FIRST SEMESTER

THEORY:

A. COMPULSORY SUBJECTS (THREE)		Lