language Compiler-New Jercy SML-NJ; www.smlnj.org

MCS-153 FORMAL ASPECTS OF PROGRAMMING LANGUAGES AND METHODOLOGY 4 Credits (3-1-0)

UNIT I **9**

Formal Syntax and Semantics: Abstract and concrete syntax; Operational, denotational, axiomatic, algebraic and other formal semantics; Domain theory and fixed-point semantics; Lambda-calculus, type theory and functional languages.

UNIT II **9**

Verification of Programs: Reasoning about programs, specification and correctness, assertions, soundness and completeness. Verification of deterministic flow and structured programs, methods for proving partial and total correctness and their soundness and completeness

UNIT III **9**

Verification of nondeterministic programs- guarded commands, deductive system for partial and total correctness, soundness and completeness, proving fair termination.

Verifying program with procedures - recursive procedures with or without parameters

UNIT IV **9**

Verifying concurrent and distributed programs - shared variable language, CSP language, deductive systems and their soundness and completeness, safety and liveness properties, fair termination etc

Books & References:

1. Verification of Sequential and Concurrent Programs - K.R. Apt and E.R. Olderog (Springer-Verlag, New York), 1991.
2. Semantics of Programming Languages: Structures and Techniques - C.A. Gunter (MIT Press, Cambridge), 1992.
3. Formal Syntax and Semantics of Programming Languages - B. L Kurtz and K. Slonneger (Addison-Wesley), Reading, Mass., 1995.
4. Foundations of Program Verification - J. Loeckx and K. Sieber (John Wiley and Sons, Chichester), 1984.
5. Program Verification - N. Francez (Addison-Wesley), Reading, Mass., 1992
6. Formal Semantics of Programming Languages: An Introduction - G. Winskel, (MIT Press, Cambridge), 1993

MCS-154 ADVANCED TOPICS IN PROGRAMMING LANGUAGES 4 Credits (3-1-0)

Course Objectives: Upon successful completion of the course, students

1. To understand the importance of programming language
2. To study the various Concurrent Programming with Threads, Java Virtual Machine, Inner classes and Reflection.

3. To understand Multi-core Architectures - Software and hardware multithreading – SMT CMP architectures – Design issues.
4. To understand Fundamental concepts–Designing for threads. Threading and parallel programming constructs.
5. To understand Open MP – Threading a loop – Thread overheads – Performance issues.
6. Understand and solutions to parallel programming problems.

Learning Outcomes: In order to pass, the student must be able to

1. Students will be able to give precise definitions of programming-language features using operational semantics and type systems.
2. Students will be able to translate programming-language specifications from mathematical notation to code.
3. Students will be able to prove properties of inductively defined sets (e.g., well-typed programs).
4. Students will be able to effectively make use of the research literature in programming languages.

UNIT I **9**

The Aesthetics of Simplicity, Motivation for Formal Semantics, Java: Design Goals, Java Constructs ; Examples , Values, Variables, and Types, Names : Scope, Access; Packages, Classes : Inheritance, Polymorphism Interfaces; Exceptions . Expressions; Statements; Finalization, Concurrent Programming with Threads, Java Virtual Machine, Inner classes and Reflection; Examples

UNIT II **9**

Parallel computer models – Symmetric and distributed shared memory architectures – Performance Issues. Multi-core Architectures - Software and hardware multithreading – SMT and CMP architectures – Design issues – Case studies – Intel Multi-core architecture – SUN CMP architecture – IBM cell processor

UNIT III **9**

Fundamental concepts – Designing for threads, Threading and parallel programming constructs – Synchronization – Critical sections – Deadlock. Threading APIs

OpenMP – Threading a loop – Thread overheads – Performance issues – Library functions. Solutions to parallel programming problems – Data races, deadlocks and livelocks – Non- blocking algorithms – Memory and cache related issues.

UNIT IV **9**

MPI Model – collective communication – data decomposition – communicators and topologies – point-to-point communication – MPI Library

Books & References:

1. Java 5.0 Tiger: A Developer's Notebook- David Flanagan, Brett McLaughlin, June 2004, ISBN: 0-596-00738-8.
2. Java in a Nutshell - David Flanagan, 5th edition, March 2005, ISBN: 0-596-00773-6.
3. The Java Language Specification - J. Gosling, B. Joy, G. Steele and G. Bracha, 3rd edition (online)
4. Inside the Java 2 Virtual Machine-Bill Venners (McGraw-Hill), 2000, ISBN 0-07-135093-4.
5. Parallel programming in C with MPI and Open MP - Michael J Quinn (Tata McGraw Hill), 2003.
6. Multi-Core Programming - Shameem Akhter and Jason Roberts (Intel Press), 2006
7. Computer Architecture : A Quantitative Approach - John L. Hennessey and David A. Patterson (Morgan Kaufmann/Elsevier Publishers), 4th edition, 2007
8. Parallel Computing Architecture: A Hardware/Software Approach - David E. Culler, Jaswinder Pal Singh (Morgan Kaufmann/Elsevier Publishers), 2004.
9. Introduction to Parallel Computing - Wesley Petersen and Peter Arbenz (Oxford University Press), 2004.
10. TAPL Types and Programming Languages-Benjamin C. Pierce (MIT Press)
11. ATTAPL Advanced Topics in Types and Programming Languages - Edited by Benjamin C. Pierce (MIT Press)
12. The Java Programming Language - K. Arnold, J. Gosling and D. Holmes (Addison-Wesley), 3rd edition, 2000. ISBN 0-201-70433-1
13. Programming for the Java Virtual Machine-J. Engel (Addison-Wesley), 1999. ISBN 0-201-30972-6
14. The JavaTM Virtual Machine Specification-T. Lindholm and F. Yellin (Addison-Wesley), 2nd edition, 1999
15. 21st Century Compilers-Aho, R. Sethi, J. Ullman and M. Lam (Addison-Wesley, Boston, MA), 2005.

Readings:

1. L. Almagor, Keith D. Cooper, Alexander Grosul, Timothy J. Harvey, Steven W. Reeves, Devika Subramanian, Linda Torczon, Todd Waterman. Finding Effective Compilation Sequences, Proc. 2004 Conf. on Languages, Compilers, and Tools for Embedded Systems (LCTES'04), June 2004.
2. Cliff Click and Keith D. Cooper. Combining Analyses, Combining Optimizations, ACM Transactions on Programming Languages and Systems, March 1995, pp. 181-196.
3. Sorin Lerner, David Grove, and Craig Chambers. Composing Dataflow Analyses and Transformations, Proc. 29th Annual Symposium on Principles of Programming Languages (POPL), January 2002.
4. http://www.cis.upenn.edu/~bcpierce/attapl/

MCS-155 ADVANCED DIGITAL IMAGE PROCESSING 4 Credits (3-1-0)

Course Objectives: Upon successful completion of the course, students

1. know and understand the fundamental concepts, techniques, and terminology of the digital image.
2. know and understand the fundamental steps and components of an image processing system.
3. know and understand the basic operations and algorithms on two dimensional images features.
4. can analyze the image processing applications in real world.

Learning Outcomes: In order to pass, the student must be able to

1. list and define the fundamental concepts of digital image processing system.
2. manually perform the operations on the given image.
3. Understand the properties of the digital image.

UNIT I **9**

Digital Image Fundamentals

Introduction: Digital Image- steps of digital image processing systems- Elements of visual perception- connectivity and relationship between pixels.

Simple operations: arithmetic, logical, geometric operations.

Mathematical preliminaries: 2D linear space Invariant systems- 2D convolution- Co relation 2D random sequence- 2D spectrum.

Image Transforms and Enhancement

Image Transforms: 3D orthogonal and Unitary Transforms- Properties and Examples. 2D DFT- FFT- DCT- Hadamard Transform- Haar Transform -Slant Transform -KL Transform- Properties & Examples

Image Enhancement: Histogram Equalization Technique- Point Processing- Spatial Filtering – In Space and Frequency – Non linear Filtering- Use of different masks.

UNIT II **9**

Image Restoration and Construction

Image Restoration: Image Observation and Degradation model, Circulant and Block Circulant Matrices and its Applications in Degradation model- Algebraic Approach to Restoration- Inverse by Weiner Filtering – Generalized Inverse- SVD and Interactive Methods -Blind Deconvolution -Image reconstruction from Projections.

UNIT III **9**

Image Compression and Segmentation

Image Compression: Redundancy and Compression Models -Lossless and Lossy. Lossless -Variable length, Huffman, Arithmetic Coding -Bit Plane Coding, Lossless Predictive Coding. Lossy Transform (DCT) based Coding, JPEG Standard – Sub Band Coding.

Image Segmentation: Edge Detection -Line Detection -Curve Detection -Edge Linking and Boundary Extraction, Boundary Representation, Region Representation and Segmentation, Morphology -Dilation, Erosion, Opening and Closing, Hit and Miss Algorithms, Feature Analysis.

UNIT IV **9**

Color and Multi spectral Image Processing

Color Image-Processing Fundamentals, RGB Models, HSI Models, Relationship between different models.

Multi spectral Image Analysis- Color image processing, Three Dimensional Image Processing- Computerized Axial Tomography- Stereometry- Stereoscopic Image Display- Shaded Surface Display.

Books & References:

1. Digital Image Processing - Gonzalez, R. C. & Woods (Pearson Education), 3rd edition, 2008.
2. Digital Image Processing - Kenneth R. Castleman (Pearson Education), 1995.
3. Digital Image Processing - S. Jayaraman, S. Esakkirajan, T. Veerakumar (McGraw Hill Education), 2009.
4. Fundamentals of Digital Image Processing - Anil Jain K. (Prentice Hall of India), 1989
5. Image Processing - Sid Ahmed (McGraw Hill, New York), 1995
6. Digital Image Processing (Vol. 1 & Vol. 2), Rosenfeld and A. C. Kak (Academic Press Inc.), 1982
7. Digital Image Processing and Analysis - Chanda and D. Dutta Mazumdar (Prentice Hall of India, New Delhi), 2000.
8. Various journal and conference articles, research reports, and book excerpts as appropriate

Software:

The examples and assignments will use MATLAB.

MCS-156 REAL TIME SYSTEMS 4 Credits (3-1-0)

Course Objectives:

1. To study issues related to the design and analysis of systems with real-time constraints.
2. To learn the features of Real time OS.
3. To study the various Uniprocessor and Multiprocessor scheduling mechanisms.
4. To learn about various real time communication protocols.
5. To study the difference between traditional and real time databases

Learning Outcomes:

1. Knowledge about Schedulability analysis.
2. Ability to learn Real-time programming environments.
3. Knowledge about real time communication and databases.
4. Ability to develop real time systems.

UNIT I **9**

Introduction to real-time computing - Structure of a real-time system - Characterization of real-time systems and tasks - Performance measures

UNIT II **9**

Task Assignment and Scheduling - Uniprocessor scheduling algorithms - Task assignment - Mode changes - Fault tolerant scheduling.

UNIT III **9**

Real-time Communication - Network topologies and architecture issues - Protocols - Contention-based, token-based, polled bus - Fault tolerant routing.

UNIT IV **9**

Real-time Databases - Transaction priorities and aborts - Concurrency control issues - Scheduling algorithms - Two-phase approach to improve predictability. Programming Languages and Tools - Hierarchical decomposition - Run-time error handling - Overloading - Timing specification - Recent trends and developments

Books & References:

Real-Time Systems - C. M. Krishna and Kang G. Shin (McGraw Hill Companies, Inc., New York), International Edition, 1997

MCS-157 EMBEDDED COMPUTING 4 Credits (3-1-0)

Course Objectives:

1. To provide a clear understanding on the basic concepts, Building Blocks for Embedded System
2. To teach the fundamentals of System design with Partioning
3. To introduce on Embedded Process development Environment
4. To study on Basic tool features for target configuration

5. To introduce different EDLC Phases &Testing of embedded system

Learning Outcomes:

1. Explain various embedded system applications and design requirements
2. Construct embedded system hardware
3. Develop software programs to control embedded system
4. Generate product specification for embedded system
5. Outline validation and testing methodologies for embedded system
6. able to apply knowledge from undergraduate engineering and other disciplines to identify, formulate, solve
7. novel advanced electronics engineering along with soft computing problems that require advanced
8. knowledge within the field
9. able to understand and integrate new knowledge within the field
10. able to design, execution and evaluation of experiments on embedded platforms.
11. able to analysis, design and testing of systems that include both hardware and software.

UNIT I **9**

EMBEDDED DESIGN WITH MICROCONTROLLERS:

Product specification – Hardware / Software partitioning – Detailed hardware and software design – Integration – Product testing – Microprocessor Vs Micro Controller – Performance tools – Bench marking – RTOS Micro Controller -issues in selection of processors.

UNIT II **9**

PARTITIONING DECISION:

Hardware / Software duality – Hardware-Software portioning- coding for Hardware- software development – ASIC revolution – Managing the Risk – Co-verification – execution environment – memory organization – memory enhancement – Firmware-speed and code density -System
startup

UNIT III **9**

FUNCTIONALITIES FOR SYSTEM DESIGN:

Timers, Watch dog timers – RAM, Flash Memory basic toolset – Integration of Hardware & Firmware- Insystem Programming, In Application Programming,, IDE-Target Configuration- Host based debugging – Remote debugging – ROM emulators – Logic analyser

UNIT IV **9**

CIRCUIT EMULATORS & EMBEDDED DESIGN LIFE CYCLE & TESTING:

Buller proof run control – Real time trace – Hardware break points – Overlay memory – Timing constraints – Usage issues – Triggers. Objective, Need, different Phases & Modelling of the EDLC, choice of Target Architectures for Embedded Application Development-for Control Dominated-Data Dominated Systems-Software &Hardware Design, PCB Design, Manufacturing & PCB Assembly-Bug tracking – reduction of risks & costs – Performance – Unit testing – Regression testing – Choosing test cases –Functional tests – Coverage tests – Testing embedded software – Performance testing – Maintenance.

Books & References:

1. Embedded system Design - James K. Peckol (John Wiley & Sons), 2010
2. Making Embedded Systems - Elicia White (O'Reilly Series, SPD), 2011
3. Embedded Systems – Rajkamal (TMH), 2009
4. Embedded Systems: An Integrated Approach - Lyla B Das (Pearson Education), 2013
5. Embedded System Design - Arnold S. Berger (CMP Books, USA), 2002.
6. Behaviour-based Robotics – Arkin, R.C. (The MIT Press), 1998.

MCS-158 MOBILE DATABASE SYSTEMS 4 Credits (3-1-0)

UNIT I **9**

Mobile Database System: Introduction, Types of Mobility, Transaction Structure, Serialization of Transactions, Serializability-Based Correctness Criteria, Serializability Theory, Degree of Isolation, Nested Transaction Model, SAGA, Cooperative Transaction, ConTract, Flex Transaction, Advanced Transaction Models

UNIT II **9**

Transaction Management in Mobile Database Systems: Mobile Database System (MDS), Transaction Execution in MDS, Mobile Transaction Model, Execution Model based on ACID Transaction Framework, Two-Level Consistency Model, Pro-Motion: Proactive management of Mobile Execution Model with Reporting Transaction, Transactions Pre-write Execution in Mobile Database Systems HiCoMo: High Commit Mobile Transaction Model, Pre-write Transaction Execution Model, Mobile Transaction Model, Moflex Transaction Model, Kangaroo Mobile Transaction Model, MDSTPM Transaction Execution Model, Mobilaction-A Mobile Transaction Model, Atomicity for Mobilaction, Isolation for Mobilaction, Data Consistency in Intermittent Connectivity, Consistency and Durability for Mobilaction

UNIT III **9**

The Consistency Model: Data Correctness, Weak Connectivity Operation, Correctness Criterion, The Serialization Graph, Protocols, A Consistency Restoration Schema, Correctness Criterion, The Extended Database Operation Interface, Concurrency Control Mechanism, Locking-Based CCMs, CCM Based on *Epsilon* Serializability, Relationship with ESR, Node Failure and Timeout Action, Decentralized 2PC, Linear or Nested 2PC, Commitment of Mobile Transactions, Commit Protocols for Mobilaction, Transaction Commitment in Mobile Database Systems, TCOT Steps-No Failure, Node Failure-Fragment Compensation, TCOT with Handoff, Special Cases, An Alternate TCOT Protocol, Correctness

UNIT IV **9**

Mobile Database Recovery: Introduction, Log Management in Mobile Database Systems, Where to Save the Log?, Mobile Database Recovery Schemes, Forward Strategy, Forward Log Unification Scheme, Forward Notification Scheme, A Three-Phase Hybrid Recovery Scheme, Low-Cost Checkpointing and Failure Recovery, **A** Mobile Agent-Based Log Management Scheme Architecture of Agent-Based Logging Scheme, interaction Among Agents for Log Management

Books & References:

1. Mobile Database Systems - Vijay Kumar (John Wiley & Sons), 2006
2. Various journal and conference articles, research reports, and book excerpts as appropriate

MCS-159 ADVANCED PARALLEL PROGRAMMING 4 Credits (3-1-0)

UNIT I **9**

Sequential model, need of alternative model, parallel computational models such as PRAM, LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model, Pyramid model, Fully Connected model, PRAM-CREW, EREW models, simulation of one model from another one. What is parallel computing, Scope of parallel computing, Scope of parallel computing. Parallel Programming Platforms: implicit parallelism, Dichotomy of parallel computing platforms, Physical organization for parallel platforms, communication cost in parallel machines, routing mechanism for interconnection networks.

UNIT II **9**

Basic Communication Operation: One-to-all broadcast; All-to-all broadcast; Reduction and prefix sums; One-to-all personalized communication; All-to-all personalized communication;

Performance Measures of Parallel Algorithms, speed-up and efficiency of PA, Cost- optimality, An example of illustrate Cost- optimal algorithms- such as summation, Min/Max on various models. The effect of granularity on performance

UNIT III **9**

Sorting: Sorting networks; Bubble sort and its variants; Quick sort and other sorting algorithms Parallel Searching Algorithm, Kth element, Kth element in X+Y on PRAM, Parallel Matrix Transportation and Multiplication Algorithm on PRAM, MCC, Vector-Matrix Multiplication, Solution of Linear Equation, Root finding.

UNIT IV **9**

Dynamic Programming: Overview of dynamic programming, Serial monadic DP Formulations: The shortest path Problem, the 0/1 Knapsack Problem, Serial Polyadic DP Formulation: all pair shortest paths algorithms.

Graph Algorithms-Connected Graphs, search and traversal, Combinatorial Algorithms-Permutation, Combinations.

Books & References:

1. Introduction to Parallel Computing - Vipin Kumar, Ananth Grama, Anshul Gupta and George Karypis (The Benjamin/Cumming Publishing Company, Inc., Masschachusetts)
2. Distributed Systems Concepts and Design - George Coulouris, Jean Dollimore and Tim Kindberg (Addison-Wesley, Masschachusetts)
3. The Decision and Analysis of Parallel Algorithms - S G Akl (PH Englewood Cliffs, New Jersey)
4. Advanced Computer Architecture: Parallelism, Scalability, Programmability (TMH)
5. An Introduction to Parallel Algorithms- J Jaja (Addison Wesley, Masschachusetts)
6. Introduction to Parallel Computing - T G Lewis and H El Rewini (Prentice Hall, Englewood Cliffs, New Jersey)
7. Parallel Computing: Theory and Practice -M J Quinn (McGraw Hill, New York)

MCS-160 CLOUD COMPUTING 4 Credits (3-1-0)

Course Objectives:

Upon successful completion of the course, students:

1. To understand the current trend and basics of cloud computing.
2. To learn cloud services from different providers.
3. To understand the collaboration of cloud services.
4. To expose various ways to collaborate the clud service online.

Learning Outcomes

In order to pass, the student must be able to

1. Able to collaborate the cloud services to any device.
2. Exploring the online applications of cloud services.
3. Implementing cloud computing for the corporation.
4. Design various applications by integrating the cloud services.

UNIT I **9**

UNDERSTANDING CLOUD COMPUTING

Cloud Computing at a glance, Defining a Cloud, History of Cloud Computing,Cloud Computing- Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others. Cloud Architecture, Cloud Storage, Why Cloud Computing Matters, Advantages of Cloud Computing, Disadvantages of Cloud Computing , Companies in the Cloud Today – Cloud Services .

UNIT II **9**

DEVELOPING CLOUD SERVICES

Web-Based Application – Pros and Cons of Cloud Service Development, Types of Cloud Service Development, Software as a Service, Platform as a Service, Web Services, On-Demand Computing, Discovering Cloud Services, Development Services and Tools - Amazon Ec2, Google App Engine – IBM Clouds. Virtualization-Characteristic features, Taxonomy Hypervisor, Virtualization and Cloud Computing, Pros and Cons of Cloud Computing, Technology Examples/Case Studies

UNIT III **9**

CLOUD COMPUTING FOR EVERYONE

Centralizing Email Communications– Collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud Computing for the Community–Collaborating on Group, Projects and Events – Cloud Computing for the Corporation, Collaborating via Web-Based Communication Tools–Evaluating Web Mail Services – Evaluating, Web Conference Tools–Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis

UNIT IV **9**

USING CLOUD SERVICES

Collaborating on Calendars, Schedules and Task Management – Exploring Online Scheduling Applications – Exploring Online Planning and Task Management–Collaborating on Event Management– Collaborating on

Contact Management– Collaborating on Project Management – Collaborating on Word Processing - Collaborating on Databases – Storing and Sharing Files

Books & References:

1. Mastering Cloud Computing - Raj Kumar Buyya, Christian Vecchiola and S. Tanurai Selvi (TMH), 2012
2. Cloud Computing for Dummies - Judith Hurwitz, R. Bloor, M. Kanfman, F. Halper (Wiley India Edition)
3. Distributed and Cloud Computing - Kaittwang Geoffrey C. Fox and Jack J Dongrra (Elsevier India) 2012
4. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate - Michael Miller (Que Publishing), Online, August 2008
5. Cloud Computing – Insights into New Era Infrastructure - Kumar Saurabh (Wiley Indian Edition), 2011
6. Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs-Haley Beard (Emereo Pvt. Limited), July 2008

MCS-176 INFORMATION SYSTEM & DATA MANAGEMENT 4 Credits (3-1-0)

Course Objectives: The objective of this course is to prepare students to be part of teams that imagine, specify, design, justify, build, implement, manage and use information systems. This course covers fundamental concepts of information systems and data management. This course is basically design for the students to:

1. develop an awareness of the nature and use of information and information systems in an organizational context;
2. show an understanding of the flow of information within organizations;
3. understand the differing types of information;
4. develop awareness of the basic ideas behind using a computer to store and manipulate data
5. Display knowledge of data analysis and modeling techniques
6. provide an introduction to database management systems;
7. Discuss various database management architectures

Learning Outcomes: Students will learn to implement modules that can form parts of larger Information Systems. More specifically students will

1. identify and utilize information and computer system;
2. identify and apply the steps involved in analyzing Information Technology (IT) solutions;
3. create and/or modify files appropriately through the use of data management technology.

UNIT I **9**

Systems-An Overview: Systems - definition, characteristics, types of systems, sub-systems, super systems, and total systems; systems concepts in business, systems approach to management problem solving

Technology of Information Systems: Introduction – Data Processing – Transaction Processing – Application Processing – Information System Processing – TQM of Information Systems

UNIT II **9**

Information and Information Systems - An Overview — Information and data - definition and distinctions, information as a corporate resource, features and qualities of information; types of information; process of generating information; value and cost of information; information needs at various levels of management; factors influencing information needs; information systems - definition and elements; information system activities; types of information systems; information systems in business management; recent trends in information systems.

UNIT III **9**

Data Management Essential- Introduction to data, how different types of data are represented in the computer? The role / authority of data management, Roles and responsibilities within data management, Data Architecture concepts, Data Management tools and techniques, Data modeling: physical, logical and conceptual data models, the entity-relationship model, translating ERD into relational model, concepts and principles of database management systems (DBMS)

UNIT IV **9**

Introduction to SQL: Characteristics of SQL. Advantage of SQL. SQL data types and literals, Types of SQL commands, SQL operators and their procedure, Tables, views and indexes, Queries and sub queries, Aggregate functions. Insert, update and delete operations. Joins, Unions, Intersection, Minus, Cursors in SQL, induction over Trees

Advanced database concepts such as transaction management and concurrency control, commit procedure, distributed databases, multi-tier client/server architectures, web-based database applications

Books & References:

1. An Introduction to Database System-Date C J (Addision Wesley)
2. Database Concepts - Korth, Silbertz, Sudarshan (McGraw Hill)
3. Fundamentals of Database Systems - Elmasri, Navathe, (Addision Wesley)
4. Database Management System - Ramakrishnan, Gehrke (McGraw Hill)
5. Database Processing: Fundamentals, Design and Implementation-Kroenke (Pearson Education)
6. DBMS: Complete Practical Approach-Maheshwari Jain (Firewall Media, New Delhi)
7. Managing with Information - Jerome Kanter (Prentice Hall of India Pvt. Ltd.)
8. Management information system, conceptual Foundations - Gordon B Davis& Margrethe H Olson (Tata McGraw Hill)
9. Fundamentals of information Technology - Deepak Bharhoke (Excel Books)

MCS-177 COMPUTER APPLICATION IN MANAGEMENT 3 Credits (2-0-2)

UNIT I **6**

Role of Computer in modern business, various functional areas of business and its applications, Concept of Computers**:** Brief History of computer, Generation and its evolution (now and then), Classification, Characteristics and limitations of computers, Basic computing Architecture, CPU and its components.

Components**:** Software, Hardware, Firmware, Input/output devices,

Operating Systems**:** Functions and types of OS, Multi- Programming, Multi- processing, Multi- tasking, Multi-Threading, Real time OS

UNIT II **6**

Use of MS-Office: Basics of MS-Word, MS-Excel and MS-PowerPoint; Application of these software' for documentation and making reports, Preparation of questionnaires, Tables and reports(Practical)

Memory Management**:** Types of memory, Storage Units (CD, DVD, Hard Disks, Pen drive), Memory types (RAM, ROM, Cache).

UNIT III **6**

Computer Networks: Overview of Computer Network, Types of computer networks (LAN, WAN and MAN), Network topologies, Internet: Overview of Internet, Architecture & Functioning of Internet, Basic services over Internet like WWW, FTP, Telnet, Gopher etc., IP addresses, ISPs, URL, Domain names, Web Browsers, Internet Protocols, Search engines, e-mail, Web browsing, searching, downloading & uploading from Internet. Applications of Information Technology

UNIT IV **6**

Developing MIS Systems: System Development Life Cycle. , Investigation Phase, Prototyping, Feasibility Analysis, System Analysis (DFD and ER Diagram), System Design, Implementing Business Systems, Testing, Documenting, Training, Conversion and Maintenance

Applications: Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), Security and Ethical Challenges Of IT, Ethical Responsibility - Business Ethics, Technology Ethics; Cyber Crime and Privacy Issues.

Books & References

1. SK Basandra.-Computer Today (Galgotia, 1st Edition)
2. Shrivastava-Fundamental of Computer& Information Systems (Wiley Dreamtech)
3. ITL ESL – Introduction to Computer science (Pearson, 2nd Edition).
4. Introduction to Computers, Norton P. (TATA McGraw Hill)
5. Leon - Fundamentals of Information Technology, (Vikas)

COMPUTER SCIENCE & ENGINEERING DEPARTMENT
M. M. M. UNIVERSITY OF TECHNOLOGY
GORAKHPUR

COURSES OFFERED

Program Core for M.Tech. (Information Technology)

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MAS-113	Probabilistic Modelling	-	3	1	2	5
2.	MCS-201	Fundamentals of Information Systems	-	3	1	2	5
3.	MCS-202	Advanced Network Design and Administration	-	3	1	0	4
4.	MCS-203	Information Security and Audit	-	3	1	0	4
5.	MCS-204	Web Programming & Administration	-	3	1	2	5
6.	MCS-205	Advanced Database Management Systems	-	3	1	0	4
7.	MCS-230	Dissertation Part-I	-	0	0	8	4
8.	MCS-220	Minor Project	-	0	0	8	4
9.	MCS-240	Seminar	-	0	0	4	2
10.	MCS-250	Dissertation Part-II	Dissertation Part-I	0	0	28	14

Program Electives for M. Tech (Information Technology)

S.N.	Paper Code	Subject Name	Prerequisite Subject	L	T	P	Credits
		PE1 & PE2 (II Semester)					
1.	MCS-251	Data Communications & Advanced Internet Technologies	-	3	1	0	4
2.	MCS-252	Network Security & Cyber Law	-	3	1	0	4
3.	MCS-253	Advance Topics on Computer Networks	-	3	1	0	4
4.	MCS-254	Wireless Networks Security and Administration	-	3	1	0	4
5.	MCS-255	Advances in Natural Language Processing	-	3	1	0	4
6.	MCS-256	Bio-Informatics	-	3	1	0	4
7.	MCS-257	Neural Networks and Fuzzy Logics	-	3	1	0	4
8.	MCS-258	Pattern Recognition and Image Processing	-	3	1	0	4
		PE-3 & PE-4 (III Semester)					
9.	MCS-259	Parallel Processing: Architectures and Algorithms	-	3	1	0	4
10.	MCS-260	Software Testing & Quality Management	-	3	1	0	4
11.	MCS-261	Transaction Mining and Fraud Detection	-	3	1	0	4
12.	MCS-262	Emerging Information Technologies & Issues	-	3	1	0	4
13.	MCS-263	Project and Change Management	-	3	1	0	4
14.	MCS-264	Data Mining & Data Warehousing	-	3	1	0	4
15.	MCS-265	Human Computer Interaction	-	3	1	0	4
16.	MCS-266	Pervasive and Ubiquitous Computing	-	3	1	0	4
17.	MCS-267	Distributed Operating Systems: Concept & Design	-	3	1	0	4

SYLLABI

MCS-201 FUNDAMENTALS OF INFORMATION SYSTEMS 5 Credits (3-1-2)

Course Objectives:

1. Upon successful completion of the course, students:
2. Obtain understanding of the concepts of Information System and its applications.
3. Become familiar with the use of Information System tools.
4. Describe in their own words the basic terminology and concepts discussed in this course in relation to information systems and information technologies and their impacts on organizational systems.
5. The primary goals of this course are to introduce the student to the language of information systems.
6. To begin understanding the role of technology in our world today.

Learning Outcomes: In order to pass, the student must be able to

1. At the end of the course, the student should be able to associate other reading and conversation with material in the course and create relationships to what they have learned.
2. Students will also create their own IS graduation plan, initial resume and cover letter, as well as identify potential jobs in the IS field that they plan to one day be qualified to apply for.
3. Information Systems is composed of a wide variety of career choices, with its own unique language, that continually changes.
4. To explore career opportunities, and to be aware of tools that will help the student adapt to changes in Information Systems.

UNIT I **9**

Demonstrate a practical understanding of the definitions and differences between "information systems" and "information technology" and how IS and IT relate to organizational "work systems" and the management of associated business processes.

UNIT II **9**

Describe the major characteristics of the digital world. Identify the major hardware components of modern personal computers and their functions. Identify the different types of software and their roles, including basic programming elements.

UNIT III **9**

Define database management systems, describe their various functions, and create basic tables & associations. Identify the components and describe the roles of networking and telecommunications technologies. Identify and describe the major Internet components and technologies as well as their purposes as part of the World Wide Web. List the steps in the traditional Systems Development Life Cycle (Waterfall methodology) and understand how it differs from iterative approaches found in Object-Oriented Systems Analysis & Design. Describe the main components of an information systems security, disaster recovery, and data retention plan. Describe the key levels of decision-making in organizations and the types of IS/IT capable of supporting these different types of decision-making.

UNIT IV **9**

Explain how information systems can help organizations achieve a strategic advantage. Describe the basic e-business models and identify successful implementations of these models. Describe the different types of business integration IT/IS and identify successful implementations of each type. Search for, identify, and describe the types of careers available in Information Systems Professionals. Complete your first complete IS graduation plan on MAPPER, including certifications and an IS internship in your home region or country. Create your first, IS-oriented Resume and Cover letter. Sign up for Y-Careers.

COMPUTER PROGRAMMING LAB

Development of program for different types of systems following the organizational and strategic role and added value of information systems, decision support systems, data mining, MIS, information systems planning, data management, computer networking, internet, analysis, design, development, and maintenance of information systems, competitive edge of information systems.

Reference Books:

1. Information Systems Technology, Ross A. Malaga (Prentice Hall), ISBN 0-13-049750-9
2. Computers Today-Suresh K. Basandra (Galgotia Publications Pvt. Ltd.)
3. Fundamental of Computer & IT - S. Jaiswal (Wiley Dreamtech India)
4. Microsoft Web Publishing Step by Step (Active Education)
5. Software: Microsoft Office Applications, Project, and Visio.

Related Websites:

www.wikipedia.org, www.howstuffworks.com, www.cnet.com, www.whatis.com, www.zdnet.com, www.bnet.com, www.eweek.com, or www.technologyevaluation.com

MCS-202 ADVANCED NETWORK DESIGN AND ADMINISTRATION — 4 Credits (3-1-0)

Learning Goals:

Students will be able to

1. describe modern network pathways and protocols;
2. implement X.500-based directory services, and plan, implement, manage, and troubleshoot rights for files and folders in the file system and for object classes in the directory services tree;
3. recognize the file services components particularly volumes and mapping of drive letters to volumes, file and directory attributes, and file system security;
4. manage the creation and login security of user objects and configure the user workstation environment using login scripts and user policies; and
5. identify and implement queue-based and distributed network printing services.

Assessment Methods for Core Learning Goals:

The assessment of Course Learning Goals is based on written tests, labs, and other assignments, as well as performance-based tasks as appropriate, and a departmental final exam.

UNIT I **9**

Defining Network System Components: Local Area Networks and the Internet, Network Components and Services - file services, print services application services, Network Entities - workstations, servers, disk storage, printers, Network Pathways - cables, topologies, Network Interface Cards, Protocols - IPX/SPX, TCP/IP, NetBEUI/NetBIOS

UNIT II **9**

X.500 Directory Services: Tree concept and context within the tree, Object classes and properties of the objects, Partitions and replicas, Security - trustee assignments, inheritance, Utilities for managing the tree - Command line, Windows, Internet

UNIT III **9**

Designing the File System: Components - disk partitions, volumes, folders and sub-folders, Mapping drive letters to network volumes, Introduction to backups, File system security - trustee assignments, inheritance, effective rights, attributes, Utilities for managing files - Command line, Windows, Internet, Managing Users and Login Security: Creating users - groups, templates, importing, Login security - passwords and other account restrictions, Utilities for user management - Command line, Windows, Internet

UNIT IV **9**

Configuring the User Workstation Environment: Login scripts, Introduction to remote management, Network Printing: The queue-based printing model, Novell Distributed Printing Services (NDPS), Planning and implementing the printing environment

Reference, Resource, or Learning Materials to be used by Students: Departmentally selected textbook. Details provided by the instructor of each course section. See course format.

MCS-203 INFORMATION SECURITY AND AUDIT — 4 Credits (3-1-0)

Course Objectives: Upon successful completion of the course, students:

1. To create awareness about the values of Information
2. How the Information security practices are meticulously implemented in IT companies worldwide.
3. To understand the mathematical foundations of security principles
4. To understand the role played by authentication in security
5. To appreciate the current trends security practices

Learning Outcomes: In order to pass, the student must be able to

1. Use creation of awareness about the values of Information
2. Use the Information security practices are meticulously implemented in IT companies worldwide.
3. Use the mathematical foundations in security principles
4. Use available security practices

UNIT I **9**

Introduction to Information Security and Need: History and evaluation of Information security CIA triangle, Components of IS, Control in IT environment, Information security Management system, components of ISMS and conceptual framework, Steps for developing ISMS. Need of Information security- Threats to information security, Risk to Information systems, Information security in organization, Introduction to cyber crimes and attacks, Information security policy, policy definition and security life cycle.

UNIT II **9**

Information Security Policy and Standards: Security principles, Types of Information security policies- Administrative and Technical, A structure and framework of compressive security policy, policy infrastructure, policy design life cycle and design processes, PDCA model. Security policy standards and practices - BS7799, ISO/IEC 17799, ISO 27001, Auditing tools such as ISO 27001 ISMS TOOL KIT, NGS AUDITOR, Windows password auditor, ISO IES 27002 2005 IS AUDIT TOOL

UNIT III **9**

Domains of IT security and IT Governance: User/accepted usage/ access, data access, physical access, Internet access, e-mail, digital signature, outsourcing, software development and acquisition, hardware acquisition. Network and telecom, BCP and DRP, security organization structure, Domains related security based case studies. What is IT Governance, good governance, objectives and dimensions, foundation, structure, processes? IT governance framework- COBIT, ITIL, ISO 17799, IT governance maturity model

UNIT IV **9**

Auditing concepts, Controls and Ethical hacking: Auditing concepts ISA need, concept, standards, performance, steps. Techniques, methodologies, around and through computer controls – Concept objectives, types, risk Controls -Input, process, validation, output, logical access, physical access. Database, network, environment, BCP, Evidence collection, evaluation and Reporting methodologies. Ethical hacking

Books & References:

1. Information security policies, procedures and standards by Thomas Pettier.
2. Information security Management Hand book- Harold F. Tipton, 5th edition
3. Computer security - Alfred Basta, Wolf Halton
4. Information security policies- Thomas R.Peltier, Peltier R. Peltier
5. Electronic Signature law - L Padmavathi
6. Network Security - Ankit Fadia
7. Security Plus study guide - Michael Cross (Norrris Johnson)
8. Information systems control and Audit - Ron Weber (Pearson Pub.)
9. IS control journals from ISACA
10. Information Systems Security: Security Management, Metrics, Frameworks And Best Practices (With Cd) : Nina Gobole
11. Information Security policies made easy version 10: Charles Cresson Wood

Reference websites:

www.searchsecurity.techtarget.com; www.secure-byte.com; www.security-internal-audit.com; www.ngssecure.com/services; www.pcisecuritystandards.org

MCS-204 WEB PROGRAMMING & ADMINISTRATION 5 Credits (3-1-2)

Course Objectives: Upon successful completion of the course, students

1. Will learn Hyper Text Markup Language (HTML) for authoring web pages.
2. Will learn Cascading Style Sheets (CSS) for supplying stylistic information to web pages.
3. Will learn JavaScript for creating interactive web pages.
4. Will learn Asynchronous JavaScript and XML (Ajax) for enhanced web interaction and applications.
5. Will learn PHP Hypertext Processor for generating dynamic pages on a web server.
6. Will learn to install, configure, manage, and secure the most widely used web server in the world, Apache.
7. Will learn how to install, use, and administer a Web Server.
8. Will understand the capabilities of Web servers.
9. Will understand and develop applications for Web servers.

Learning Outcomes: In order to pass, the student must be able to

1. Identify common design mistakes when creating a web based application.
2. Discuss the process of editing a web page using text editors and web page editors
3. Cover commonly used HTML tags and discuss how this knowledge is important to a web designer
4. Demonstrate an understanding of basic CSS, JavaScript, AJAX, and PHP

UNIT I **9**

Web Page Designing –HTML- list, table, images, frames, forms; CSS

UNIT II **9**

Client-Side Scripting -Java script-Introduction, documents, forms, statements, functions, objects, Event and event handling; Introduction to AJAX

UNIT III **9**

Server Side Scripting - PHP(Hypertext Preprocessor)-Introduction, syntax, variables, strings, operators, if- else, loop, switch, array, function, form ,mail, file upload, session, error, exception, filter, PHP-ODBC.

UNIT IV **9**

Web Server Administration - An Overview of the World Wide Web, Apache and Other Servers ,Installing Apache, The Apache Core Directives, Apache Modules ,Virtual Hosting, Apache Logging ,Basic Security for Your Web Server.

COMPUTER PROGRAMMING LAB

List of programs/assignments to be carried out for the successful completion of the course of Web Programming & Administration

1. Develop and demonstrate a XHTML document that illustrates the use external style sheet, ordered list, table, borders, padding, color, and the tag.
2. Develop and demonstrate a XHTML file that includes Java Script script for the following problems:
   a) Input : A number n obtained using prompt
      Output : The first n Fibonacci numbers
   b) Input : A number n obtained using prompt
      Output : A table of numbers from 1 to n and their squares using alert
3. Develop and demonstrate a XHTML file that includes Java Script script that uses functions for the following problems:
   a) Parameter: A string
      Output: The position in the string of the left-most vowel
   b) Parameter: A number
      Output: The number with its digits in the reverse order
4. a) Develop and demonstrate, using Java Script script, a XHTML document that collects the identification number (the valid format is: A digit from 1 to 4 followed by two upper-case characters followed by two digits followed by two upper-case characters followed by three digits; no embedded spaces allowed) of the user. Event handler must be included for the form element that collects this information to validate the input. Messages in the alert windows must be produced when errors are detected.
   b) Modify the above program to get the current semester also (restricted to be a number from 1 to 8)
5. Design an XML document to store information about a student in an engineering college affiliated to MMMUT
   The information must include id, Name, Name of the College, Branch, Year of Joining, and e-mail id. Make

up sample data for 3 students. Create a CSS style sheet and use it to display the document.

6. Write a PHP program to store current date-time in a COOKIE and display the "Last visited on" date-time on web page upon reopening of the same page.
7. Write a PHP program to store page views count in SESSION, to increment the count on each refresh, and to show the count on web page.
8. Write a program to demonstrate the application of AJAX that passes the user name to the server without refreshing the web page.
9. Understand the installation and configuration processes of Apache Tomcat Server. Also implement a simple JSP program using Apache Tomcat Server
10. Create a registration form which takes the input as id, name, address from the user and redirects it to home page of the website using the CGI.

Books & References:

1. Web Programming Step – Step, Stepp/Miller/Kirst, 2nd edition, 2009, ISBN:978-1-105-57878-6
2. Creating Database Web Applications with PHP and ASP, Jeanine Meyer (Thomson Learning-Course Technology, Boston, MA), 2003. ISBN:1-5845-0264-9
3. PHP for the Web: Visual Quick Start Guide- Ullman (Pearson Education), 4th edition, 2011, ISBN-10: 0321733452 | ISBN-13: 978-0321733450
4. Web Technology and Design-Xavier, C. (New Age International), 2007. ISBN: 8122414508, 9788122414509
5. Web Enabled Commercial Application Development Using HTML, DHTML, Java Script, Perl & CGI - Ivan Bayross (BPB Publication), 2005, ISBN:8183330088, 9788183330084
6. Web Technologies –Jackson (Pearson Education), 2007, ISBN: 8131717151, 9788131717158
7. Introduction to Web Technology & Internet – Patel and Barik (Acme Learning), 2009, ISBN: 8190710435, 9788190710435.
8. Linux Apache Web Server Administration - Charles Aulds (Cambridge University Press), 2nd edition, 1996 ISBN: 521-56543-X.
9. Web Server Administration - Steve Silva,2008.ISBN-10: 1423903234 | ISBN-13: 9781423903239

Software:

Firefox web browser (with Firebug add-on), and the TextPad (Windows), Apache 2.2 on the CentOS Linux platform

Readings:

Various journal and conference articles, research reports, and book excerpts as appropriate

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MCS-205 ADVANCED DATABASE MANAGEMENT SYSTEMS 4 Credits (3-1-0)

Course Objectives:

This is an advanced graduate course to introduce the students the emerging topics in database systems. This course is especially designed to be a technology course geared for CS graduate junior students with emphasis on advanced concepts and algorithms in database systems, topics that are state-of-the-art research**,** or recent seminal contributions in the broad field of database and information systems.

Learning Outcomes: Upon successful completion of this course, the student will be able to:

1. able to understand the background and knowledge of some advanced topics in database that have become key techniques in modern database theory and practices; typical topics are distributed concurrency control, database recovery, query optimization
2. able to understand the background and knowledge of some contemporary topics in database research; typical topics are data mining, uncertainty data management, XML data.
3. able to implement some practical application modules based on selected advanced database techniques.

UNIT I **9**

The Relational Model of Data, Design Theory of Relational Database, High Level Database Models, Algebraic & Logical Query Language, Advanced topics in relational Databases

UNIT II **9**

Database Architectures, Parallel and Distributed Databases, Design of Parallel Databases, Distributed Data Storage-Fragmentation & Replication, Location and Fragment Transparency Distributed Query Processing and Optimization, Distributed Transaction Modelling and Concurrency Control, Distributed Deadlock, Commit Protocols, Parallel Query Evaluation, How to Parallelize Processing

UNIT III **9**

ACID in depth, Transaction Integrity, Advanced Transaction Processing, Transactional Communications, Nested and Multilevel Transactions, Compensating Transactions and Saga, Long Duration Transactions, Weak Levels of Consistency, Transaction Work Flows, Transaction Processing Monitors. Compensation & Transaction Recovery

UNIT IV **9**

Object-oriented/object-relational databases, Active database systems and Real Time Database Systems-Triggers, Event Constraint and Action: ECA Rules, Trigger, WEB Database-Accessing Databases through WEB, WEB Servers, XML Databases, Commercial Systems, Overview of emerging database applications and challenges

Books & References:

1. Elmarsi, Navathe, Somayajulu, Gupta, "Fundamentals of Database Systems", 4th Edition, Pearson Education, 2007
2. Garcia-Molina H, Ullman JD and Widom J, Database Systems: The Complete Book, 2nd Edition, Pearson, 2009.
3. Simon AR, Strategic Database Technology: Management for the Year 2000 (Morgan Kaufmann), 1995
4. Concurrency Control and Recovery in Database Systems-Bernstein, P. A., V. Hadzilacos, N. Goodman (Addison –Wesley), 1987

Readings:

1. An Introduction to Database Systems - Date CJ (Addison Wesley), 8th edition, 2003
2. Transaction Processing: Concepts and Techniques - Gray J and Reuter A. (Morgan Kaufmann), 1993
3. Various journal and conference articles, research reports, and book excerpts as appropriate.

MCS-251 DATA COMMUNICATIONS & ADVANCED INTERNET TECHNOLOGIES 4 Credits (3-1-0)

Learning Goals:

Students will be able to

1. describe modern network architecture, signalling and internet fundamentals required for web programming;
2. implement web applications in using PERL and CGI scripting
3. Usage and Programming implementation of servlets
4. Programming related to JSP with usage of database at backend.

Assessment Methods for Core Learning Goals:

The assessment of Course Learning Goals is based on written tests, labs, and other assignments, as well as performance-based tasks as appropriate, and a departmental final exam.

UNIT I **9**

Communication system models, components, topology, protocols, signal encoding, error detection and correction methods, transmission media and fundamentals of wireless communication.

UNIT II **9**

Internet Basics: Overview of Internet, history, web system, architecture, Uniform Resource Locator, HTTP:protocol basics, HTTP request & response, Cookies Basics, PERL & CGI: CGI architecture, Intro PERL with Features, variable & operators, Control statements, Working with Strings & arrays, File Handling, Pattern matching & formatting, Creating & using subroutines, Using PERL for CGI scripting

UNIT III **9**

Servlets: Introduction , Servlet vs CGI , Servlet API Overview , Servlet Life Cycle , Coding , Writing & running simple servlet , Generic servlet, HTTPServlet , ServletConfig, ServletContest , Writing servlet to handle Get & Post , methods, reading use request data , Session tracking in servlets, Servlets & JDBC. Writing threadsafe servlet

UNIT IV **9**

JSP: Why JSP? , JSP Directives , Writing simple JSP page , Scripting Elements , Default Objects in JSP , JSP Actions , Managing Sessions using JSP , JSP with beans , JSP & Databases , Error Handling in JSP ,Introduction to custom tag.

Books & References:

1. E-Commerce Fundamentals & Application (Wiley publications)
2. Teach Yourself PERL in 21 days (Pearson Education)
3. Programming the World Wide Web - Robert W. Sebesta
4. Web enabled commercial application development using HTML, DHTML, JavaScript, PERL-CGI - Ivan Bayross
5. Inside Servlets - Dustine R. Callway
6. Developing Java Servlets - James Goodwill
7. Professional JSP - Wrox press
8. Complete reference JSP
9. Java Server Programming Vol. I - Wrox press.

MCS-252 NETWORK SECURITY & CYBER LAW 4 Credits (3-1-0)

Learning Goals: Students will be able to

1. Understand threats to network and information security;
2. Understand Security challenges related to mobile devices
3. Need and usage of security measures like digital signature, finger prints, firewalls, security concern in VPN
4. Understanding the applications of patent, copyright laws against different types of cybercrimes

Assessment Methods for Core Learning Goals:

The assessment of Course Learning Goals is based on written tests, labs, and other assignments, as well as performance-based tasks as appropriate, and a departmental final exam.

UNIT I **9**

History of Information Systems, and its Importance, basics, Changing Nature of Information Systems, Need of Distributed Information Systems, Role of Internet and Web Services, Information System Threats and attacks, Classification of Threats and Assessing Damages, Security in Mobile and Wireless Computing- Security Challenges in Mobile Devices, authentication Service Security, Security Implication for organizations, Laptops Security; Basic Principles of Information Security, Confidentiality, Integrity Availability and other terms in Information Security, Information Classification and their Roles.

UNIT II **9**

Security Threats to E Commerce, Virtual Organization, and Business Transactions on Web, E Governance and EDI, Concepts in Electronics payment systems, E Cash, Credit/Debit Cards. Physical Security- Needs, Disaster and Controls, Basic Tenets of Physical Security and Physical Entry Controls, Access Control- Biometrics, Factors in Biometrics Systems, Benefits, Criteria for selection of biometrics, Design Issues in Biometric Systems, Interoperability Issues, Economic and Social Aspects, Legal Challenges

UNIT III **9**

Model of Cryptographic Systems, Issues in Documents Security, System of Keys, Public Key Cryptography, Digital Signature, Requirement of Digital Signature System, Finger Prints, Firewalls, Design and Implementation Issues, Policies; Network Security- Basic Concepts, Dimensions, Perimeter for Network Protection, Network Attacks, Need of Intrusion Monitoring and Detection, Intrusion Detection; Virtual Private Networks- Need, Use of Tunneling with VPN, Authentication Mechanisms, Types of VPNs and their Usage, Security Concerns in VPN

UNIT IV **9**

Security metrics- Classification and their benefits; Information Security & Law, IPR, Patent Law, Copyright Law, Legal Issues in Data mining Security, Building Security into Software Life Cycle; Ethics- Ethical Issues, Issues in Data and Software Privacy; Cyber Crime Types & overview of Cyber Crimes

Books & References:

1. Information Systems Security – Godbole (Willey)

2. Information Security – Merkov, Breithaupt (Pearson Education)
3. Information Assurance for the Enterprise - Schou, Shoemaker (Tata McGraw Hill)
4. Cyber Laws Simplified – Sood (McGraw Hill)
5. Computer Insecurity – Furnell (Springer)
6. IT Act 2000

MCS-253 ADVANCE TOPICS ON COMPUTER NETWRKS 4 Credits (3-1-0)

Course Objectives

1. To study the problematic of service integration in TCP/IP networks focusing the protocol design, implementation and performance issues.
2. To debate the current trends and leading research in the computer networking area.
3. To understand the recent advancement in networking.

Learning Outcomes:

1. To gain a thorough understanding of the design of modern computer networks and protocols, including the Internet.
2. To understand the workings of at least one actual TCP/IP Stack and will be able to apply this understanding in modifying it or implementing additional protocols.

UNIT I **9**

Introduction: Internet protocol stack, MAC protocols for high-speed LANS, MANs, DQDB, FDDI, Gigabit Ethernet, Wireless Ethernet.

UNIT II **9**

Network Layer:

Internet Architecture and addressing, IPv4, Routing Protocols- OSPF, RIP, BGP. IPv6- basic protocol, extensions and options, support of QoS, security, etc. Mobility in networks, Mobile IP, Multicast routing protocols

UNIT III **9**

Transport Layer:

Design Issues, Connection management, Transmission Control Protocol (TCP), User Datagram Protocol (UDP), TCP extensions for high-speed networks, SCTP protocol, Wireless TCP, RTP, Mobile TCP, RTCP.

UNIT IV **9**

Application Layer:

Principles of Network Applications, The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, Domain Name System, P2P File Sharing, Voice over IP.

Books & References:

1. Data Communications and Networking -Behrouz A. Forouzan (Tata McGraw Hill), 4th edition, 2007
2. Data Communications - W. Stallings (PHI Publication)
3. TCP/IP Illustrated, Volume 1: The Protocols - W.R. Stevens (Addison Wesely), 1994
4. An Engineering Approach to Computer Networking -S. Keshav (Pearson Education)
5. Computer and Communication Networks - Nader F. Mir (Pearson Education), 2007
6. Computer Networking: A Top-Down Approach Featuring the Internet - James F. Kurose, Keith W. Ross (Pearson Education), 3rd edition, 2007
7. The Internet and Its Protocols - A. Farre (Elsevier)

MCS-254 WIRELESS NETWORKS SECURITY AND ADMINISTRATION 4 Credits (3-1-0)

Course Objectives: Upon successful completion of the course, students:

1. The goal of Wireless Network Security is to familiarize students with the issues and technologies involved in designing a wireless system that is robust against attack.

2. Students will be trained for computer PC repair and maintenance, operating systems installation and troubleshooting, computer networking, and system administration and security
3. Students will gain an understanding of the various ways in which wireless networks can be attacked and tradeoffs in protecting networks.
4. Students will gain an appreciation of the need to develop an understanding of underlying system applications and potential security issues early in the design process.
5. Students will achieve a thorough understanding of the design, installation, maintenance, and troubleshooting of computers, operating systems and wired/wireless networks.

Learning Outcomes: In order to pass, the student must be able to

1. Identify the key security roles and placement issues for wireless network security elements
2. Defend a computer against a variety of different types of security attacks using a number of hands-on techniques.
3. Defend a LAN against a variety of different types of security attacks using a number of hands-on techniques.
4. Practice and use safe techniques on the World Wide Web.
5. Understand the network analysis, simulation, testing and optimizing of security attacks to provide Quality of Service.

UNIT I **9**

Introduction- Overview of Cryptography and Basic Wireless issues, Security Services, Mechanisms, and administration, Security issues particular to wireless. Economic tradeoffs, introduction to security assessment process

UNIT II **9**

Security in Bluetooth, Security in Wireless LANs, Security in Cellular Networks, Wide Area Wireless Data Services (CDPD, GPRS, EDGE, etc.), security and privacy in RFID systems, vehicular networks, wireless mesh networks, satellite networks, etc.

UNIT III **9**

Spread Spectrum Technologies, IEEE 802.11-2007 Standard (as amended and including 802.11n-draft2.0), IEEE 802.11 Industry Organizations and Their Roles, IEEE 802.11 Network Design, Implementation, and Management, IEEE 802.11 Network Troubleshooting

UNIT IV **9**

IEEE 802.11 Network Security Architecture, IEEE 802.11 Network Security Analysis, Performance Analysis, and Troubleshooting, IEEE 802.11 Network Security Policy Basics, IEEE 802.11 Network Site Survey Fundamentals, EEE 802.11 Network Site Survey Systems and Devices, Advanced Topics, Future Directions, and case studies.

Books & References:

1. Wireless Security–Models, Threats, and Solutions - Nichols and Lekkas (McGraw Hill), 2002, ISBN 0071380388.
2. Security and Cooperation in Wireless Networks - Buttyan and Hubaux
3. Guide to Wireless Network Security - Vacca
4. Network Security: Private Communication in a Public World - Charlie Kaufman, Radia Perlman, and Mike Speciner (Prentice Hall), 2nd edition, ISBN-10: 0130460192
5. Network Security: Current Status and Future Directions - Douligeris and Serpanos
6. CWNA: Certified Wireless Network Administrator Certification - Veronica Henry
7. Security for Wireless Sensor Networks - Liu and Ning
8. http://www.cis.syr.edu/~wedu/Teaching/wireless/syllabus.html

MCS-255 ADVANCES IN NATURAL LANGUAGE PROCESSING 4 Credits (3-1-0)

Course Objectives:

1. Upon completion of 6.864, students will be able to explain and apply fundamental algorithms and techniques in the area of natural language processing (NLP). In particular, students will:
2. Understand approaches to syntax and semantics in NLP.
3. Understand approaches to discourse, generation, dialogue and summarization within NLP.

4. Understand current methods for statistical approaches to machine translation.
5. Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP.

Learning Outcomes:

1. Upon Completion of the course, the students will be able to
2. Understand the mathematical and linguistic foundations underlying approaches to the above areas in NLP (measured by problem sets and quizzes).
3. Design, implement and test algorithms for NLP problems (measured by problem sets).

UNIT I **9**

Basic automata theory, Finite-state acceptors and transducers, weighted finite-state acceptors and transducers ,The noisy-channel model, language models and their applications, earning models from data, String transformations and their applications.

UNIT II **9**

Bayesian inference: Variational methods. Monte Carlo methods: Metropolis-Hastings, Gibbs sampling, sampling from FSTs, slice sampling, particle filtering, Spectral learning,+ Discriminative training, The perceptron algorithm, Conditional random fields, Max-margin training, Discriminative unsupervised training.

UNIT III **9**

Context-free grammars (CFGs), Parsing, Inside-Outside algorithm, Statistical parsing, Synchronous context-free grammars and machine translation, Dependency parsing, Spanning trees, Chu-Liu-Edmonds algorithm, Matrix-Tree Theorem, Tree-adjoining grammars and graph rewriting grammars.

UNIT IV **9**

Machine Translation – Transfer Metaphor - Interlingua and Statistical Approaches, Discourse Processing – Dialog and Conversational Agents – Natural Language Generation – Surface Realization and Discourse Planning.

Books & References:

1. Speech and Language Processing -Daniel Jurafsky and James H. martin, 2000
2. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, 2nd edition - Daniel Jurafsky and James Martin. (J&M)
3. Survey of the State of the Art in Human Language Technology - Ron Cole, J.Mariani, et.al (Cambridge University Press), 1997.
4. Survey of Text Mining: Culstering, Classification and Retrieval- Michael W. Berry (Springer Verlag), 2003.
5. Foundations of Statistical Natural Language Processing - Christopher D.Manning and Hinrich Schutze (MIT Press), 1999

MCS-256 BIO INFORMATICS 4 Credits (3-1-0)

Course Objectives: Upon successful completion of the course, students

1. know and understand the basic computational methods of organizing and analyzing biological data.
2. know and understand the basics of Genome data and its organization.
3. can use the concepts understood in determining the structure predictions of the genome data.
4. can evaluate Perl programs to gain the better understanding of the concepts learned.

Learning Outcomes: In order to pass, the student must be able to

1. list and define the fundamental concepts of bio informatics.
2. Understand the molecular biology data and associated abstractions (sequences, structure, genome expression, molecular network data) access to available resources (public databases, computational tools on the web).
3. Prediction of structure of the various sequence data banks.
4. Apply the bio informatics to the various real world fields such as biotechnology or medical techniques.
5. Manually execute the programs in Perl.
6. Implement basic computational methods for biological data analysis and use understanding of these methods to solve other problems that arise in biological data analysis.

UNIT I **9**

Introduction to Genomic Data and Data Organization- Sequence data banks: Introduction to sequence data banks- protein sequence data bank. NBFR-PIR, , SWISSPROT, Signal peptide data bank, Nucleic acid sequence data bank – GenBank, EMBL nucleotide sequence data bank, AIDS virus sequence data bank. RRNA sequence data bank, structural data banks-protein data bank, The Cambridge Structural Database: Genome data bank - Metabolic pathway data: Microbial and Cellular Data banks.

UNIT II **9**

Introduction to Microbial Strain Data Network (MSDN)- Numerical Coding System of Microbes, Hibridoma Data Bank Structure, Virus Information System Cell, line information system: other important data banks in the area of biotechnology/life sciences/ bio diversity.

Sequence Analysis: Analysis Tools for Sequence Data Banks; Pairwise Alignment- NEEDLEMAN and Wunsch Algorithm, Smith Waterman, BLAST, FASTA Algorithms to analyze Sequence Data: Sequence Pattern Motifs and Profiles.

UNIT III **9**

Secondary Structure Predictions- Prediction Algorithms: Chao Fasman Algorithm, Hidden Markov Model, Neural Networking, Tertiary Structure Predictions, Prediction Algorithms.

UNIT IV **9**

Applications in Bio Technology-Protein Classifications, Fold Libraries, Protein Structure Prediction: Fold Recognition (Threading), Protein structure predictions: Comparative Modeling (Homology), Advanced Topics: Protein Folding, Protein Legand Interactions, Molecular Modeling and Dynamics, Drug Designing.

Books & References:

1. Introduction to Bioinformatics – Atwood (Pearson Education)
2. Introduction to Bioinformatics - Lesk
3. Bioinformatics Computing – Bergeron (Pearson Education)
4. Developing Bioinformatics Computer - Cynthia Gibas and Per Jambeck (SPD), 2001.
5. Beginning Perl for Bioinformatics, Tisdall (SPD).
6. Biocomputing: Informatics and Genome Projects - Smith, D. W. (Academic Press, New York), 1994.
7. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins - Baxevanis, A. D. Quellette, B. F. F. John (Weiley and Sons)
8. Bioinformatics – CSV (Himalya)

Software:

The examples and assignments will be implemented using Perl.

Readings:

Various journal and conference articles, research reports, and book excerpts as appropriate

MCS-257 NEURAL NETWORKS AND FUZZY LOGICS 4 Credits (3-1-0)

Course Objectives: Upon successful completion of the course, students

1. know and understand the fundamental concepts, techniques, and terminology of the Computational Intelligence such as neural network and fuzzy logic.
2. know and understand the basic structure and learning mechanism of the neural networks.
3. Know and understand the probabilistic reasoning using fuzzy inference rules.
4. can evaluate the performance of the neural network by applying various learning mechanisms.
5. know and understand the hybrid intelligent systems combining the best features of neural networks and fuzzy logic.

Learning Outcomes: In order to pass, the student must be able to

1. list and define the fundamental concepts of neural networks.
2. List and define the fundamental concepts of fuzzy logic.
3. manually execute a program to incorporate learning in a neural network by suitably adjusting the weights and biases.
4. Apply the concepts of fuzzy logic reasoning in real world applications.

UNIT I **9**

Basic concepts- Introduction to Neural Network, Human Brain, Models of a Neuron, Neural Network as Directed Graph, Network Architectures, Knowledge Representation, **Single Layer Perceptron**- Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Relation between Perceptron and Bayes Classifier for Gaussian Environment **Advanced Algorithms**- Adaptive Network- Radial Basis Network, Modular Network- Applications, Artificial Intelligence and Neural Networks. **Multilayer Perceptron-** Back Propagation Algorithm, XOR Problem.

UNIT II **9**

Learning rules- Error Correction Learning, Memory Based Learning, Competitive Learning, Boltzman Learning, Credit Assignment Problem, Memory, Statistical Nature of Learning Process, Unsupervised Learning, **Competitive Learning Networks**- Kohonen **Self Organizing Networks**- Learning Vector Quantization, Hebbian Learning, Learning Curve, Learning rate annealing Techniques, Perceptron Convergence Theorem, **Hopfield Network**- content addressable nature, Binary Hopfield network, Continuous Hopfield Network, Traveling salesman problem, **Adaptive Resonance Theory**- Bidirectional Associative Memory- Principle, Component, Analysis.

UNIT III **9**

Introduction- Crisp sets: An Overview, Th Notion of Fuzzy Sets, Basic Concept of Fuzzy Sets, **Classical Logic**- An Overview, Fuzzy Logic, **Operations on Fuzzy Sets**- Fuzzy Complement, Fuzzy Union, Fuzzy Intersection, Combination of Operations- General Aggregation Operations.

Crisp and Fuzzy Relations- Binary Relations, Binary Relations on a Single Set, Equivalence and Similarity Relations, Compatibility or Tolerance Relations, Ordering, **Membership Functions**- Methods of Generation, Defuzzification Methods. Applications of Fuzzy Logic Rules in Engineering Problems.

UNIT IV **9**

Adaptive Neuro Fuzzy Based inference systems- Classification and Regression Trees, decision trees, CART Algorithms, **Data clustering algorithms-** K- Means Clustering, Fuzzy C Means Clustering, Mountain Clustering, Subtractive Clustering, Rule Based Structural Identification, **Neuro Fuzzy Controls-**Adaptive Neuro Fuzzy Inference Systems (ANFIS), Fuzzy Associative Memories, Fuzzy Rule Generation Using Neural Network Approaches, Control Systems, Expert Control, Inverse Learning, Specialized Learning, Back propagation through Real- Time Recurrent Learning.

Books & References:

1. Neuro Fuzzy and Soft Computing - Jang J. S. R. , Sun C. T. and Mizutani E. (Pearson Education), 2004
2. Fundamentals of Neural Networks - Laurence Fauseett (Prentice Hall India, New Delhi), 1994
3. Fuzzy Logic Engineering Applications – Ross (McGraw Hill, New York), 1997
4. Neural Networks, Fuzzy Logics and Genetic Algorithms - S. Rajsekeran, G. A. Vijaylakshmi Pai (Prentice Hall of India), 2003
5. Fuzzy Sets and Fuzzy Logic - George J. Klir and Bo Yuan (Prentice Hall Inc. New Jersey), 1995
6. Principles of Soft Computing- S. N. Sivnandam, S. N. Deepa (Wiley India Pvt. Ltd.)
7. Artificial Neural Networks - H. Vegnanarayana (Prentice Hall of India Pvt. Ltd.), 2005
8. Neural Networks - James A. Ereeman, David M. S. Kapura (Pearson Education), 2004
9. Soft Computing: New Trends and Applications- L. Fortuna, G. Rozzotto, M. Lavorgna (Springer)
10. First Course on Fuzzy Theory and Applications - Kwang Hyung Lee (Springer)
11. Applications and Science in Soft Computing - Ahmad Lotfi, Jonathan Garibaldi (Springer)
12. Soft Computing and Industry: Recent Applications - Rajkumar Rao, Mario Koppen (Springer)
13. Soft Computing in Engineering Design and Manufacturing - Pravir Chawdhry, Rajkumar Roy, Raj Pant (Springer).

Readings:

Various journal and conference articles, research reports, and book excerpts as appropriate

MCS-258 PATTERN RECOGNITION AND IMAGE PROCESSING 4 Credits (3-1-0)

Course Objectives: Upon successful completion of the course, students:

1. know and understand the fundamental concepts, techniques, and terminology of the pattern recognition.
2. know and understand the fundamental and various methods of pattern classification.
3. know and understand the concept of supervised and unsupervised classification techniques and differentiation among them.
4. know and understand the fundamentals of a digital image.
5. understand the concepts of the various steps of an image processing system.

Learning Outcomes: In order to pass, the student must be able to

1. Explain and compare a variety of pattern classification, structural pattern recognition and pattern classifier combination techniques.
2. Summarize, analyze and relate research in the pattern recognition area verbally and in writing.
3. Apply performance evaluation methods for pattern recognition and critique comparisons of the techniques in the research literature.
4. Apply pattern recognition techniques to real world problems such as document analysis and recognition.
5. Implement simple pattern classifiers, classifier combinations and structural pattern recognizers.
6. Manually perform the various filter and transformation operations on the image.
7. Implement various operations on the image using the software MATLAB.
8. Apply the various image processing techniques and pattern classification mechanisms to real world problems.

UNIT I **9**

Pattern recognition fundamentals: Basic concepts of Pattern recognition, Fundamental Problems in Pattern Recognition System, Design Concept and Methodologies, Example of Automatic Pattern Recognition Systems, Simple Automatic Pattern Recognition Model.

Pattern classification: Pattern Classification by Distance Function, Measures of Similarity, Clustering criteria, K-means Algorithm and Pattern Classification by Likelihood Function, Support Vector Machine Classifier, Learning Vector Quantization, Pattern Classification as a Statistical Decision Problem, Bayes Classifier for Normal Patterns,

Problem of Dimensionality: Feature Extraction, Feature Selection Karhunen Loeve, Stochastic Approximation, Kernel Approximation, Divergence Measure, Independent Component Analysis.

UNIT II **9**

Introduction: Image Definition and its Representation, Neighborhood, Orthogonal Transformation like DFT, DCT, Wavelet. Fundamental Steps of Image Processing, Components of an Image Processing System, Image Model- Image Acquisition, Sampling and Quantization, Relationship between Pixels, Distance Functions, Scanner.

Enhancement and restoration

Contrast Enhancement, Smoothing and Sharpening, Filtering and Restoration, Intensity Functions, Transformations, Histogram Processing, Smoothing and Sharpening, Spatial Filters, Frequency Domain Filters, Homomorphism Filtering, Image Filtering and Restoration, Inverse Weiner Filtering, Filtering using Image Transforms, Smoothing Splines and Interpolation, **Basic Morphological Operations**-Opening and Closing Operations, Dilations and Erosions, Hit or Miss Transforms, Morphological Algorithms, Extension to Gray Scale Images.

UNIT III **9**

Segmentation and edge detection region operations: Pixel Classification, Local/Global Gray Level Thresholding, **Basic Edge Detection**- Hough Transform, Second Order Detection, Crack Detection, Gradient Operators, Compass and Laplace Operators, Edge Linking and Boundary Detection, Threshold Region based Segmentation, Segmentation by Morphological Watersheds.

Image Compression: Image Feature/ Primitive Extraction, Component Labeling, Medial Axis Transform, Skeletonization, Shape Properties, Textural Features- Fourier Descriptor, Types and Requirements, Statistical Compression, Spatial Compression, Contour Coding, Quantizing Compression, Image Data Compression-Predictive Technique, Pixel Coding, Transfer Coding Theory, Lossy and Lossless Predictive Type Coding.

UNIT IV **9**

Representation and Description: Chain Codes, Polygonal Approximation, Signature Boundary Segments, Skeletons, Boundary Descriptors, Regional Descriptors, Relational Descriptors, Principle Components for Description, Advanced Applications Like Biomedical Image Processing and Digital Watermarking.

Books & References:

1. Digital Image Processing-Rafel C. Gonzalez, Richard E. Woods (Pearson Education), 3rd edition
2. Pattern Recognition Principles - Julus T. Tou and Rafel C. Gonzalez (Addision-Wesly)
3. Image Processing, Analysis and Machine Vision- Milan Sonka, Vaclav Illavac and Roge Boyle (Thomson Learning), 2nd edition
4. Digital Image Processing -Williamk Pratl (John Weiley)
5. Fundamentals of Digital Image Processing - A. K. Jain (Prentice Hall of India, New Delhi), 2000.
6. Pattern Classification - Richard Duda, Hart and David Strok (John Weiley Publishers)
7. Digital Image Processing - S. Jayaraman, S. Esakkirajan, T. Veerakumar (TMH)
8. Pattern Recognition - R. Shinghal (Oxford University Press)
9. Computational Intelligence: Principles, Techniques and Applications - A. Konar (Springer), 2005
10. Combining Pattern Classifiers: Methods and Algorithms - Lumila I. Kuncheva (Wiley), 2004
11. Pattern Recognition - S. Theodoris, K. Koutroumbas (Academic Press), 1999.

Readings

Various journal and conference articles, research reports, and book excerpts as appropriate

ELECTRICAL ENGINEERING DEPARTMENT
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COURSES OFFERED

Program Core (Power Electronics & Drives)

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MAS-101	Numerical Methods & Engineering Optimization	-	3	1	2	5
2.	MEE-101	Advance Microprocessors & Applications	-	3	1	2	5
3.	MEE-102	Electric Drives & Traction	Power Electronic	3	1	0	4
4.	MEE-103	Power Converter -I	-	3	1	2	5
5.	MEE-104	Modeling, Simulation & Evolutionary Techniques	-	3	1	2	5
6.	MEE-105	Power Converter -II	Power Converter -I	3	1	0	4
7.	MEE-130	Dissertation Part-I	-	0	0	8	4
8.	MEE-120	Minor Project	-	0	0	8	4
9.	MEE-140	Seminar	-	0	0	4	2
10.	MEE-150	Dissertation Part-II	Dissertation Part-I	0	0	28	14

Program Electives PE1 & PE2 (Power Electronics & Drives)

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MEE-151	Power system Planning & Optimization	-	3	1	0	4
2.	MEE-152	Power Semiconductor Controlled Drives	-	3	1	0	4
3.	MEE-153	System Reliability	-	3	1	0	4
4.	MEE-154	Operation Research	-	3	1	0	4
5.	MEE-155	Fuzzy, ANN and AI Systems	-	3	1	0	4
6.	MEE-156	Robotics & Automation	-	3	1	0	4
7.	MEE-157	FACTS Controllers & Devices	-	3	1	0	4
8.	MEE-158	Modeling and Simulation of Power Electronic Circuits	-	3	1	0	4

Program Electives PE3 & PE4 (Power Electronics & Drives)

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MEE-159	New and Renewable Energy Resources	-	3	1	0	4
2.	MEE-160	Electric Power Quality	-	3	1	0	4
3.	MEE-161	Power System Instrumentation	-	3	1	0	4
4.	MEE-162	Digital Signal Processing	-	3	1	0	4
5.	MEE-163	HVDC Systems	-	3	1	0	4
6.	MEE-164	Energy Management	-	3	1	0	4
7.	MEE-165	Power System Dynamics & Control	-	3	1	0	4
8.	MEE-166	Special Electric Machine	-	3	1	0	4

SYLLABI

MEE-101 ADVANCE MICROPROCESSORS AND APPLICATIONS 5 Credits (3-1-2)

UNIT I **9**

Introduction to Microprocessors and Microcontrollers: Review of basics microprocessor, architecture and instruction set of a typical 8 bit microprocessor. Overview of 16 bit and 32 bit microprocessors, arithmetic and I/O coprocessors, Architecture, register details, operation, addressing modes and instruction set of 16 bit 8086 microprocessor, assembly language programming, introduction to multiprocessing, multi-user, multitasking operating system concepts, Pentium-1,2,3 and 4 processors, Motorola 68000 processor. Concepts of micro controller and micro computer, microcontroller (8051/8751) based design, applications of microcomputer in on line real time control

UNIT II **9**

Input/Output, Memory Interfacing: Parallel and series I/O, Interrupt driven I/O, single and multi interrupt levels, use of software polling and interrupt controlling for multiplying interrupt levels, programmable interrupt controller, DMA controller, programmable timer/counter, programmable communication and peripheral interface, synchronous and asynchronous data transfer, standard serial interfaces like Rs.232. Types of Memory, RAM and ROM interfacing with timing considerations, DRAM interfacing

UNIT III **9**

Programmable Support Chips: Functional schematic, operating modes, programming and interfacing of 8255, 8251, 8259 and 8253 with microprocessor

UNIT IV **9**

Analog Input & Output: Microprocessor compatible ADC and DAC chips, interfacing of ADC and DAC with microprocessor, user of sample and hold circuit and multiplexer with ADC.

Microprocessor Applications: Design methodology, examples of microprocessor applications.

EXPERIMENTS

1. Simple arithmetic operations: Multi precision addition / subtraction / multiplication / division
2. Programming with control instructions: Increment / Decrement, Ascending Descending order, Maximum / Minimum of numbers, Rotate instructions, Hex /ASCII / BCD code conversions
3. Interface Experiments: A/D Interfacing, D/A Interfacing, Traffic light controller
4. Interface Experiments: Simple experiments using 8255, 8254/8253, 8251,8279
5. Programming with 8086-experiments including BIOS/DOS calls: Keyboard control, Display, File Manipulation.
6. Programming practice on MACRO assembler and simulator tools.
7. Demonstration of basic instructions with 8051 Micro controller execution, including Conditional jumps, looping, Calling subroutines, Stack parameter testing
8. Parallel port programming with 8051 using port 1 facility: Stepper motor and D / A converter.
9. Programming Exercise on RAM direct addressing and Bit addressing
10. Study of Microcontrollers with flash memory.

Books & References:

1. Advanced Microprocessors - Y. Rajshree (New Age International Publication), 2008
2. Advanced Microprocessors - A. K. Rai and K. M. Bhurchandi (Tata McGraw Hill), 2006

MEE-102 ELECTRIC DRIVES & TRACTION 4 Credits (3-1-0)

UNIT I **9**

Basic drive components, classification and operating modes of electric drive, nature and types of mechanical loads, review of speed-torque Characteristics of electric motors and load, joint speed-torque characteristics, plugging, dynamic and regenerative braking of dc and ac motors.

UNIT II **9**

Equation of motion, equivalent system of motor-load combination, stability considerations, electro-mechanical transients during starting and braking, calculation of time and energy losses, optimum frequency of starting

UNIT III **9**

Electric traction services, duty cycle of traction drives, calculations of drive rating and energy consumption, desirable characteristics of traction drive and suitability of electric motors, control of traction drives. Losses in electric drive system and their minimization energy, efficient operation of drives, load equalization.

UNIT IV **9**

Heating and cooling of electric motors, load diagrams, classes of duty, reference to Indian Standards, estimation of rating of electric motors for continuous, short time and intermittent ratings, Servo motor drive, stepper motor drive, linear induction motor drive, permanent magnet motor drive. Selection criteria of electric drive for industrial applications, case studies related to steel mills, paper mills, textile mills and machine tool etc.

Books & References:

1. Electric Drives- N. K. De (Prentice Hall of India), 2006.
2. Utilization of Electric Power- R. K. Rajput (Laxmi Publication), 2013.
3. Utilization of Electric Powers- N. V. Suryanarayana (New Age Publication), 1994.

MEE-103 POWER CONVERTER-I 5 Credits (3-1-2)

UNIT I **9**

Power Semiconductor Devices: Structure, Characteristics, ratings and protection of SCR, triac and Gate Turn Off Thyrister.

UNIT II **9**

Line Commutated Converters: Single and three phase fully controlled and half controlled converters, performance characteristics, effect of source inductance, discontinuous current operation, inverter operation, power factor improvement techniques, sequence control, 12-pulse converters, dual converter, triggering circuits.

UNIT III **9**

AC Voltage Controllers: Single phase AC voltage controllers feeding resistive and resistive-inductive loads, sequence control, three phase AC voltage controllers.

UNIT IV **9**

Cyclo-Converter: Single phase and three phase cyclo-converters, circulating and non-circulating current operations, performance characteristics, control of harmonics, voltage and frequency control, control circuit.

EXPERIMENTS

1. Study of 1-phase AC to DC controlled converter (half controlled and full controlled).
2. Study the of 3- phase AC to DC full controlled converter.
3. Study of a Triac based single phase ac regulator and determine of Thyristor switching characteristics and pulse transformer characteristics.
4. Study of Thyristors based dc to dc converter (dc chopper).
5. Study of a 3 phase PWM inverter with fixed output frequency and study of a non –PWM type inverter with 120 degree conduction of switches.
6. Study of an inverter fed adjustable speed drive for a 3 phase induction motor.
7. Study of a Thyristor based dc-drive with closed loop speed control.
8. MOSFET based dc to dc converter (buck, boost and buck-boost types with non-isolated output voltage)
9. Study of an industrial type fly-back dc to dc converter with isolated and regulated voltage.
10. Study of a single phase PWM AC to DC converter.

Books & References:

1. Power Electronics-P. C. Sen (Tata McGraw Hill), 1987
2. Power Electronics-R. S. Ananda Murthy and V. Nattarasu (Pearson India Publication), 2010
3. Fundamental of Electrical Drives- G. K. Dubey (Alpha Science), 2001

MEE-104 MODELING, SIMULATION & EVOLUTIONARY TECHNIQUES **5 Credits (3-1-2)**

UNIT I **9**

Modeling: Model classification, Mathematical, physical and analog models, Estimation of model parameters.

UNIT II **9**

Simulation: Experimental nature of simulation, steps involved in simulation studies, Validation of simulation models, computer simulation of continuous & discrete systems.

UNIT III **9**

Evolutionary Techniques I: Neural networks, Fuzzy logic systems and their applications.

UNIT IV **9**

Evolutionary Techniques II: Genetic algorithms, Hybrid systems and their applications.

EXPERIMENTS

1. Single phase fully controlled converter using R and RL load using MATLAB / SIMULINK
2. Three phase fully controlled converter using R and RL load using MATLAB / SIMULINK
3. Single phase AC voltage regulator using MATLAB / SIMULINK
4. Formation of Y bus matrix by inspection / analytical method using MATLAB Software
5. Formation of Z bus using building algorithm using MATLAB Software
6. Gauss Seidal load flow analysis using MATLAB Software
7. Newton Raphson method of load flow analysis using MATLAB Software
8. Fast decoupled load flow analysis using MATLAB Software
9. Fault analysis using MATLAB Software
10. Economic dispatch using MATLAB Software

Books & References:

1. Neural Networks, Fuzzy Logic and Genetic Algorithms- S. Rajsekaran and G. A. V. Pai (Prentice Hall of India), 2013.
2. Fundamental of Artificial Neural Network and Fuzzy Logic- Rajesh Kumar (University Science Press), 2009.

MEE-105 POWER CONVERTER-II **4 Credits (3-1-0)**

UNIT I **9**

Power Semiconductor Devices: Structure, characteristics and ratings of Power Transistor, MOSFET, Insulated Gate Bipolar Transistor (IGB) and MOS – Controlled Thyristor (MCT), drive and snubber circuits.

UNIT II **9**

DC-DC Converters: Review of chopper fundamentals, Step down chopper with resistive and resistive-inductive loads with continuous and discontinuous current operations, step up chopper, commutation techniques, impulse commutated and resonant pulse choppers, multiquadrant and multiphase choppers.

UNIT III **9**

DC-AC Inverters: Single phase and three phase voltage source and current source inverters, commutation methods, voltage and frequency control, harmonics reductions

UNIT IV **9**

Resonant Inverters: Classification, series and parallel resonant inverters, load resonant inverters, zero voltage switching and zero current switching resonant inverters, resonant dc link inverters

Books & References:

1. Power Electronics- M. H. Rashid (Pearson Prentice Hall), 2009
2. Fundamental of Electrical Drives- G. K. Dubey (Alpha Science), 2001

MEE-151 POWER SYSTEM PLANNING & OPTIMIZATION 4 Credits (3-1-0)

UNIT I **9**

Introduction to restructuring of power industry, Key issues and challenges facing power industries, Ancillary services management, deregulation effect

UNIT II **9**

Electricity pricing mechanism in competitive electricity market, Fundamental of Economics, cost criteria.

UNIT III **9**

Concepts of FACTS devices& Controllers, General aspects -HVAC and HVDC links –comparison economic, technical performance reliability-limitation-properties of thyristor converter circuits, custom Power and custom power park.

UNIT IV **9**

Automatic generation control -Review of load frequency control (LFC) and Economic Dispatch control (EDC), Reactive Power management, optimal power flow control

Books & References:

1. Electric Power Applications of Optimization - James A. Momoh (Marcel Dekker), 2001
2. Optimization of Power System Operation - Jizhog Zhu (Wiley), 2009
3. Power system Optimization - D. P. Kothari, J. S. Dhillon (PHI Publication), 2011

MEE-152 POWER SEMICONDUCTOE CONTROLLED DEVICES 4 Credits (3-1-0)

UNIT I **9**

Solid state controlled electric drive-Concept, elements and salient features, power converter motor system, closed loop control of electric drives, sensing of speed and current, performance parameters.

UNIT II **9**

Control of D.C. separately and series excited motor drives using controlled converters (single phase and three phase) and choppers, static Ward-Leonard control scheme, solid state electric braking schemes, closed loop control of solid state DC drives.

UNIT III **9**

Operation of induction and synchronous motor drives from voltage source and current source inverters slip power recovery, pump drives using AC line controllers, self-controlled synchronous motor derives, brushless DC motor drive, switched reluctance motor drive.

UNIT IV **9**

Function of microprocessor in electric drive control, salt features of microprocessor control microprocessor based control scheme for D.C. induction and synchronous motor drives, applications.

Books & References:

1. Power Semiconductor Drives- S. Sivanagaraju, M. Balasubba Reddy and A. M. Prasad (PHI), 2009
2. Fundamental of Electric Drives- G. K. Dubey (Alpha Science), 2001

MEE-153 SYSTEM RELIABILITY 4 Credits (3-1-0)

UNIT I **9**

Rliability: Definition and basic concepts, Failure data, failure modes and reliability in terms of hazard rates and failure density function. Hazard models and bath tub curves, Applicability of Weibull distribution

UNIT II **9**

Reliability calculation for series, parallel, parallel-series and K-out-M systems Use of redundancy and system reliability improvement methods

UNIT III **9**

Maintenance: Objectives, Types of maintenance, preventive, condition based and reliability centered maintenance. Terotechnology and total productive maintenance, (TPM), Maintainability: Definition, basic concepts, Relationship between reliability, maintainability and availability: corrective maintenance time distributions and maintainability demonstration.

UNIT IV **9**

Design considerations for maintainability. Introduction to life testing-estimation of parameters for exponential and Weibell distributions, component reliability and MIL standards

Books & References:

1. Power Distribution System Reliability- Ali A. Chowdhary and Don O. Koval (Wiley), 2009
2. Reliability and Safety Engineering- A. K. Verma and S.A Durga (Springer), 2010

MEE-154 OPERATION RESEARCH 4 Credits (3-1-0)

UNIT I **9**

Linear Programming: Graphical LP solution, simplex method, Big M method, two phase method, degeneracy, alternate optima, unbounded optimal solutions, infeasible solutions, duality and sensitivity analysis- dual simplex method, primal dual computations

Transportation Problems: Determination of starting solution iterative computations of lanation

UNIT II **9**

Integer Programming: Branch and bound method, zero-one implicit enumeration algorithm, cutting plane algorithm**.**

Probabilistic Decision Making: Decision making under risk, probabilistic dynamic programming.

UNIT III **9**

Inventory Models: Static EOQ models, EOQ with price breaks, multi-item EOQ with storage limitation, dynamic EOQ models

Game Theory: Optimal solution of two person zero sum game, solution of mixed strategy games.

UNIT IV **9**

Queuing Theory: Role of exponential distribution, pure birth and death models, generalized Poisson queuing model, specialized Poisson queues.

Project Scheduling by CPM/PERT: Network representations, critical path computations, construction of time schedule.

Books & References:

1. Operations Research- R. Panneerselvan (Prentice Hall of India), 2006.
2. Operations Research- P. SarkarIyer (Tata McGraw Hill), 2008.

MEE-155 FUZZY, ANN AND AI SYSTEMS 4 Credits (3-1-0)

UNIT I **9**

Fuzzy System: Basics: Fuzzy sets and systems, basic concepts, fuzzy sets and crisp sets, fuzzy set theory and operations, fuzzy entropy theorem, fuzzy and crisp relations, fuzzy to crisp conversions.

Fuzzy Associative Memories: Representation of fuzzy sets, membership functions, basic principle of interface in fuzzy logic, fuzzy IF-THEN rules, fuzzy inference engines, fuzzification /defuzzification.

Applications: Fuzzy control system design and its elements, fuzzy logic controller, applications of fuzzy control in electric drive, power system, measurement and instrumentation.

UNIT II **9**

Neural Networks: Basics: Simple neuron, nerve structure and synapse, concept of neural network multilayer nets, auto-associative and hetero-associative networks; neural network tools (NNTs), artificial neural network (ANN) and traditional computers.

Neural Dynamics: Neurons as functions, neuronal dynamic systems, signal functions, activation models.

UNIT III **9**

Synaptic Dynamics: Learning in neural nets, Unsupervised and supervised learning, signal hebbian learning, competitive learning, differential, hebbian learning, differential competitive learning, single layer perception models, the back propagation algorithm

Applications: Applications in load flow study, load forecasting, detection of faults in distribution system and steady state stability, neural network simulator, applications in electric drive control.

UNIT IV **9**

Artificial Intelligent: Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Knowledge Representation & Reasoning, Machine Learning, Pattern Recognition.

Books & References:

1. Artificial Intelligence-Ela Kumar (I. K. International), 2008
2. Neural Networks, Fuzzy Logic and Genetic Algorithms- S. Rajsekaran and G. A. V. Pai (PHI), 2013

MEE-156 ROBOTICS & AUTOMATION 4 Credits (3-1-0)

UNIT I **9**

Robotics: Brief History, Types of robots, Overview of robot subsystems, resolution, repeatability and accuracy, Degrees of freedom of robots, Robot configurations and concept of workspace

UNIT II **9**

Introduction, direct & inverse kinematics of robot arm dynamics: LE formulation, equation of motion; Robot controller design approaches: computed torque, variable structure, and adaptive control;

UNIT III **9**

Image processing fundamentals for robotic applications, image acquisition and preprocessing, Segmentation and region characterization object recognition by image matching and based on features, applications of robotics etc.

UNIT IV **9**

Automation: Introduction to automation**,** Types of production, Functions of Manufacturing, Organization and Information Processing in Manufacturing, Production concepts and Mathematical Models, Automation Strategies, industrial automation and applications, Mechatronics systems.

Books & References:

1. Control in Robotics and Automation- B. K. Ghosh, Hing Xi, T. J. Tan (Academic Press), 1999
2. Robotics and Automation Hand Book-Thomos R. Kurfess (Taylor and Francis), 2005

MEE-157 FACTS CONTROLLERS & DEVICES 4 Credits (3-1-0)

UNIT I **9**

Fundamentals of ac power transmission, transmission problems and needs, emergence of FACTS-FACTS control considerations, FACTS controllers

UNIT II **9**

Principles of shunt compensation – Variable Impedance type & switching converter type- Static Synchronous Compensator (STATCOM) configuration, characteristics and control

UNIT III **9**

Principles of static series compensation, TCSC and TSSC, applications, Static Synchronous Series Compensator (SSSC),Interline power flow controller(IPFC),

UNIT IV **9**

UPFC-Principles of operation and characteristics, independent active and reactive power flow control, comparison of UPFC with the controlled series compensators and phase shifters Generalized Unified Power Flow Controller (GUPFC), unified power flow conditioners,

Books & References:

1. FACTS: Controller in Power Transmission and Distribution - K. R. Padiyar (Anshan Publication), 2009
2. Understanding FACTS: Concept and Technology of FACTS - N. G. Hingorani and L. Gyuayi (Wiley), 2000

MEE-158 MODELING AND SIMULATION OF POWER ELECTRONIC CIRCUITS **4 Credits (3-1-0)**

UNIT I **9**

Simulation Tools: General overview and understanding of SPICE/PSPICE and MATALB SIMULINK software.

UNIT II **9**

Modeling of Power Electronic Drives: Criteria for switch selection, modeling of Diode, SCR, Power Transistor, MOSFET for ac and dc circuits using SPICE/PSPICE and MATLAB SIMULANK software

UNIT III **9**

modeling of and IGBT for ac and dc circuits using SPICE/PSPICE and MATLAB SIMULANK software, simulation of driver and snubber circuits.

UNIT IV **9**

Simulation of Power Electronic Circuits: Simulation and design of converters, choppers, ac voltage controllers, inverters and cyclo-converters

Books & References:

1. Power Electronics - M. D. Singh and K. B. Khanchandani (Tata McGraw Hill), 2007.
2. Power Electronics Handbook - M. H. Rashid, B. H, 2011.

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COURSES OFFERED

Program Core for M.Tech. (Control & Instrumentation)

S.N.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MAS-101	Numerical Methods & Engineering Optimization	-	3	1	2	5
2.	MEE-201	Advance Control System	-	3	1	2	5
3.	MEE-202	Optimal Control	-	3	1	0	4
4.	MEE-203	Advance Measurement & Instrumentation Technology	-	3	1	2	5
5.	MEE-104	Modeling, Simulation & Evolutionary Techniques	-	3	1	2	5
6.	MEE-204	Nonlinear Systems & Adaptive Control	-	3	1	0	4
7.	MEE-230	Dissertation Part-I	-	0	0	8	4
8.	MEE-210	Minor Project	-	0	0	8	4
9.	MEE-240	Seminar	-	0	0	4	2
10.	MEE-250	Dissertation Part-II	Dissertation Part-I	0	0	28	14

Programne Electives PE1 & PE2

S.N.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MEE-151	Power System Planning & Optimization	-	3	1	0	4
2.	MEE-153	System Reliability	-	3	1	0	4
3.	MEE-154	Operation Research	-	3	1	0	4
4.	MEE-155	Fuzzy, ANN and AI Systems	-	3	1	0	4
5.	MEE-156	Robotics & Automation	-	3	1	0	4
6.	MEE-157	FACTS Controllers & Devices	-	3	1	0	4
7.	MEE-251	Biomedical Engineering	-	3	1	0	4
8.	MEE-252	Digital Control Systems	-	3	1	0	4

Programme Electives PE3 & PE4

S.N.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MEE-159	New and Renewable Energy Resources	-	3	1	0	4
2.	MEE-160	Electric Power Quality	-	3	1	0	4
3.	MEE-161	Power System Instrumentation	-	3	1	0	4
4.	MEE-162	Digital Signal Processing	-	3	1	0	4
5.	MEE-164	Energy Management	-	3	1	0	4
6.	MEE-165	Power System Dynamics & Control	-	3	1	0	4
7.	MEE-253	Bio-Medical Signal Processing	-	3	1	0	4
8.	MEE-254	Digital Image Processing	-	3	1	0	4

SYLLABI

MEE-201 ADVANCE CONTROL SYSTEMS 5 Credits (3-1-2)

UNIT I **9**

Advance Control Analysis: Dynamic system modeling, State space model of dynamical system in continuous time and discrete time; Solution of continuous time state equation- similarity transformation; Cayley Hamilton approach and inverse Laplace approach; Solution of discrete time state equation.

UNIT II **9**

Controllability and Observability: General concepts, controllability and observability test for continuous time and discrete time system; test for continuous and discrete time systems; Stabilizabilty and detectability definition and tests; Loss of controllability and observability due to sampling; Controllable and observable canonical forms.

UNIT III **9**

Controller Design: Pole placement technique; Ackerman's approach and linear quadratic regulator for continuous time and discrete time systems;

UNIT IV **9**

Observer Design: Full order and reduced order observer designs.

EXPERIMENTS

1. To obtain the moment of inertia and then develop the transfer function of the given DC Motor for (a) Armature controlled case and (b) Field controlled case. Draw the relevant block diagrams.
2. To conduct experiments on the given amplidyne for (a) To obtain the transfer function (b) To obtain the load characteristics under different levels of compensation (c) To obtain the characteristics of a metadyne.
3. To design a Lag-Lead compensator and to obtain the characteristics by simulation using MATLAB® Verify the performance using experiments with the compensator circuit made of passive elements.
4. To set up a system for closed loop voltage regulation for a dc separately excited generator using amplidyne and to obtain its characteristics
5. To conduct experiments on the Level Process Control Station and to study the working of a level control loop.
6. To set up a closed loop feedback control system using the FEEDBACK® MS150 DC Modular Servo System-with velocity (rate) feedback.
7. Temperature controller using PID.
8. To set up an open loop control system using Micro-processor for controlling the stepper motor
9. To design a Lead compensator and to obtain the characteristics by simulation using MATLAB®. Verify the performance using experiments with the compensator circuit made of passive elements.
10. Effect of P, PD, PI, PID Controller on a second order systems.
11. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor?

Books & References

1. Modern Control System Theory - M. Gopal (New Age International Publishers), 2005
2. Advanced Control Systems - B. N. Sarkar (Printice Hall of India), 2013

MEE-202 OPTIMAL CONTROL 4 Credits (3-1-0)

UNIT I **9**

Dynamic system optimization, Optimal system performance indices, Finite & Infinite horizon problems

UNIT II **9**

Calculus of variations, constrained and unconstrained minimization, Euler equation, Hamiltonian

UNIT III **9**

Optimality principle, Potryagin's principle, Dynamic programming, Matrix Riccati Equation; Hamilton Jacobi Bellman (HJB), Linear Quadratic Regulator (LQR), constrained and unconstrained input

UNIT IV **9**

Linear quadratic Gaussian (LQG), State estimator, Kalman filter, discrete and continuous-time.

Books & References

1. Optimal Control Systems -Desineni Subharam Naidu (CRC Press), 2003
2. Optimal Control- F. L. Lewis, D. L. Varbie and V. L. Syramos (John Wiley), 2012

MEE-203 ADVANCE MEASUREMENT & INSTRUMENTATION TECHNOLOGY — 5 Credits (3-1-2)

UNIT I **9**

Functional elements of measurement systems, Performance characteristics (static/dynamic) of measurement system, Concept of generalized measurement system. Generalized static stiffness and input-output impedance, Error analysis, uncertainty, Histogram, normal distribution, Standards & Echelon labs

UNIT II **9**

Analog measuring instruments, general features, design of sprigs, pivot/jewel, Ammeters, voltmeters, wattmeter, frequency meter, energy meters. Measurement of parameters R, L & C. Transfer function and frequency response of zero, first and second order measurement system

UNIT III **9**

Classification of Instrumentation Transducer, Analog/digital, active/passive, Variable Resistance transducers, Measurement of non electrical parameters: displacement, velocity, acceleration, pressure, force, temperature, humidity, moisture level control/monitoring, Potentiometers, strain gauges, Special Transducers: Piezoelectric, Electromagnetic transducers, Smart Sensors.

UNIT IV **9**

Analog Signal Conditioning techniques: DAQ, Telemetry, Bridge amplifier, carrier amplifiers, charge amplifiers and impedance converters, modulation - demodulation, dynamic compensation, linearization, multiplexing and de-multiplexing. Digital interfacing techniques, Signal Display/Recording systems, Graphic display systems, storage oscilloscope, LED, LCD, Recorders, Microprocessor based measurement & instrumentation schemes.

EXPERIMENTS

1. Measurement of Power and Power Factor of three phase balance inductive load by two wattmeter method.
2. Measurement of speed using Strobometer.
3. Study of Inductive type transducer and use it as an electrical balance and find the weight of given sample.
4. Study of LVDT experimental set up and use it as transducers and take reading of linearity of output variation versus input variation.
5. Calibration of single phase induction type Energy meter with the help of Single phase wattmeter and stopwatch.
6. Measurement of low resistance using Kelvin's Double Bridge.
7. To study AC and DC signal conditioning system.
8. Measurement of speed of given Shunt Motor by Magnetic pick up and photo-electric pick up and verify it by tachometer.
9. Study of analog signal conditioning techniques.
10. Study of different types display devices.

Books & References:

1. Measurement and Instrumentation - Alan S. Morris and R. Langari (Academic Press), 2012
2. Measurement Systems - E. O. Decblin (Tata McGraw Hill), 2001
3. Principle of Measurement Systems - John P. Bentley (Pearson), 2009

MEE-204 NONLINEAR SYSTEMS & ADAPTIVE CONTROL 4 Credits (3-1-0)

UNIT I **9**

Nonlinear Control Systems: Nonlinear models, equilibrium points, linearization of nonlinear models, separable nonlinearities; Describing function analysis, describing function of common nonlinearities; Feedback linearization.

UNIT II **9**

Stability Analysis: Stability concepts, describing function method; Phase plane analysis of nonlinear systems

UNIT III **9**

Lyapunov Stability Analysis: stability definition in the sense of Lyapunov Stability of continuous and discrete time linear systems; Stability of nonlinear systems; Lyapunov stability and instability theorems; Lyapunov's direct method for continuous and discrete time systems; Lyapunov function for nonlinear systems

UNIT IV **9**

Adaptive Control: Adaptive systems, Model Reference Adaptive Control (MRAC), Self Tuning Regulator (STR), dual control; System identification; model predictive control; sliding mode control; H-infinity control; Bang-Bang control system, Applications.

Books & References:

1. Nonlinear and Adaptive Control with Application - A. Astolfi, D. Kargiannis, R.Ortega (Springer), 2008
2. Nonlinear System: Analysis Stability and Control - Shamkar. Sastry (Springer), 1999

MEE-251 BIOMEDICAL ENGINEERING 4 Credits (3-1-0)

UNIT I **9**

Introduction to Bio-medical engineering and its development, anatomy and physiology, Biopotentials, Transducers and Electrodes : Different types of transducers and their selection for Biomedical applications, Electrode theory, Different types of electrode Hydrogen Calomel, Ag-Agcl, Ph, Po2 Pco2 electrodes, selection criteria of electrodes.

UNIT II **9**

Cardiovascular system and measurement: The heart and other cardio vascular systems, Measurement of Blood pressure, Blood flow, Cardiac output and cardiac rate, Electrocardiography, Phonocardiography, Plethysmography, Cardiac pace-maker, defibrillator.

UNIT III **9**

Measurement of electrical Activities in Muscles: Electromyography, Organization of brain: Electroencephalograph and their interpretation, Respiratory system measurement: Respiratory mechanism, Measurement of gas volume, flow rate carbon dioxide & oxygen concentration in inhaled air, Spirometers

UNIT IV **9**

Computer application in bio medical engineering, Medical Imaging: Ultra sound Imaging, Radiography, MRI, Electrical tomography & applications.

Biotelemetry: Transmission and reception aspects of biological signals via long distances. Telemedicine, Aspects of patient care monitoring, prevention against shock hazards.

Books & References:

1. Principle of Biomedical Engineering - S. V. Madihally (Libraray of Congress), 2010
2. Introduction to Biomedical Engineering - J. Enderle and J. Bronzine (Academic Press), 2012

MEE-252 DIGITAL CONTROL SYSTEMS 4 Credits (3-1-0)

UNIT I **9**

Review of Z-transform. Computation of time response of Discrete Data system, Billnear Transformation, W-plane, prewarping, inverse transformation

UNIT II **9**

Design of discrete controllers, Z-domain compensation, w-plane compensation, state variable back deadbeat controller

UNIT III **9**

Sampled data version of PID controllers, Effect of Data Digitization, Effect of finite word size, limit cycle determination

UNIT IV **9**

State Variable Analysis of Digital Control Systems

Books & References:

1. Digital Control Systems - P. N. Parakevopoulos (Prentice Hall), 1996
2. Digital Control and State Variable methods - M. Gopal (Tata McGraw Hill), 2006

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Programme Core for M.Tech. (Digital Systems)

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MAS-112	Advanced Engineering Mathematics	-	3	1	0	4
2.	MEC-101	DSP Processor & Application	-	3	1	0	4
3.	MEC-102	Microprocessor & Microcontroller	-	3	1	2	5
4.	MEC-103	VLSI Technology & Design	-	3	1	0	4
5.	MEC-104	Embedded Systems Design	-	3	1	2	5
6.	MEC-105	Digital Systems Design	-	3	1	0	4
7.	MEC-130	Dissertation Part-I	-	0	0	8	4
8.	MEC-110	Minor Project	-	0	0	8	4
9.	MEC-140	Seminar	-	0	0	4	2
10.	MEC-150	Dissertation Part-II	Dissertation Part-I	0	0	28	14

Programme Electives PE1 & PE2

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MEC-151	Digital Signal Processing	-	3	1	0	4
2.	MEC-152	Digital Control Systems	-	3	1	0	4
3.	MEC-153	ASICs	VLSI Technology & Design	3	1	0	4
4.	MEC-154	Computer Aided Design of Electronics Circuits	VLSI Technology & Design	3	1	0	4
5.	MEC-155	Data and Computer Communication Networks	-	3	1	0	4
6.	MEC-156	Digital Integrated Circuits	VLSI Technology & Design	3	1	0	4

Programme Electives PE3 & PE4

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MEC-161	VLSI Testing	VLSI Technology & Design	3	1	0	4
2.	MEC-162	Artificial Intelligence	-	3	1	0	4
3.	MEC-163	Neural Networks	-	3	1	0	4
4.	MEC-164	Virtual Instrumentation	-	3	1	0	4
5.	MEC-165	Digital Mobile Communication Systems	-	3	1	0	4
6.	MEC-166	Optoelectronics Devices & Circuits	-	3	1	0	4

SYLLABI

MEC-101 DSP PROCESSORS AND APPLICATIONS 4 Credits (3-1-0)

UNIT I **9**

Review of DSP fundamentals

Issues involved in DSP processor design – speed, cost, accuracy, pipelining parallelism, Quantization error, etc.

UNIT II **9**

Key DSP hardware elements – Multiplier, ALU, Shifter, Address generator, etc.

DSP Processor and Architecture – Texas, ADSP and Motorola DSP chips, Architecture, Instruction sets.

UNIT III **9**

Software development tools – Assembler, Linker, and Simulator.

UNIT IV **9**

Applications using DSP processors – Spectral analysis, FIR / IIR filters, Linear Predictive Coding, Imaging, Instrumentation, etc.

Books & References:

1. Practical Approach to Digital Signal Processing -K Padmanabhan, S Ananthi & RV Rajeshwaran
2. TMS Data Manual
3. ADSP Data Manual
4. Motorola Data Manual
5. Rabiner LR & Gold B - Theory and Application of Digital Signal Processing (PHI), 1996

MEC-102 MICROPROCESSORS AND MICROCONTOLLERS 5 Credits (3-1-2)

UNIT I **9**

16-bit Processors: Architecture, Signal Description, Physical Memory Organization, Bus–operation, Art of Assembly Language Programming (8086)

UNIT II **9**

32-bit Processors: Architecture, Addressing Modes, Real, Virtual and Protected modes, Segmentation and Paging, Enhanced Instruction set.

UNIT III **9**

Recent Advances in Microprocessors: Pentium, MMX Architecture, MMX Instruction set, Pentium Pro, Pentium II, Pentium III, Power PCs, etc.

UNIT IV **9**

8 and 16-bit Microcontrollers: 8031/8051, 8096/8097 Microcontroller Architecture, Memory Organization, Addressing Modes, Interrupt and Port Structures, Assembly Language Programming and Applications

EXPERIMENTS

Minimum 8 experiments must be performed during semester. Minimum 6 and 2 experiments should be performed from group-A and group-B respectively

1. Group-A: 8 Assembly Language programs based on 8086
2. Group-B: 4 Interfacing based experiments.

Books & References:

1. Advanced Microprocessors and Peripherals –A. K. Ray & M.K. Bhurchandi (TMH)
2. Microprocessors and Interfacing - D.V. Hall (TMH)
3. Advanced Microprocessor & Microcontroller-B. P. Singh & Renu Singh (New Age Publications)
4. Microprocessors and Applications – V. Rafiquzzaman (TMH)

MEC-103 VLSI TECHNOLOGY & DESIGN 4 Credits (3-1-0)

UNIT I **9**

VLSI Technology: Clean Room Specification, Crystal Growth & Epitaxy, Film Deposition, Lithography & Etching, Impurity Doping and Metallization process.

UNIT II **9**

Application of Technology in Integration: Passive Components design and its layout, Formation of nMOS and CMOS on Wafer with passive components, Challenges in the Design of microelectronics.

UNIT III **9**

Electrical behavior of MOS transistors and its design challenges: Short channel effects, Types of Scaling and its impact, High-k Technology

Inverters: nMOS and CMOS inverters, its design challenges, Switching Characteristics, Introduction of Pass transistors and CMOS Transmission gates, Design of circuits using pass transistor and CMOS TG

UNIT IV **9**

Stick diagram and Layout representation of various ICs, VLSI Design Flow, VLSI Design Hierarchy, Design quality, and Design Styles, Packaging Technology and CAD Technology applications

Books & References:

1. Semiconductor Devices :Physics & Technology - S.M. Sze (Wiley India Publications)
2. CMOS Digital Integrated Circuits - Kang and Leblebici (TMH Publications)
3. CMOS VLSI Design - Weste, Harris and Bannerjee (Pearson Education Publication)
4. Basic VLSI Design - Douglas A. Pucknell, Kamran Eshraghian (PHI)
5. Introduction to VLSI Systems - Carver Mead & Lynn Conway

MEC-104 EMBEDDED SYSTEMS DESIGN 5 Credits (3-1-2)

UNIT I **9**

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems, Applications

UNIT II **9**

Embedded Processor: Devices & Architecture of 8051/89C51 Motorola, PIC, AVR, etc., Review of memory Architecture, I/ O, Timer/ Counter & Interrupts

UNIT III **9**

RTOS Based Embedded & Task Communication: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS

UNIT IV **9**

Design &Tools: Design of an embedded application, Examples / Case Study

EXPERIMENTS

1. Embedded programming on 6713, TMS 320C6713/32 Embedded Trainer Kit
2. Embedded programming on 5410/16,, TMS 320VC5410/16 Embedded Trainer Kit

Books & References:

1. Real-Time Systems and Programming Languages -Burns, Alan and Wellings, Andy, 2e, (Addison-Wesley-Longman), 1997
2. An Introduction to real time systems: Design to networking with C/C++ - Raymond J.A. Bhur and Donald L. Bialey (Prentice Hall), 1999
3. Real time Programming: A guide to 32 Bit Embedded Development- Grehan Moore, and Cyliax (Addison-Wesley-Longman), 1998

4. Embedded Systems Design - Heath, Steve (Newnes), 1997
5. Embedded System Design: A Unified Hardware /Software Introduction - Frank Vahid and Tony Givargis (Wiley), 2001

MEC-105 DIGITAL SYSTEM DESIGN 4 Credits (3-1-0)

UNIT I **9**

Introduction: Number System & Codes, Combinational logic circuits, Flip-Flops and related devices Digital Arithmetic operations and circuits counters and registers.

UNIT II **9**

Integrated Circuit Logic family: Digital I.C. Terminology, TTL, ECL, MOS/CMOS logic families, IC interfacing, TTL driving CMOS & Vice Verso Low voltage Technology.

MSI Logic Circuits: Decoders/drivers, Encoders, Multiplexers, De-multiplexers, Magnitude Comparators, applications of MSI logic ICs.

UNIT III **9**

Memory Devices: General memory operations, Programmable logic devices, Semi-conductor memories, SRAM, DRAM, expanding word size and capacity, special memory functions

UNIT IV **9**

Introduction to Microprocessor & Micro-Computers:

Alphanumeric display devices, LCD and CRT Displays Applications of programmable logic devices

Books & References:

1. Digital System: Principles & Applications - R.J. Tocci (PHI)
2. Manufacturers IC – Data Sheet

MEC-151 DIGITAL SIGNAL PROCESSING 4 Credits (3-1-0)

UNIT I **9**

Realization of Digital Systems: Introduction, direct form realization of IIR systems, cascade realization of an IIR systems, parallel form realization of an IIR systems, Ladder structures: continued fraction expansion of H(z), example of continued fraction, realization of a ladder structure, example of a ladder realization.

UNIT II **9**

Design of Infinite Impulse Response Digital Filters : Introduction to Filters, Impulse Invariant Transformation, Bi-Linear Transformation, All- Pole Analog Filters: Butterworth and Chebyshev, Design of Digital Butterworth and Chebyshev Filters

UNIT III **9**

Finite Impulse Response Filter Design: Windowing and the Rectangular Window, Other Commonly Used Windows, Examples of Filter Designs Using Windows ,The Kaiser Window

UNIT IV **9**

Discrete Fourier Transforms: Definitions, Properties of the DFT, Circular Convolution, Linear Convolution Fast Fourier Transform Algorithms: Introduction, Decimation –In
Time(DIT) Algorithm, Computational Efficiency, Decimation in Frequency(DIF) Algorithm

Books & References:

1. Digital Signal Processing - Johnny R. Johnson (PHI Learning Pvt Ltd.), 2009
2. Digital Signal Processing - John G Prokias, Dimitris G Manolakis (Pearson Education).
3. Digital Signal Processing - Oppenheim & Schafer (PHI)

MEC-152 DIGITAL CONTROL SYSTEM 4 Credits (3-1-0)

UNIT I **9**

Sampling Process & Control System: A/D & D/A conversion, Discrete System Modeling using Z-transform, Discrete Control System Analysis Stability, Error-analysis, Bilinear Transformation, Frequency Response

UNIT II **9**

Discrete Transform Approximations: Folding Aliasing, Transformations method (s,z and, w) Numerical Solution of Difference Equations.

Implementing Digital Control System: Control Logic, Software, Data flow Diagram, Real Time Design for Digital, Control Real Time Scheduling

UNIT III **9**

Compensator Design: Cascade Compensation using Digitization Technique and Direct Techniques, Feedback Compensation Techniques, Software for Digital Controllers.

Basics of Modern Discrete Control Theory: System Structure, Controllability, Observability & State -Space stability.

UNIT IV **9**

Discrete Optimal Control: Optimal Control Concepts, Maximum Principle, Discrete Linear Regulator, Sampling Time.

Books & References:

1. C. H. Houpis, Gray B. Lamont - Digital Control Systems, McGraw Hill.
2. I.J. Nagrath, M. Gopal - Control System Engineering, New Age Publications

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MEC-153 ASICs **4 Credits (3-1-0)**

UNIT I **9**

Types of ASICs, Full Custom ASICs, Standard Cell based ASICs, Gate Array based ASICs, Channeled gate array, Channel less gate array, Structured gate array, PLDs and FPGA

UNIT II **9**

ASIC Design Methodology: ASIC library design, Transistor Paracitic capacitances, turn-around-time (TAT), Price of the die, Power consumption, Miscellaneous aspects, Design methodology: Design Views, Design Entry, Design Analysis, Technology Optimization, Logic Synthesis, Test Insertion Clock Planning and Insertion, Floor-planning Design Verification, ASIC Methodology Flow: Model Development, Process development, Tool Development, Library development

UNIT III **9**

Design using PLDs: Classification, Design of circuits using ROM, PLA, PAL, PROM, EEPROM etc. Antifuse Technology, Programmable ASIC Logic Cells, Programmable ASIC interconnects

UNIT IV **9**

ASIC pad selection, placement, and package type, About trace port signal quality, PCB design guidelines: Physical Trace Port Signal Guidelines ASIC design in nanometer era, high level interconnect, design productivity, flat and hierarchical design methods, packaging priorities, design quality, power management noise and signal integrity

Books & References:

Application-Specific Integrated Circuits, by Michael John Sebastian Smith from Pearson Publications

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MEC-154 COMPUTER AIDED DESIGN OF ELECTRONIC CIRCUITS **4 Credits (3-1-0)**

UNIT I **9**

Modelling analogies, and their role, Introduction to general purpose analog computer and its applications in simulation of linear and non-linear systems, CAD Tools, Importance of SPICE simulation, Introduction to HDL and verilog

UNIT II **9**

Modelling & Simulation of Semiconductor Devices to predict its electrical behaviour, SPICE parameter of MOS and BJT, Simulation of MOS and BJT based circuits

UNIT III **9**

Digital Computer Simulation of Electrical and Electronic Circuits, Application of HDL and verilog for digital circuit simulation, Verification mechanism in design flow

UNIT IV **9**

Various CAD tools for front end and back-end design, CAD tools for layout generation, CAD tools for testing and verification of ICs

Books & References:

1. Neil Weste - Principle of CMOS Design, Addison Wesley
2. Rashid - Spice for Circuits of Electronics using PSpice, Prentice Hall
3. Banafsheh Rezaeian - Simulation and Verification Methodology of Mixed Signal Automotive ICs, November 22, 2012

MEC-155 DATA AND COMPUTER COMMUNICATION NETWORKS — 4 Credits (3-1-0)

UNIT I **9**

LAN Networking & Data Transmission Protocols: IP, IPX, Apple-Talk, Ethernet, FDDI, Token Ring, Wireless 802.11(b)

WAN Digital Transmission Technologies: T-Carrier, SONET, Frame Relay ISDN, Global Cellular.

UNIT II **9**

Design & Implementation of Enterprise: Networks, Routers & Switches (including ATM Switches), Router configuration Multiprotocol Network Traffic Routing in PDN & Internet Environments.

UNIT III **9**

Network Performance Measurement & Trouble Shooting Concepts: including SNMP

UNIT IV **9**

Cellular Mobile Computer Communication: GSM Technology, NA-TDM, PCN VoIP/FoIP & SMS,CISCO's IGRP /EIGRP, ACL NAT, TUNNELING & IOS basics, Satellite Links & Broad Band ISDN Network.

Books & References:

1. M James Martin - Understanding the Network, Techmedia Publications.
2. William Stallings- Data & Computer Communication, Pearson Education
3. William C. Y. Lee - Mobile Cellular Tele Communication, McGraw Hill

MEC-156 DIGITAL INTEGRATED CIRCUITS — 4 Credits (3-1-0)

UNIT I **9**

Semiconductor Components of Digital Integrated Circuits: Modelling of PN Junction Diodes, BJTs, and MOSFETs, Model Parameter Extraction of these devices

UNIT II **9**

BJT Inverters DC and Switching Characteristics, Schottky Transistor Specifications of Logic Circuits, Qualitative discussion on TTL Circuits, Standard TTL Circuits, Advanced TTL Circuits, I-square L Technology, Edge triggered D-F/F, I-square L-Condition for Proper Operation, Schottky Transistor Logic, Stacked I-square L, ECL Basic Operation

UNIT III **9**

nMOS Logic Circuits, nMOS inverters; CMOS inverters, MOS NAND,NOR and Other Gates: Clocked CMOS, Dynamic CMOS, Transmission Gates; Realization Of MUX, decoder, D-F/F BiCMOS Gates, BiCMOS Driver

UNIT IV **9**

Memories: Types of Memory, Static and dynamic Memories, BiCMOS SRAM-DRAM, CMOS and BiCMOS ROM-EPROM,EEPROM and Flash EPROM

Books & References:

1. Digital Integrated Circuits-Rabaey, Jan, Anantha Chandrakasan, and Bora Nikolic, Prentice Hall Publications.
2. CMOS Digital Integrated Circuits- Kang and Leblebici, TMH Publications.

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Program Core for M.Tech. (Communication Engineering)

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MAS-112	Advanced Engineering Mathematics	-	3	1	0	4
2.	MEC-201	Advanced Digital Comm.	-	3	1	2	5
3.	MEC-202	Advanced Digital Signal Processing	-	3	1	0	4
4.	MEC-204	Optical Communication System	-	3	1	2	5
5.	MEC-205	Mobile Communication Systems	-	3	1	0	4
6.	MEC-105	Digital Systems Design	-	3	1	0	4
7.	MEC-230	Dissertation Part-I	-	0	0	8	4
8.	MEC-210	Minor Project	-	0	0	8	4
9.	MEC-240	Seminar	-	0	0	4	2
10.	MEC-250	Dissertation Part-II	Dissertation Part-I	0	0	28	14

Program Electives (PE1 & PE2)

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MEC-251	ISDN and Broadband Networks	-	3	1	0	4
2.	MEC-252	Microwave Devices & Circuits	-	3	1	0	4
3.	MEC-253	Optoelectronics Integrated Circuits	-	3	1	0	4
4.	MEC-254	Digital Image Processing	-	3	1	0	4
5.	MEC-256	Advanced Coding Theory	-	3	1	0	4
6.	MEC-257	Embedded Systems	-	3	1	0	4

Program Electives (PE3 & PE4)

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MEC-163	Neural Networks	-	3	1	0	4
2.	MEC-261	Antenna Design and MIMO Systems	Antenna and Wave Propagation	3	1	0	4
3.	MEC-262	Satellite Comm.	-	3	1	0	4
4.	MEC-263	Inter & Intra-net	-	3	1	0	4
5.	MEC-264	Body Area Networks	-	3	1	0	4
6.	MEC-265	IC Design	VLSI Technology & Design	3	1	0	4

SYLLABI

MEC-201 ADVANCED DIGITAL COMMUNICATION 5 Credits (3-1-2)

UNIT I **9**

Overview of Digital Communication: Digital communication system model. Communication channels characteristics and Models, Signal space representations. Digitally modulated signals-Representations

UNIT II **9**

Communication Through Band-Limited Linear Filter Channels: Optimum receiver for channels with ISI and AWGN. Linear equalization, Decision feedback equalization, Turbo equalization, Self recovering equalization,

UNIT III **9**

Multichannel ,Multicarrier Systems and Spread Spectrum Signals: Model of Spread spectrum system. Direct sequence spread spectrum signals. Frequency -Hopped spread spectrum signals. Synchronization of spread spectrum signals.

UNIT IV **9**

Digital Communications through Fading Multipath Channels: Characterization and model. Frequency-Non selective, slowly fading channel, Diversity techniques, Digital signaling over a frequency-selective, slowly fading channel, Coded waveforms for fading channel

Multiple access techniques, Capacity of multiple access methods, CDMA, Random access methods

EXPERIEMNTS

1. Experiment on QPSK digital Modulation.
2. Experiment on M-ary QAM for different fading channels.
3. Analysis of Bit Error Rate (BER) for BPSK digital Modulation.
4. Analysis of Bit Error Rate (BER) for BFSK digital modulation
5. Analysis of BER for ASK digital modulation.
6. Study of ASK, PSK and FSK digital modulation using MATLAB.

Books & References:

1. John G. Proakis, Digital Communications, 4/e, McGraw-Hill
2. Viterbi, A. J., and J. K. Omura, Principles of Digital Communication and Coding. NY: McGraw-Hill, 1979. ISBN: 0070675163.
3. Marvin K Simon, Sami M Hinedi, William C Lindsey - Digital Communication Techniques –Signal Design & Detection, PHI.
4. MIT OpenCourseWare, Electrical Engineering and Computer Science, Principles of Digital communication II, Spring 2006
5. Aazhang B. Digital Communication Systems (Connexions Web site). January 22, 2004. available at: http://cnx.rice.edu/content/col10134/1.3/

MEC-202 ADVANCED DIGITAL SIGNAL PROCESSING 4 Credits (3-1-0)

UNIT I **9**

Basics of Multirate systems and its application, up sampling and Down - Sampling, Fractional Sampling rate converter, Polyphase decomposition, Efficient realisation of Multirate systems, Uniform filter banks and it's implementation using polyphase decomposition.

UNIT II **9**

Two channel Quadrature Mirror Filter Banks, Perfect Reconstruction, M-channel PR QMFB. Time Frequency Analysis, Heisenberg's uncertinity principle, Short time Fourier transform - Gabor transform, Continuous Wavelet Tranform and it's properties, Multi Resolution Analysis, Discrete Wavelet Transform, Orthonormal Wavelet Analysis- Filterbank interpretation. Haar and Daubechise wavelets, Bi-orthogonal wavelets and Filter bank interpretation

UNIT III **9**

B-Spline wavelets, Wavelet packets.2D wavelt transforms. Application of wavelet transform for data compression, noise reduction. Linear Prediction -Forward and Backward Prediction - Levinson-Durbin Algorithm, Schur Algorithm.

UNIT IV **9**

Power spectrum estimation of signals: Wide Sense Stationary Random Processes. Power spectral density. Non parametric methods: periodogram, Backman-Tuckey method. Parametric method: ARMA, AR processes, Yule-Walker method.

Books & References:

1. P. P. Vaidyanathan - Multirate Systems and Filterbanks, Prentice Hall
2. Wavelet Transforms - Bopadikar and Rao, Pearson Education
3. Insight Into Wavelets - K. P. Soman, Prentice Hall India
4. Digital signal Processing - John G. Proakis, Dimitris G. Manolakis, Pearson Education

MEC-203 COMPUTER COMMUNICATION NETWORKS 4 Credits (3-1-0)

UNIT I **9**

Network models, Digital Transmission, Ethernet, FDDI, Token Ring, Wireless 802.11(b), Multiplexing, Transmission Media, Switching, Error Detection and Correction, Data link Control, Multiple Access,

UNIT II **9**

Wireless LAN, Connecting Devices, Backbone Network, Virtual LAN, Ethernet, T-Carrier, SONET, Frame Relay ISDN, Global Cellular. Design & Implementation of Enterprise- Networks.

UNIT III **9**

Network Layer, Routers & Switches (including ATM Switches), Router configuration Multiprotocol Network Traffic Routing in PDN & Internet Environments, Network Performance Measurement & Trouble Shooting Concepts: including SNMP

UNIT IV **9**

Cellular Mobile Computer Communication: GSM Technology, NA-TDM, PCN VoIP/FoIP & SMS.CISCO's IGRP /EIGRP, ACL NAT, TUNNELING & IOS basics. Satellite Links & Broad Band ISDN Network

Books & References:

1. M James Martin - Understanding the Network, Techmedia Publications.
2. William Stallings - Data & Computer Communication, Pearson Education
3. William C. Y. Lee - Mobile Cellular Tele Communication, McGraw Hill

MEC-204 OPTICAL COMMUNICATION SYSTEMS 5 Credits (3-1-2)

UNIT I **9**

Lightwave system components-Optical Transmitters and receivers–concepts, components and design, Control of Longitudinal Modes – Design of Optical transmitters

UNIT II **9**

Receiver Noise and sensitivity, Sensitivity degradation- Receiver Design, Architecture and Design of Light wave systems- Loss limited and Dispersion limited lightwave systems.

UNIT III **9**

systems –Components and performance issues.

UNIT IV **9**

Soliton based systems- Impact of amplifier noise-Timing Jitter, Gordon – Hauss Effect, Bit Error Rate Performance, Coherent light wave systems-Concepts, Modulation Formats and Bit Error Rate Performance

EXPERIMENTS

1. MAT Lab based experiments
2. Experiments on various losses
3. Experiments are the pulse broadening of a fiber optic communication link
4. Setting up a fiber optic digital link
5. Fiber Optics on PC: An interactive simulation package to study various aspects of fiber optics

Books & References:

1. Govind P. Agrawal - Fiber Optic Communication System, John Wiley and Sons, 2003
2. W J Diggonet - Rare Earth Doped Fiber Lasres and Amplifiers

3. Hasegawa - Solitons in Optical Communications
4. Govind P. Agrawal - Nonlinear Optics, Academic press 2nd ed.

MEC-205 MOBILE COMMUNICATION SYSTEMS 5 Credits (3-1-2)

UNIT I **9**

Fixed TDM, classical ALOHA, Slotted ALOHA, Carrier Sense Multiple Access, Demand Assigned Multiple Access

UNIT II **9**

Introduction, Fundamental Concepts, pseudo noise sequences, CDMA, FHSS, DSSS, Synchronization of Spread Spectrum, Spread Spectrum applications in cellular communication, PCs, and mobile communication

UNIT III **9**

Mobile Services, System Architecture, Radio interface, Protocols, localization and calling, Handover, Security, New Data Services.

UNIT IV **9**

TCP, UTP, SCTP, Routing & Bridging, Mobile IP. Electronic navigation & surveillance Systems, Blue tooth, GPS, Global Mobile Satellite Systems

Books & References:

1. Dr. Kamilo Feher - Wireless Digital Communications, PHI
2. Jochen Schiller - Mobile Communications, Pearson Education
3. Raj Pandya - Mobile and Personal Communication Systems and Services, IEEE Press, PHI

MEC-251 ISDN AND BROADBAND NETWORKS 4 Credits (3-1-0)

UNIT I **9**

ISDN Channels, Access interface, functional devices and reference, Overview of ISDN services, Protocol structure, D- Channel Layer 3 Protocols, Numbering and addressing, ISDN Products.

UNIT II **9**

Broadband networks - need, Fast packet switching, Frame relay, Cell relay & ATM, FDDI, SMDS.

Frame Relay – Basic Definition, Protocol Architecture, Permanent and switched VC, Frame relay standards, Multicast services.

UNIT III **9**

ATM – ATM standards, Terms and Concepts, B-ISDN Protocol Architecture, Physical Layer, ATM Layer, AAL, ATM services.

UNIT IV **9**

ATM switches. SMDS Overview, SMDS Interface & Services, ISDN, B-ISDN and Internet Protocols

Books & References:

1. Kessler & Southeick – ISDN, McGraw Hill, 3e, 1996.
2. William Stallings – ISDN, Pearson Education

MEC-252 MICROWAVE DEVICES & CIRCUITS 4 Credits (3-1-0)

UNIT I **9**

Microwave Devices: Tunnel Diode, Microwave Bipolar Transistors, HBTs, JFETs, MESFET, HEMTs, Mos Transistors and memory devices, CCDs. Transferred electron devices

UNIT II **9**

Principle of Operation and characteristics of Gunn diode, TRAPATT and IMPATT diodes, GaAs Diode, RWH Theory, LSA Diode. Avalanche Transit Time Devices: Read diode IMPATT Diode, TRAPATT Diode, BARITT Diode, Parametric Devices.

UNIT III **9**

Microwave Network Representations: S-matrix representations, matrices of some typical, microwave components such as attenuator, matched load, power divider, directional coupler, magic tee etc.

UNIT IV **9**

Lumped element in MICs, Material and Fabrication Technique, Technology of hybrid MICs, Design of MIC components- transitions,

Books & References:

1. S.Y. Liao - Microwave Devices & Circuits, Prentice Hall of India, 3rd ed.,1995.
2. G.P. Srivatava,Vijay Laxmi Gupta -Microwave Devices and Circuit Design, PHI,2006
3. M L Sisodia, G S Raghuvanshi, Microwave Circuits and Passive Devices, New Age International (p) Ltd, 2001

MEC-253 OPTOELECTRONICS INTEGRATED CIRCUITS 4 Credits (3-1-0)

UNIT I **9**

Optoelectronic Properties of Semiconductor: effect of temperature and pressure on bandgap, Carrier scattering phenomena, conductance processes in semiconductor, bulk and surface recombination phenomena Optical Properties of Semiconductor, EHP formation and recombination, absorption in semiconductors, Effect of electric field on absorption, absorption in quantum wells, radiation in semiconductors, deep level transitions, Augur recombination's

UNIT II **9**

Junction theory, Schottky barrier and Ohmic contacts, semiconductor heterojunctions, LEDs, Photo detectors, Solar Cells, Lasers: Operating Principles, Various Structures and its types

UNIT III **9**

Special Detection Schemes: Phototransistors, Modulated Barrier Photodiode, Schottky Photdiode, MSM photodiode

UNIT IV **9**

Optoelectronic modulation and switching devices: Analog and Digital modulation, Franz-Keldysh and Stark effects modulators, Electro-optic modulators, Optolectronic Integrated Circuits (OEICs): Need for hybrid and monolithic integration, OEIC transmitters and receivers

Books & References:

1. Semiconductor Optoelectronic Devices-Pallab Bhattachrya, Prentice Hall Publications.
2. Physics of Semiconductor Devices- S.M. Sze, Wiley Publications.
3. Optoelectronics and Photonics: Principles and Practices- S. O. Kasap, Prentice Hall Publications.
4. Integrated Optoelectronics- Ebeling, Springer-Verlag, Berlin, 1992

MEC-254 DIGITAL IMAGE PROCESSING 4 Credits (3-1-0)

UNIT I **9**

Introduction to Digital Image model and Transforms: Digital Image Representation, Image Processing Systems, Digital Image fundamentals, Image model, Sampling & Quantization, Introduction to Fourier Transform, Properties, DFT, FFT, Separable Image Transform, Hough Transform.

UNIT II **9**

Image Enhancement: Spatial Frequency Domain methods, Histogram modification techniques, Direct histogram modification techniques, Direct histogram specifications, Image Smoothening, Image Sharpening.

UNIT III **9**

Image Restoration & Encoding: Degradation model, Diagonalization of Circulant and Block Circulant matrices, Algebraic Approach, Inverse Filtering, Wiener Filtering.
Image Encoding: Fidelity criteria, The Encoding Process, Error – free encoding relative to fidelity criteria.

UNIT IV **9**

Image Segmentation:
Detection of discontinuities, Edge Linking & Boundary Linking, Thresholding, Region oriented Segmentation.

Books & References:

1. Rafael C. Gonzalez, Paul Wintz - Digital Image Processing, Prentice Hall
2. Anil K Jain - Fundamentals of Digital Image Processing, Prentice Hall
3. A Resenfeld and A.C. Kak - Digital Image Processing, Academic Press

MEC-256 ADVANCED CODING THEORY 4 Credits (3-1-0)

UNIT I **9**

Linear block codes, encoding and decoding, cyclic codes, Non-binary codes. Linear convolutional encoders – Structural properties of convolutional codes – State diagrams – Transparent convolutional codes – Receiver phase offset and Differential decoding – Trellis diagrams – Viterbi algorithm – Performance analysis – Design and Implementation of Viterbi decoder – Punctured convolutional codes.

UNIT II **9**

Tree diagrams – The Fano algorithm – The Stack algorithm – Performance analysis for Sequential decoders – Burst error correcting codes – Decoding of single burst error correcting cyclic codes – Fire Interleaved codes – Phased burst error correcting codes – Concatenated codes

UNIT III **9**

M-ary signaling–One and Two-dimensional TCM – Multiple TCM – Decoding and performance analysis – Implementational considerations

UNIT IV **9**

Turbo decoder, Interleaver, Turbo decoder MAP and log MAP deicers Iterative turbo decoding, Optimum decoding of turbo codes

Books & References:

1. S. Lin & D. J. Costello - Error Control Coding (2/e), Pearson, 2005.
2. B. Vucentic & J. Yuan - Turbo Codes, Kluwer, 2000
3. C.B. Schlegel & L.C. Perez - Trellis and Turbo Coding, Wiley.
4. Stephen B. Wicker - Error control systems for Digital communication and storage, Prentice Hall
5. Upper Saddle River, NJ, 1994.
6. E. Biglieri, et al. - Introduction to Trellis coded modulation with Applications, Macmillan Publishers,1991.
7. R. Johannesson and K.S. Zigangirov - Fundamentals of Convolutional coding, IEEE Series on Digital and Mobile Communication, Wiley-IEEE Press, 1999.

MEC-257 EMBEDDED SYSTEMS 4 Credits (3-1-0)

UNIT I **9**

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems, Applications.

UNIT II **9**

Embedded Processor: Devices & Architecture of 8051/89C51 Motorola, PIC, AVR, etc., Review of memory Architecture, I/ O, Timer/ Counter & Interrupts.

UNIT III **9**

RTOS Based Embedded & Task Communication: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

UNIT IV **9**

Embedded Communication Protocols: Embedded Networking: Introduction – Serial/Parallel Communication – Serial communication protocols -RS232 standard – RS485 – Synchronous Serial Protocols -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I^2C) – PC Parallel port programming -ISA/PCI Bus protocols

Books & References:

1. Burns, Alan and Wellings, Andy: Real-Time Systems and Programming Languages, 2e, Addison-Wesley-Longman, 1997.
2. Raymond J.A. Bhur and Donald L. Bialey: An Introduction to real time systems: Design to networking with C/C++ – Prentice Hall, 1999.
3. Grehan Moore, and Cyliax: Real time Programming: A guide to 32 Bit Embedded Development– Addison-Wesley-Longman, 1998.
4. Heath, Steve: Embedded Systems Design – Newnes, 1997.
5. Frank Vahid and Tony Givargis: Embedded System Design: A Unified Hardware /Software Introduction – Wiley 2001

MECHANICAL ENGINEERING DEPARTMENT
M. M. M. UNIVERSITY OF TECHNOLOGY
GORAKHPUR

COURSES OFFERED

Program Core (Computer Integrated Manufacturing)

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MAS-101	Numerical Methods & Engineering Optimization	-	3	1	2	5
2.	MME-101	Advanced Computer Aided Design	Computer Aided Design	3	1	2	5
3.	MME-102	Simulation, Modelling and Analysis	-	3	1	0	4
4.	MME-103	Machining Science	Manufacturing Science	3	1	0	4
5.	MME-104	Advanced Computer Aided Manufacturing	Basic Machining Science	3	1	2	5
6.	MME-105	Advance Machining Processes	Machining Science	3	1	0	4
7.	MME-120	Minor Project	-	0	0	8	4
8.	MME-130	Dissertation Part-I	-	0	0	8	4
9.	MME-140	Seminar	-	0	0	4	2
10.	MME-150	Dissertation Part-II	Dissertation Part-I	0	0	28	14

Program Electives (Computer Integrated Manufacturing)

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
		PE1 & PE2 (Semester-II)					
1.	MME-151	Machine Tool Design	Manufacturing Science	3	1	2	5
2.	MME-152	Computer Aided Process Planning	-	3	1	0	4
3.	MME-153	Design for Manufacture	-	3	1	0	4
4.	MME-154	Robotic Engineering	-	3	1	0	4
5.	MME-155	Robust design	-	3	1	0	4
6.	MME-156	Micro-Machining and Precision Engineering	Manufacturing Science	3	1	0	4
7.	MME-157	Production and Operations Management	-	3	1	0	4
8.	MME-158	Rapid Prototyping and Tooling	Manufacturing Science	3	1	0	4
		PE3 & PE4 (Semester-III)					
9.	MME-161	Finite Element Method	-	3	1	0	4
10.	MME-162	Industrial Automation & Robotics	-	3	1	0	4
11.	MME-163	Advanced Materials Technology	Material Science & Engineering	3	1	0	4
12.	MME-164	Flexible Manufacturing System	Manufacturing Science	3	1	2	5
13.	MME-165	Concurrent Engineering & Product Lifecycle Management	-	3	1	0	4
14.	MME-166	Quality Assurance	-	3	1	0	4
15.	MME-167	Materials Management	-	3	1	0	4
16.	MME-168	Work Science	-	3	1	0	4

SYLLABI

MME-101 ADVANCED COMPUTER AIDED DESIGN 5 Credits (3-1-2)

UNIT I

Graphic Systems **5**

Introduction, Graphics systems, Graphics hardware input devices, Display devices, Color displays, Solid state monitors, Output devices, Software configuration and functions, Graphics software standards

Output Primitives **4**

Scan conversion of primitives, Bresenham's Circle generating algorithm and Ellipse generating algorithms, problems.

UNIT II

3D Transformation **4**

Linear transformations, translation, rotation, scaling, reflection and shear, Matrix representation, Overall scaling, Composite transformations, Rotation about local axes parallel to global axes, Rotation about an arbitrary axis, Scaling with respect to fixed point, Reflection through an arbitrary plane

Projections **5**

Plane geometric projection, Parallel projections–Matrix equations for Orthographic projection, Oblique projection-Cavalier and Cabinet projections, Axonometric projections-isometric, diametric and trimetric projections, Perspective projections-vanishing point, Equation for one point, two point and three point perspective projections, Stereographic projections-monocular and binocular depth perceptions

UNIT III

Curves **9**

Classical representation of curves, Parametric analytic curves, Space curves, Hermite curves-Blending functions, properties, Bezier curves-Blending functions, properties, Composite Bezier curves and drawbacks, Non-rational B-spline curves-spline blending functions, blending function formulation, knot vector, uniform, open uniform and non uniform non rational spline blending functions, B-splines curve generation for various control points, Shape control of spline curves, properties, Rational B-spline curves-open uniform, periodic uniform and non uniform knot vector, Conic sections generation

UNIT IV

Surface Description and Generation **4**

Parametric representation, Surfaces of revolution, Sweep surfaces, Bilinear surface, Ruled and developable surfaces, Coons bicubic surfaces, Bezier and B-spline surfaces

3D Graphics **5**

Polygon surfaces-polygon meshes, Wire frame and Solid models-Regularized Boolean set operations, Sweep and boundary representations, Constructive Solid Geometry- unbounded and bounded primitives

EXPERIMENTS

Note: Minimum Eight experiments are to be performed

1. Understanding and use of drafting software AutoCAD
2. Sketching and solid modeling of a machine component in CAD software such as ProE/Solidworks etc.
3. Writing and validation of circle drawing algorithm
4. Writing and validation of ellipse drawing algorithm
5. Writing and validation of computer program for individual geometric transformation such as translation/rotation/ scaling
6. Writing and validation of computer program for combined geometric transformations such as translation/rotation/ scaling
7. Writing and validation of computer program for design of shaft under the combined bending and torsional loading
8. Experiments on generation of analytic curves
9. Experiments on generation of space curves
10. Experiments on generation of surfaces
11. Experiments on generation of solid models in CAD software

12. Experiments on projection of an object

Books & References:

1. Computer Graphics-Hearn & Baker, Prentice Hall of India
2. Computer Aided Engineering Design-Anupam Saxena & B. Sahay, Anamaya Publishers
3. CAD/CAM Theory and Practice- Ibrahim Zeid & R Sivasubramaniam, McGraw Hill
4. Mathematical Elements for Computer Graphics- DF Rogers & JA Adams, McGraw Hill
5. CAD/CAM-HP Groover & EW Zimmers Jr, Prentice Hall India Ltd
6. Computer Aided Design-S.K. Srivastava, IK International Publications
7. Computer Aided Design-R.K. Srivastava, Umesh Publications

MME-102 SIMULATION, MODELLING AND ANALYSIS 4 Credits (3-1-0)

UNIT I **9**

Introduction and Probability Concepts in Simulation: Models and Simulation, A review of basic probability and statistics, Estimation of means variances and correlation**,** Stochastic variables, discrete and continuous probability functions, Random numbers, Generation of Random numbers, properties of random numbers ,generation of random variate, Variance reduction techniques.

UNIT II **9**

Physical Modelling: Concept of System and environment, Continuous and discrete systems, Linear and non-linear systems, Stochastic activities, Static and Dynamic models, Principles of modeling, Role of simulation in model evaluation and studies, advantages and disadvantages of simulation

UNIT III **9**

System Simulation: Techniques of simulation, Monte Carlo method, Experimental nature of simulation, Numerical computation techniques for Continuous and discrete system models, Analog simulation, Computers in simulation studies, Simulation software packages.

UNIT IV **9**

System Dynamics: Exponential Growth and Decay models, modified exponential growth models, Logistic curves, causal loop diagram, types of equations in system dynamics, System dynamics diagrams.

Simulation of Mechanical Systems: Simulation of translational and rotational mechanical systems, Simulation of hydraulic systems, Simulation of waiting line systems, simulation of material handling and manufacturing systems, Simulation software for manufacturing.

Books & References:

1. System Simulation- Geoffrey Gordon (Prentice Hall)
2. System Simulation: The Art and Science- Robert E. Shannon (Prentice Hall)
3. System Modelling and Control- J. Schwarzenbach and K.F. Gill (Edward Arnold)
4. Modelling and Analysis of Dynamic Systems- Charles M Close and Dean K. Frederick (Houghton Mifflin)
5. Simulation of manufacturing- Allan Carrie (John Wiley & Sons)

MME-103 MACHINING SCIENCE 4 Credits (3-1-0)

UNIT 1 **9**

Mechanics of metal cutting-Tool geometry, Mechanics of orthogonal and oblique cutting, Shear angle relations in orthogonal cutting, Shear angle and chip flow direction in oblique cutting, Chip control methods, Analysis of cutting process, Machining with rotary tools

UNIT II **9**

Thermodynamics of chip formation, Machining at super high speeds, Theories of tool wear, Basic action of cutting fluids, tool life, Factors governing tool life, Machinability-definition and evaluation.

UNIT III **9**

Economics of metal cutting-Single and multipass machining operations, Criteria, variables, and restrictions for the economical conditions

UNIT IV **9**

Dynamic metal cutting-Comparison of steady and dynamic process, Shear angle and force relationships, Grinding mechanics, Wheel characteristics and theory of wheel wear, Lapping, Honning, High speed grinding theory, Grinding of drills, form cutters etc., Problems associated with machining of plastics, Tools for plastic cutting, Analysis of non-conventional machining processes ECM, EDM, LBM, WJM, USM etc.

Books & References:

1. Metalwork and Machining Hints and tips (Workshop Practice)- Arnold Throp
2. Machining Fundamentals- Walker John R (Goodheart)
3. Introduction to Machining Science- GK Lal (New Age International)
4. Non-Conventional Machining- P K Mishra (Narosa)

MME-104 ADVANCED COMPUTER AIDED MANUFACTURING 5 Credits (3-1-2)

UNIT I **9**

Introduction: Introduction to CAM, CAD/CAM interface, Introduction to Automation, Historical developments and future trends, automation in production system, automation strategies, advantages and disadvantages of automation, Need of NC system, fundamental of NC machine tool, Classification of NC machine tool, suitability and limitations, applications of NC system.

UNIT II **9**

Features of CNC machine tool: Development in MCU technology, Principle of operation of CNC, standard controllers, Design considerations of CNC machines for improving machining accuracy – structural members, slideways, spindle drive, feed drive, lead screws; Methods for improving productivity , work holding device, automatic tool changer, features of CNC machining centres

Control of CNC Systems: Open and Closed loop control systems, feedback devices, interpolators, Adaptive control systems.

UNIT III **9**

CNC Part Programming: Part programming fundamentals**,** Manual Programming for turning, milling, drilling, etc., Tool length compensation, cutter radius compensation, canned cycle, Do loops, Subroutine and Macro; Concept of computer aided part programming, APT language structure, Geometry, motion and post processor commands, APT part program.

UNIT IV **9**

FMS, CIMS & CAPP: Building blocks of flexible manufacturing systems (FMS), tool management systems, workpiece handling systems, FMS control, computer integrated manufacturing systems, computer aided process planning- variant and generative process planning.

EXPERIMENTS

1. Study on Retrofitting of Conventional Milling Machine to CNC Milling Machine.
2. To study the characteristics features of CNC lathe trainer (Model SS-PT-100).
3. To study the characteristics features of CNC Turning (XLTURN)
4. To study the characteristics features of CNC Milling (XLMILL)
5. Write a manual part program for turning operations and prepare the component on CNC Turning.
6. Write a manual part program for Grooving and threading operations and prepare the component on CNC Turning.
7. Write a manual part program for Peck drilling operations and prepare the component on CNC Turning.
8. Write a manual part program using linear and circular interpolation for CNC Milling and prepare the component.
9. Write a manual part program for rectangular pocket milling operation for CNC Milling and prepare the component.
10. Study and perform operations of Flexible Manufacturing System.

Books & References:

1. Computer Control of Manufacturing Systems- Koren (McGraw- Hill)
2. CAD/CAM- Groovers (Prentice Hall)
3. NC Machine Tools- S J Martin
4. CAD/CAM- P N Rao (Tata McGraw Hill)
5. CAD/CAM- P Radhakrishnan, S Subramanyam, V Raju
6. Computer Aided Manufacturing- Chang, Wysk & Wang (Prentice Hall of India)

MME-105 ADVANCE MACHINING PROCESSES 4 Credits (3-1-0)

UNIT I **9**

Introduction: Limitations of Conventional machining processes, Need of advanced machining processes and its classification.

UNIT II **9**

Mechanical Type Metal Removal Processes: Ultrasonic machining; Elements of the process; Tool design and economic considerations; Applications and limitations, Abrasive jet and Abrasive water jet machining principles; Mechanics of metal removal; Design of nozzles; applications, Abrasive finishing process, Magnetic abrasive finishing process

UNIT III **9**

Thermal Type Advance Machining Processes: Classification, General principles and applications of Electro discharge, Plasma arc, Ion beam, Laser beam, Electron beam machining, Mechanics of metal removal in EDM, selection of EDM pulse generator dielectric, machining accuracy, surface finish and surface damage in EDM, Generation and control of electron beam for machining applications, advantages and limitations

UNIT IV **9**

Chemical and Electro-chemical Type Metal Removal Processes: Principle, working advantages, disadvantages and applications of Electrochemical, Chemical machining, Economy aspects of ECM, Electro-chemical deburring and honning

Hybrid Unconventional Machining Processes: Introduction to ECDM, ECAM, Abrasive EDM etc.

Books & References:

1. Advance Machining Processes- V.K. Jain (New Age)
2. Modern Machining Processes- P.C. Pandey (New Age)
3. Manufacturing Processes- Degarmo
4. Manufacturing Processes- Kalpakjian (Tata McGraw-Hill International)

MME-151 ADVANCE MACHINING PROCESSES 4 Credits (3-1-0)

UNIT I **9**

Machine Tool Drive: working and auxiliary motion in machine, Machine tool drives, Hydraulic transmission, Mechanical transmission, General requirements of machine tool design, Layout of machine tools.

Regulation of Speed and Feed Rates: Aim of speed feed regulation, stepped regulation of speed, design of speed box, Design of feed box, Special cases of gear box design, Set stopped regulation of speed and feed rates.

UNIT II **9**

Design of Machine Tool Structure: Fundamentals of machine tool structures and their requirements, Design criteria of machine tool structure, Static and dynamic stiffness, Design of beds and columns, Design of housing models, Techniques in design of machine tool structure.

UNIT III **9**

Design of Guide-ways and power Screws: Function and type of guide-ways, design of slide-ways, Protecting devices for slide-ways, Design of power screws.

UNIT IV

Design of Spindles and Spindle Supports: Materials for spindles, Design of spindles, Antifriction bearings, sliding bearings. **Dynamics of Machines Tools:** General procedure of assessing dynamic stability of EES, Cutting processing, closed loop system, Dynamic characteristics of cutting process, Stability analysis.

Books & References:

1. Machine Tool Design- N.K. Mehta (Tata McGraw Hill)
2. Machine Tool design Handbook (CMTI Bangalore)

MME-152 COMPUTER AIDED PROCESS PLANNING 4 Credits (3-1-0)

UNIT I **9**

Introduction to CAPP: Information requirement for process planning system, Role of process planning, advantages of conventional process planning over CAPP, Structure of Automated process planning system, Feature recognition, Generative CAPP system: Importance, principle of Generative CAPP system, automation of logical decisions, Knowledge based systems, Inference Engine, implementation, benefits. Retrieval CAPP system: Significance,

UNIT II **9**

Group technology, structure, relative advantages, implementation, and applications, Selection of manufacturing sequence: Significance, alternative-manufacturing processes, reduction of total set-up cost for a particular sequence, quantitative methods for optimal selection, examples. Determination of machining parameters: reasons for optimal selection of machining parameters, effect of parameters on production rate, cost and surface quality, different approaches, advantages of mathematical approach over conventional approach, solving optimization models of machining processes.

UNIT III **9**

Determination of manufacturing tolerances: design tolerances, manufacturing tolerances, methods of tolerance allocation, sequential approach, integration of design and manufacturing tolerances, advantages of integrated approach over sequential approach

UNIT IV **9**

Determination of optimal index positions for executing fixed sequence, Quantitative methods, Implementation techniques for CAPP: MIPLAN system, Computer programming languages for CAPP, criteria for selecting a CAPP system and benefits of CAPP. Computer integrated planning systems, and Capacity planning system.

Books & References:

1. Mikell P. Groover, Automation, Production systems and Computer Integrated Manufacturing System, Prentice Hall, 2007.
2. Sadhu Singh, Computer Aided Design and Manufacturing, Khanna Publishers, New Delhi, 2003.

MME-153 DESIGN FOR MANUFACTURE 4 Credits (3-1-0)

UNIT I **9**

Introduction: Introduction, Concept and need of concurrent Engineering, Automation of design and manufacturing functions in CIM, Computer Aided Process Planning, Design for X, Approach to DFM & DFM, Design for automated manufacturing and design for economic manufacturing.

Effect of Materials & manufacturing processes on Design: Major phases in design & Manufacture, Effect of material properties on design, Effect of manufacturing process on design, Material selection process, Cost per unit property & Weighted properties method.

UNIT II **9**

Design Quality: Quality by Design, QFD, Taguchi's concept of Quality Loss function parameter design, comparing alternate designs, tolerance design, system optimization, Robust design.

Design for Reliability: Basic concepts, reliability analysis during design phase, failure mode analysis, reliability analysis of mechanical systems, design guidelines for reliability, reliability tests, quality and reliability assurance during production phase.

UNIT III **9**

Design Knowledge Representation: Design for manufacturing and re-design considerations in automated CAD/CAM systems. Design and manufacturing knowledge representation, Knowledge representation for DFM support, Intelligent evaluation of design for manufacturing cost.

UNIT IV **9**

Evaluation for Manufacturability: Evaluation of the manufacturability of a part design, methods for defining manufacturability index, Interpretation of the MI value, Manufacturability evaluation, a multi criteria approach.

Books & References:

1. Integrated Product Development- M.M. Anderson and L Hein (IFS Publications)
2. Product Design for Manufacture -G Boothroyd, P Dewhurst and W Knight (Marcel Dekker)
3. Design for Manufacture- Harry Peck (Pitman Publications)
4. Handbook of Product Design for Manufacture: A Practical Guide to Low Cost Production- J.G. Bralla (McGraw Hill)
5. Concurrent Engineering- Kusiak (Wiley Eastern)
6. Engineering Design A Materials and Processing Approach- G Dieter (McGraw Hill)
7. Competitive Product design for Manufacturability- Barkan and Ishvi (McMillan)
8. Engineering Design Products, Process and Systems- Kusiak (Academic Press)

MME-154 ROBOTIC ENGINEERING 4 Credits (3-1-0)

UNIT I

Introduction **5**

Definition, Classification of Robots, Geometric classification and control classification, Robot Components-manipulator, controller and its elements, sensory devices, Functions of a robot system, Robot specifications and applications,

Robot Sensors **4**

Introduction, Classification, Non-optical position sensors, Optical position sensors, Velocity sensors, Acceleration sensors, Contact and non-contact type proximity sensors

UNIT II

Mechanical Systems: Components, Dynamics and Modelling **9**

Introduction, Linear motion, Rotational motion, Moment of Inertia-calculation and measurement, Mechanical work and power, Motion conversion, Rotary-to-rotary motion, Rotary-to-linear motion, Problems with real world components, Modelling of mechanical systems, elements, examples

UNIT III

Robot Control **5**

Introduction, Closed-loop control in position servo, Effect of friction and gravity, DC servomotor, position with no friction or gravity, position with nonzero friction and/or gravity, PID control of position servo, Frequency domain characteristics-Bode plots

Robot Programming **4**

Robot control sequencing, Language based programming, Program algorithm, examples, robot programming for foundry, welding, machine tools, material handling, warehousing assembly, etc.

UNIT IV

Manipulator Kinematics **4**

Homogeneous coordinates, Coordinate transformations-translational, rotational, Matrix operators, Coordinate reference frames, Homogeneous transformations and the manipulator, forward solution, inverse solution, examples.

Robot Design **5**

Introduction, Egg packing problem, Robot design and process specifications-system specifications, mechanical description, motion sequence, motor and drive selection, encoder selection, Vision system consideration, Robot economics and safety

Books & References:

1. Robotic Engineering-R.D. Kaftler, T.A. Chmielewski and M. Negin, Prentice-Hall International
2. Robotic Technology-Phillipe Collet, Prentice Hall of India
3. An Introduction to Robot Technology- Coiffet and Chirooza, Kogan Page
4. Robotics for Engineers- Y. Koren, McGraw Hill
5. Robotics - K.S. Fu, R.C. Gonzalez & CSG Lee, McGraw Hill International
6. Introduction to Robotics - J.J. Craig, Pearson Education
7. Industrial Robots- Groover, Mitchell Weiss, Nagel Octrey- McGraw Hill
8. Robots & Manufacturing Automation - Asfahl , Wiley Eastern
9. Robotics-K.C. Jain and L.N. Aggrawal, Khanna Publishers

MME-155 ROBUST DESIGN 4 Credits (3-1-0)

UNIT I **9**

Quality by Experimental Design: Quality, western and Taguchi quality philosophy, Elements of cost, Noise factors causes of variation, Quadratic loss function and variation of quadratic loss functions.

Robust Design: Steps in robust design: parameter design and tolerance design, reliability improvement through experiments, Illustration through numerical examples.

UNIT II **9**

Experimental Design: Classical experiments: factorial experiments, terminology, factors. Levels, Interactions, Treatment combination, randomization, 2-level experimental design for two factors and three factors, 3-level experiment deigns for two factors and three factors, factor effects, factor interactions, Fractional factorial design, Saturated design, Central composite designs, Illustration through numerical examples

UNIT III **9**

Analysis and interpretation of experimental data: Measures of variability, Ranking method, column effect method and plotting method, Analysis of variance (ANOVA), in factorial experiments: YATE's algorithm for ANOVA, Regression analysis, Mathematical models from experimental data, illustration through numerical examples

UNIT IV **9**

Taguchi's Orthogonal Arrays: Types orthogonal arrays, Selection of standard orthogonal arrays, Linear graphs and interaction assignment, dummy level technique, Compound factor method, modification of linear graphs, Column merging method, Branching design, Strategies for constructing orthogonal arrays.

Signal to Noise ratio (S-N Ratios) : Evaluation of sensitivity to noise, Signal to noise ratios for static problems, Smaller – the – better types, Nominal – the – better – type, larger – the- better – type. Signal to noise ratios for dynamic problems, Illustrations through numerical examples.

Parameter Design and Tolerance Design : Parameter and tolerance design concepts, Taguchi's inner and outer arrays, Parameter design strategy, Tolerance deign strategy, Illustrations through numerical examples**.**

Books & References:

1. M. S. Phadake - Quality Engineering using Robust Design, Prentice Hall, Englewood Clifts, New Jersey, 1989.
2. Douglas Montgomery, Design and analysis of experiments, Willey India Pvt. Ltd., 5th Edition, 2007.
3. P. J. Ross, Taguchi, Techniques for Quality Engineering, 2nd Edition. McGraw Hill Int. Edition, 1996.
4. T. B. Barker, M. Dekker, Quality by Experimental Design, Inc ASQC Quality Press, 1985.
5. C. F. Jeff Wu, Michael Hamada, Experiments planning, analysis and parameter design optimization, John Willey Ed., 2002.
6. W. L. Condra, Marcel Dekker, Reliability improvement by Experiments, Inc ASQC Quality Press, 1985.

MME-156 MICRO-MACHINING AND PRECISION ENGINEERING 4 Credits (3-1-0)

UNIT I **9**

Introduction to micromachining technologies, bulk micromachining, LIGA, Surface Micromachining, Characterization of micro-machining, Tool making, Micromachinability of materials, Diamond micro-machining: machining principles, diamond turning, diamond grinding, accuracy and dimensional control, , future trends in ultrahigh speed machining

UNIT II **9**

Microelectro discharge Machining: Principles of micro-EDM, micro-EDM by Die-sinking and WEDG, micro-WEDM, micro-WEDG, micro-ECM, Principles of micro-turning, micro-drilling and micro-milling, hybrid micro-machining method, on-line measurement by machine vision and integrated probe. ;

UNIT III **9**

Abrasive micromachining and micro grinding: Abrasive micromachining mechanisms, micro-grinding mechanism, micro-machining rate, micro-machining cooling media; Laser micromachining: Principles of laser material removal, laser micro-drilling, laser micro-adjustment, laser surface structuring, laser micro-cutting;

UNIT IV **9**

Micro-machining by finishing techniques: micro-lapping, microhoning, magneto-abrasive micromachining and finishing (MAF), ELID Grinding, Measuring Techniques in micro-machining: stylus instruments, scanning tunneling microscopes, atomic force microscope, measurement of micromoles and slots using optical method, elastic transmission method, computer aided measurement testing, surface integrity and other related measurements

Books & References:

1. J. M. Geough, Micro-machining of Engineering Materials, Edited by Marcel Dekker, 2002
2. R.W. Johnstone, M. Parameswaran, An introduction to surface-micromachining, Kluwer Academic Publishers, 2004
3. N. P Mahalik. Micro-manufacturing and nano-technology, edited by, Springer Publication, 2006
4. M. P. Groover, Automation, Production Systems and Computer-Integrated Manufacturing, 2003

MME-157 PRODUCTION & OPERATIONS MANAGEMENT 4 Credits (3-1-0)

UNIT I **9**

Introduction: Operations strategy, Framework for operations strategy in manufacturing, Operations strategy services, Meeting the competitive challenges. Selection of forecasting method, Focus forecasting, Aggregate planning techniques, Inventory systems for independent demand, Fixed order quantity and fixed time period models, Inventory systems for independent time period models, Inventory systems for dependent demand, MRP type systems, Embedding JIT into MRP, Lot sizing in MRP, Advanced MRP Systems

UNIT II **9**

Operations Scheduling: Scheduling & control functions, Priority rules and techniques, Single machine scheduling problems, Scheduling in jobs on 'm' machines, Personal scheduling, Simulation methodology, Two assembly simulation

UNIT III **9**

Design of Facilities & Jobs: Strategic capacity planning concepts, determining capacity requirements, Planning service capacity, JIT production systems, JIT implementation requirements, Facility location, Plant location methods, Facility, Process and Product layout, GT layout, Retail service layout, Computer aided layout techniques, Job design and work measurement, Considerations in job design, Work measurements and standards, Financial incentive plans, Learning curves and its applications

UNIT IV **9**

Product Design & Process Selection: Product design process, Designing for the customer QFD, Value analysis, designing products for manufacturer & assembly. Process selection, product process matrix, Choosing from alternative processes & equipment, Virtual factory, Waiting line management & models, Quality management,

Quality specifications & costs, Tolls and procedures for continuous improvement, Shingo system of fail-safe design, Review of SQC models

Books & References:

1. Operations management- Buffa (John Wiley)
2. Operations management- Starr (Prentice Hall)
3. Production and Operations management- Adam & Ebert (Prentice Hall India)

MME-158 RAPID PROTOTYPING AND TOOLING 4 Credits (3-1-0)

UNIT I **9**

Introduction: Historical developments, Fundamentals of RP Systems and its Classification, Rapid prototyping process chains, 3D modeling and mesh generation, Data conversion and transmission

UNIT II **9**

RP Systems: Liquid polymer based rapid prototyping systems, Teijin Seikis' solid form and other similar commercial RP systems, Solid input materials based rapid prototyping systems, laminated object manufacturing (LOM) and fused deposition modelling systems etc., Power based rapid prototyping systems, selective Laser sintering, Soligen Diren's shell production casting (DSPC), Fraunhofer's multiphase jet solidification (MJS) and MIT's 3D printing (3DP) etc.

UNIT III **9**

RP Database: Rapid prototyping data formats, STL format, STL file problems, STL file repair, Network based operations, Digital inspection, Data warehousing and learning from process data.

UNIT IV **9**

RP Applications: Development of dies for moulding, RP applications in developing prototypes of products, application in medical fields, Development of bone replacements and tissues, etc., RP materials and their biological acceptability.

Books & References:

Rapid Prototyping Of Digital Systems: A Tutorial Approach- Hamblen James O (Kluwer Aca)
Rapid Prototyping: Principles And Applications- Kai Chua Chee (World Scie)
Rapid System Prototyping With Fpgas: Accelerating The Design Process- R C Cofer (Newnes)
Rapid Prototyping of Digital Systems- James O Hamblen (Springer)

MECHANICAL ENGINEERING DEPARTMENT
M. M. M. UNIVERSITY OF TECHNOLOGY
GORAKHPUR

COURSES OFFERED

Program Core (Energy Technology and Management)

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MAS-101	Numerical Methods & Engineering Optimization	-	3	1	2	5
2.	MME-201	Energy Conversion Systems	Applied Thermodynamics	3	1	2	5
3.	MME-202	Renewable Energy Systems	NCER	3	1	0	4
4.	MME-203	Energy Scenario and Policy	Alternate Energy	3	1	0	4
5.	MME-204	Advanced Heat Transfer	Heat Transfer	3	1	2	5
6.	MME-205	Energy Management and Audit	-	3	1	0	4
7.	MME-220	Minor Project	-	0	0	8	4
8.	MME-230	Dissertation Part-I	-	0	0	8	4
9.	MME-240	Seminar	-	0	0	4	2
10.	MME-250	Dissertation Part-II	Dissertation Part-I	0	0	28	14

Program Electives PE1 & PE2 (Energy Technology and Management)

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MME-251	Economics and Planning of Energy Systems	-	3	1	0	4
2.	MME-252	Power Plant Engineering	Applied Thermodynamics	3	1	0	4
3.	MME-253	Computer Aided Design of Thermal Systems	Computer Aided Design	3	1	0	4
4.	MME-254	Combustion Engineering	Applied Thermodynamics	3	1	0	4
5.	MME-255	Wind Energy and Hydro Power Systems	NCER	3	1	0	4
6.	MME-256	Energy Storage Systems	NCER	3	1	0	4
7.	MME-257	Hydrogen Energy	NCER	3	1	0	4

Program Electives PE3 & PE4 (Energy Technology and Management)

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MME-261	Finite Element Method	-	3	1	0	4
2.	MME-262	Energy Modeling and Project Management	-	3	1	0	4
3.	MME-263	Advanced Materials Technology	Material Science	3	1	0	4
4.	MME-264	Alternative Fuels for Transportation	I.C. Engines	3	1	0	4
5.	MME-265	Nuclear Science and Engineering	-	3	1	0	4
6.	MME-266	Gas Turbines and Compressors	Applied Thermodynamics	3	1	0	4
7.	MME-267	Environmental Impact of Energy Systems	-	3	1	0	4

SYLLABI

MME-201 ENERGY CONVERSION SYSTEMS 5 Credits (3-1-2)

UNIT I **9**

Classification of Energy Sources: Classification of Energy Sources, Principle fuels for energy conversion: Fossil fuels, Nuclear fuels. Energy Sources: prospecting, extraction and resource assessment and their peculiar characteristics, Direct use of primary energy sources, Conversion of primary into secondary energy sources such as Electricity, Hydrogen, Nuclear energy etc., Energy Conversion through fission and fusion, Nuclear power generation etc

UNIT II **9**

Thermal and Mechanical Energy: Thermal energy using fossil fuels. Conversion of Thermal Energy to Mechanical energy & Power, Turbines: Steam turbines, Hydraulic turbines

Thermal and Mechanical Energy Utility systems: Boilers -Types, combustion in boilers, performance evaluation, analysis of losses, feed water treatment, blow down.

FBC Boilers: Introduction, mechanism of fluidized bed combustion, advantages, types of FBC boilers, operational features, retrofitting FBC system to conventional boilers

UNIT III **9**

Refrigeration and Air Conditioning: Vapor compressor refrigeration cycle, refrigerants, coefficient of performance, capacity, factors affecting refrigeration and air conditioning system performance, Vapor absorption refrigeration systems: Working principle, type and comparison with vapor compressor system.

Basics of Mechanical Engineering (Energy Related) : Sterling Engines, Steam Engine, Internal Combustion systems and external combustion system, Power Transmission: Concepts of Belts Drives, Gearing, Coupling etc. Bearing and Lubricants as Energy Saving Measures

UNIT IV **9**

Co-generation, Tri-generation & Waste Energy Recovery: Co-generation & Tri-generation: Definition, need, application, advantages, classification, saving Potential. Waste Heat Recovery: Concept of conversion efficiency, energy waste, waste heat recovery classification, advantages and applications, commercially viable waste heat recovery devices. Thermal Energy Measurements

EXPERIMENTS

Note: Minimum Eight experiments are to be performed

1. Experiment on Boilers
2. Experiment on Steam Turbines
3. Experiment on Hydraulic Turbines
4. Experiment on Vapour compressor Refrigeration
5. Experiment on Vapour absorption Refrigeration
6. Experiment on Sterling Engine
7. Experiment on Steam Engines
8. Experiments on Internal Combustion systems
9. Experiments on Power Transmission

Books & References:

1. Direct Energy Conversion : W.R. Corliss
2. Aspects of Energy Conversion : I.M. Blair and B.O. Jones
3. Principles of Energy Conversion : A.W.Culp (McGrawHill International
4. Energy conversion principles : Begamudre , Rakoshdas
5. Fuel Economy Handbook, NIFES,
6. Industrial Furnaces (Vol I & II) and M.H. Mawhinney, (John Wiley Publications)
7. Refractories – F.H. Nortan,(John Wiley Publication.)
8. Domestic and commercial oil Burners Charles H. Burkhadt (McGraw Hill Publication)
9. The efficient use of steam – Oliver Lyle, (HMSO London)
10. Boilers – Types, Characteristics and functions – Carl D. Shields (McGraw Hill book)

11. The Efficient use of steam generation – General editor – P.M. Goodall

MME-202 RENEWABLE ENERGY SYSTEM 4 Credits (3-1-0)

UNIT I **9**

Solar Energy: Sun as Source of Energy, Availability of Solar Energy, Nature of Solar Energy, Solar Energy & Environment. Various Methods of using solar energy –Photothermal, Photovoltaic, Photosynthesis, Present & Future Scope of Solar energy

Hybrid wind energy systems - wind + diesel power, wind + conventional grid, wind + Photovoltaic system etc

Bio-mass energy: Biomass: Generation and utilization, Properties of biomass, Agriculture Crop & Forestry residues used as fuels. Biochemical and Thermo-chemical Conversion, Combustion, Gasification, Biomass gasifiers and types etc., Applications of Gasifiers to thermal power and Engines, Biomass as a decentralized power generation source for villages

UNIT II **9**

Wind Energy: Wind Energy: Basics & Power Analysis, Wind resource assessment, Power Conversion Technologies and applications, Wind Power estimation techniques, Principles of Aerodynamics of wind turbine blade, Various aspects of wind turbine design, Wind Turbine Generators: Induction, Synchronous machine, constant V & F and variable V & F generations, Reactive power compensation. Site Selection, Concept of wind form & project cycle, Cost economics

UNIT III **9**

Geothermal, Tide and Wave Energy : Availability of Geothermal Energy-size and Distribution, Recovery of Geothermal Energy, Various Types of Systems to use Geothermal Energy, Direct heat applications, Power Generation using Geothermal Heat, Sustainability of Geothermal Source, Status of Geothermal Technology, Economics of Geothermal Energy.

UNIT IV **9**

Fuel Cell: Fuel cell – Principle of working, construction and applications

Hydel Energy: Hydro power: Potential, Hydropower Generation and Distribution, Mini and Microhydel Power (MHP) Generation: Classification of hydel plants, Concept of micro hydel, merits, MHP plants: Components, design and layout, Turbines, efficiency, Status in India.

Books & References:

1. Renewable Sources of Energy and Conversion Systems: N.K. Bansal and M.K. Kleeman
2. Principles of Thermal Process: Duffie -Beckman.
3. Solar Energy Handbook: Kreith and Kreider (McGraw Hill)
4. Solar Cell : Marteen A. Green
5. Solar Hydrogen Energy Systems -T. Ohta (Ed.) (Pergamon Press)
6. Biomass Renegerable Energy – D.O.hall and R.P. Overeed
7. Handbook : Batteries and Fuel cell – Linden (McGraw Hill)
8. Wind energy Conversion Systems – Freris L.L. (Pr entice Hall1990)

MME-203 ENERGY SCENARIO AND POLICY 4 Credits (3-1-0)

UNIT I **9**

Role of energy in economic development and social transformation: Energy & GDP, GNP and its dynamics. Discovery of various energy, Energy Consumption in various sectors and its changing pattern, Exponential increase in energy consumption and future demands, Future Energy Options

UNIT II **9**

Energy resources & Consumption: Commercial and noncommercial forms of energy, Fossil fuels, Renewable sources including Bio-fuels in India, their utilization pattern in the past, present and future projections of consumption pattern, Sector wise energy consumption

UNIT III **9**

Energy Policy Issues: Fossil Fuels, Renewable Energy, Power sector reforms, restructuring of energy supply sector, energy strategy for future. Energy Conservation Acts, Global Energy Issues, National & State Level Energy Issues,

UNIT IV **9**

Energy Security, International Energy Policies of G-8 Countries, G-20 Countries, OPEC Countries, EU-Countries International Energy Treaties (Rio, Montreal, Kyoto), INDO-US Nuclear Deal

Books & References:

1. Energy for a sustainable world: Jose Goldenberg, Thomas Johansson, A.K.N. Reddy, Robert Williams (Wiley Eastern).
2. Energy policy: B.V. Desai (Wiley Eastern)
3. Modeling approach to long term demand and energy implication: J.K. Parikh
4. Energy Policy and Planning: B. Bukhootsow
5. TEDDY Year Book Published by Tata Energy Research Institute (TERI)
6. World Energy Resources : Charles E. Brown, Springer, 2002

MME-204 ADVANCED HEAT TRANSFER 5 Credits (3-1-2)

UNIT I **9**

Review: Reviews of basic laws of Conduction, Convection and Radiation

Conduction: One dimensional steady state conduction with variable thermal conductivity and with internal distributed heat source, Local heat source in non-adiabatic plate, Thermocouple conduction error, Extended Surfaces-Review, Optimum fin of rectangular profile, straight fins of triangular and parabolic profiles, Optimum profile, Circumferential fin of rectangular profile, spines, design considerations.

UNIT II **9**

2D steady state heat conduction, semi -infinite and finite flat plates, Temperature fields in finite cylinders and in infinite semi-cylinders, spherical shells, Graphical method, relaxation technique, Unsteady state conduction, Sudden changes in the surface temperatures of infinite plates, cylinders and spheres using Groeber's and Heisler charts for plates, cylinders and spheres suddenly immersed in fluids.

UNIT III **9**

Radiation: Review of radiation principles, Diffuse surfaces and the Lambert's cosine law. Radiation through non-absorbing media, Hottel's method of successive reflections, Gebhart's unified method, Poljak's method. Radiation through absorbing media, Logarithmic decrement of radiation, Apparent absorptive of simple shaped gas bodies, Net heat exchange between surfaces separated by absorbing medium, Radiation of luminous gas flames.

UNIT IV **9**

Convection: Heat transfer in laminar flow, free convection between parallel plates, Forced internal flow through circular tubes, Fully developed flow, Velocity and thermal entry length, solutions with constant wall temperature and with constant heat flux, Forced external flow over a flat plate, two-dimensional velocity and temperature boundary layer equations, Karman Pohlhousen approximate integral method. Heat transfer in turbulent flow, Eddy heat diffusivity, Reynold's analogy between skin friction and heat transfer, Prandtl-Taylor, Von Karman and Martineli's analogies, Turbulent flow through circular tubes.

EXPERIMENTS

Note: Minimum Eight experiments are to be performed

1. Experiment on Conduction - Composite wall experiment
2. Experiment on Conduction - Composite cylinder experiment
3. Experiment on Convection - Pool Boiling experiment
4. Experiment on Convection - Experiment on heat transfer from tube-natural convection.
5. Experiment on Convection - Heat Pipe experiment.
6. Experiment on Convection - Heat transfer through fin-natural convection .
7. Experiment on Convection - Heat transfer through tube/fin-forced convection.
8. Experiment on Any experiment on Stefan's Law, on radiation determination of emissivity, etc.
9. Experiment on Any experiment on solar collector, etc.

10. Experiment on Heat exchanger - Parallel flow experiment
11. Experiment on Heat exchanger - Counter flow experiment
12. Experiment on Any other suitable experiment on critical insulation thickness.
13. Experiment on Conduction - Determination of thermal conductivity of fluids.
14. Experiment on Conduction - Thermal Contact Resistance Effect.

Books & References:

1. Advances in Heat Transfer- James P Hartnett (Academic Press)
2. Principles of Heat Transfer- Kaviany M (Wiley-International)
3. Heat Transfer: Principles and Applications-B.K. Datta (Prentice Hall of India)
4. Heat Transfer Calculations- Myer Kutz (McGraw-Hill)
5. Convective Heat Transfer- Burmeister Louis (Wiley-International)

MME-205 ENERGY MANAGEMENT AND AUDIT 4 Credits (3-1-0)

UNIT I **9**

Energy Management: Definition & Objectives of Energy Management; Importance; Indian need of Energy Management; Duties and responsibilities of energy managers, Energy conservation in boilers, steam turbines and industrial heating systems; Application of FBC; Cogeneration and waste heat recovery; Thermal insulation; Heat exchangers and heat pumps; Building Energy Management.

UNIT II **9**

Energy Audit: Energy Audit: Types and Methodology; Energy Audit Reporting Format; Understanding Energy Costs; Benchmarking and Energy Performance; Matching Energy Usage to Requirement; Maximising System Efficiency; Fuel and Energy Substitution; Energy Audit Instruments; Duties and responsibilities of energy auditors.

UNIT III **9**

Material and Energy Balance: Basic Principles; The Sankey Diagram and its Use; Material Balances; Energy Balances; Method for Preparing Process Flow Chart; Facility as an Energy System; How to Carryout Material and Energy (M & E) Balance.

UNIT IV **9**

Energy Action Planning: Key elements; Force field analysis; Energy policy purpose, perspective, contents, formulation, ratification; Organizing the management: location of energy management, top management support, managerial function, accountability; Motivation of employees: Information system-designing barriers, strategies; Marketing and communicating: Training and planning.

Books & References:

1. Energy Management: W.R. Murphy, G. Mckay (Butterworths).
2. Energy Management Principles: C.B. Smith (Pergamon Press).
3. Efficient Use of Energy : I.G.C. Dryden (Butterworth Scientific)
4. Energy Economics -A.V. Desai (Wieley Eastern)
5. Industrial Energy Conservation : D.A. Reay (Pergammon Press)
6. Energy Management Handbook – W.C. Turner (John Wiley and Sons, A Wiley Interscience Publication)
7. Industrial Energy Management and Utilization–L .C. Witte, P.S. Schmidt, D.R. Brown (Hemisphere Publication, Washington)

MME-251 ECONOMICS AND PLANNING OF ENERGY SYSTEMS 4 Credits (3-1-0)

UNIT I **9**

Relevance of financial and economic feasibility, Evaluation of energy technologies and systems, Basics of engineering economics, Financial evaluation of energy technologies, Social cost benefit analysis, Case studies on techno-economics of energy conservation and renewable energy technologies.

UNIT II **9**

Energy demand analysis and forecasting, Energy supply assessment and evaluation, Energy demand – supply balancing, Energy models, Software for energy planning,

UNIT III **9**

Energy – economy interaction, Energy investment planning and project formulation. Energy pricing, Policy and planning implications of energy – environment interaction, clean development mechanism, technology transfer and its financing

UNIT IV **9**

Carbon credits and trading opportunities, Financing of energy systems, Energy policy related acts and regulations

Books:

1. Economic Issues of Renewable Energy Systems Gerhard Oelert, Falk Aner & Klaus Pertz
2. Energy Policy: B. G. Desai

MME-252 POWER PLANT ENGINEERING 4 Credits (3-1-0)

UNIT I **9**

Introduction: Rankine cycle with reheat & regeneration; Binary vapour cycle and flow through nozzles; Energy resources & development of power in India; Hydro, thermal and nuclear energy; present power position & Future planning of policies in India.

Thermal Power Plants: Introduction, Fossil fuel & its resources; Fuel properties and storage, Classification of coal; Use of high ash coal, Lignite coal, Drying, Storage and handling of liquid fuels, Types of petroleum fuels; Producer gas; Fuel firing; Furnaces construction; Grates; Pulverizes; Oil & gas burners and fluidized bed combustion system, Ash handling and flue gas analysis; High pressure boilers; Super critical boilers; Steam plant accessories; Effect of component characteristics on the plant performance and variable load problem.

UNIT II **9**

Diesel Electric Power Plants: Field of use, Outline of diesel power plant, different systems, Super charging, Diesel plant efficiency & heat balance, Research in diesel power plant.

Gas Turbine Plants: Introduction, Classification; Types of gas turbine plants; Analysis of closed and open cycle, Constant pressure gas turbine plants; Methods to improve the thermal efficiency of a simple open cycle constant pressure gas turbine plant; Auxiliaries & controls. Environmental impact of gas turbine power plants

UNIT III **9**

Hydro Electric Power Plants: Hydrology-rainfall, Runoff & its measurement, Hydrograph & storage of water; Classification of Hydro units; Design, construction & operation of different components of hydroelectric power stations. **Nuclear Power Plants:** Principles of nuclear energy; Classification, Main parts of nuclear reactors; Types of reactors; PWR, BWR, Heavy water reactors, gas cooled reactor, Liquid metal cooled reactors; Organic moderated cooled reactors, Breeder reactors plant operation, safety features & Radioactive waste disposal.

Non-Conventional Power Generation: Introduction; Geo thermal power; Tidal; solar & Wind power plants and direct energy conversion systems.

UNIT IV **9**

Economic analysis of Power Plants and its Tariffs: Instrumentation & control in thermal power plants, energy conservation & management.

Environmental aspects of Power Generation: Pollutants from fossils fuels and health hazards, Control of emissions and particulate matter, desulfeorization, Coal gasification & Introduction to greenhouse effect.

Books & References:

1. Power Plant Engineering- Drbal Larry F (Kluwer Aca)
2. Plant Genetic Engineering-Dodds John H (Cambridge)
3. Plant Design and Economics for Chemical Engineers- Peters Max Stone (McGraw-Hill)
4. Plant Engineering's Fluid Power Handbook, Volume 2: Hehn Anton H (Gulf Profe)

MME-253 COMPUTER AIDED DESIGN OF THERMAL SYSTEMS 4 Credits (3-1-0)

UNIT I **9**

Study of the design aspects, Review of Computer aided design, fluid flow and heat transfer characteristics and material requirements of heat exchange equipments,

UNIT II **9**

Liquid-to-liquid and Liquid –to-gas heat exchange systems, Familiarity with use of design related International/National and other codes.

UNIT III **9**

Design of any of the subsystems using compressor, condenser, evaporator and optimization for minimum cost and maximum performance etc

UNIT IV **9**

Development of computer programs for designing the systems
Environmental considerations in design of thermal systems

Books & References:

1. CAD/CAM , Computer Aided Design and Manufacturing-M P Groover & E W Zimmers Jr (Prentice-Hall of India)
2. Computer Aided Design- Software And Analytical Tools -C S Krishnamoorthy (Narosa Publishing)
3. Developments In The Design Of Thermal Systems - Robert F Boehm (Cambridge University)
4. Design Analysis Of Thermal Systems - R F Boehm (John Wiley)

MME-254 COMBUSTION ENGINEERING 4 Credits (3-1-0)

UNIT I **9**

Introduction: Importance of combustion; Combustion equipments, Hostile fire problems, pollution problems arising from combustion.

Thermodynamics of Combustion: Enthalpy of formation; Enthalpy of reaction; Heating values; First & second laws; Analysis of reaction system, Chemical equilibrium, Equilibrium composition; Adiabatic & equilibrium, Flame temperature.

UNIT II **9**

Kinetics of Combustion: Law of mass action; Reacting rate; Simple and complex reaction; Reaction order & molecularity, Arhenius laws; Activation Energy; Chain reaction; Steady rate & Partial equilibrium approximation; chain explosion; Explosion limit and oxidation characteristics of hydrogen, Carbon monoxide, Hydrocarbons.

Flames: Remixed flame structure & propagation of flames in homogeneous mixtures; Simplified Rankine Hugoniot relation, Properties of Hugoniot curve, analysis of Deflagration & detonation branches, Properties of Chapmen Jouguet wave, Laminar flame structure; Theories of flame propagation & calculation of flame speed measurements.

Stability limits of laminar flames; Flammability limits & quenching distant, Burner design, Mechanism of flame stablization in laminar & turbulent flows, Flame quenching, Diffusion flames; Comparison of diffusion with premixed flame, combustion of gaseous fuel, jets burke & Schumann development.

UNIT III **9**

Burning of Condensed Phase: General mass burning considerations, Combustion of fuels droplet in a quiescent and convective environment, Introduction to combustion of fuel sprays

Ignition: Concept of ignition, Chain ignition, Thermal spontaneous ignition, Forced ignition.

UNIT IV **9**

Combustion Generated Pollution & its Control: Introduction, Nitrogen oxide, Thermal fixation of atmospheric nitrogen prompts, NO, Thermal NOx & control in combustors. Fuel NOx & control, post combustion destruction of NOx, Nitrogen dioxide, carbon monoxide Oxidation-Quenching, Hydrocarbons, Sulphur oxide.

Books & References:

1. Internal Combustion Engines: Applied Thermo sciences- Ferguson Colin R (John Wiley)
2. Engineering Fundamentals of the Internal Combustion Engine- Pulkrabek (Pearson Education)

3. Instrumentation for Combustion and Flow in Engines- Durao D F G (Kluwer Aca)
4. Energy From Biomass: A Review of Combustion and Gasification Technologies - Quaak Peter

MME-255 WIND ENERGY AND HYDRO POWER SYSTEM 4 Credits (3-1-0)

UNIT I **9**

Introduction, General theories of wind machines, Basic laws and concepts of aerodynamics, Micro-siting, Description and performance of the horizontal–axis wind machines

UNIT II **9**

Blade design, Description and performance of the vertical–axis wind machines, The generation of electricity by wind machines, case studies, Overview of micro mini and small hydro, Site selection and civil works, Penstocks and turbines, Speed and voltage regulation

UNIT III **9**

Investment issues, load management and tariff collection, Distribution and marketing issues, case studies,

UNIT IV **9**

Wind and hydro based stand-alone / hybrid power systems, Control of hybrid power systems, Wind diesel hybrid systems.

Books & References:

1. Wind Energy Technology - John F. Walker & Nick Jenkins
2.Wind Energy - Sathyajith & Mathew

MME-256 ENERGY STORAGE SYSTEM 4 Credits (3-1-0)

UNIT I **9**

Need of energy storage; Different modes of Energy Storage

Potential energy: Pumped hydro storage; KE and Compressed gas system: Flywheel storage, compressed air energy storage; Electrical and magnetic energy storage: Capacitors, electromagnets; Chemical Energy storage: Thermo-chemical, photo-chemical, bio-chemical, electro-chemical, fossil fuels and synthetic fuels, Hydrogen for energy storage. Solar Ponds for energy storage

UNIT II **9**

Electrochemical Energy Storage Systems

Batteries: Primary, Secondary, Lithium, Solid-state and molten solvent batteries; Lead acid batteries; Nickel Cadmium Batteries; Advanced Batteries. Role of carbon nano-tubes in electrodes

Sensible Heat Storage

SHS mediums; Stratified storage systems; Rock-bed storage systems; Thermal storage in buildings; Earth storage; Energy storage in aquifers; Heat storage in SHS systems; Aquifers storage.

UNIT III **9**

Latent Heat Thermal Energy Storage

Phase Change Materials (PCMs); Selection criteria of PCMs; Stefan problem; Solar thermal LHTES systems; Energy conservation through LHTES systems; LHTES systems in refrigeration and air-conditioning systems; Enthalpy formulation; Numerical heat transfer in melting and freezing process.

UNIT IV **9**

Some Areas of Application of Energy Storage

Food preservation; Waste heat recovery; Solar energy storage; Green house heating; Power plant applications; Drying and heating for process industries.

Books & References:

1. Energy storage Robert Huggins Springer
2. Solar Energy Handbook: Kreith and Kreider (McGraw Hill)

MME-257 HYDROGEN ENERGY 4 Credits (3-1-0)

UNIT I **9**

Hydrogen pathways introduction – current uses, General introduction to infrastructure requirement for hydrogen production, storage, dispensing and utilization, and hydrogen product ion power plants.

Thermal-Steam Reformation – Thermo Chemical Water Splitting – Gasification – Pyrolysis, Nuclear thermo catalytic and partial oxidation methods. Electrochemical – Electrolysis – Photo electro chemical, Biological – Photo Biological – Anaerobic Digestion Fermentative Micro- organisms

UNIT II **9**

Physics and chemical properties – General storage methods, compressed storage – composites cylinders – Glass micro sphere storage – Zeolities, Metal hydride storage, chemical hydride storage and cryogenic storage.

UNIT III **9**

Overview of hydrogen utilization: I.C. Engines, gas turbines, hydrogen burners, power plant, refineries, domestic and marine applications. Hydrogen fuel quality, performance, COV, emission and combustion characteristics of Spark Ignition engines for hydrogen, back firing, knocking, volumetric efficiency, hydrogen manifold and direct injection, fumigation, NOx controlling techniques, dual fuel engine, durability studies, field trials, emission and climate change.

UNIT IV **9**

Safety barrier diagram, risk analysis, safety in handling and refueling station, safety in vehicular and stationary applications, fire detecting system, safety management, and simulation of crash tests.

Books & References:

1. Fuel Cells and Hydrogen Energy Bansal, Narottam P.
2. Industrial Hydrogen Hugh S. Taylor D.Sc
3. Hydrogen Generator Gas for Vehicles and Engines John D Cash; Martain Cash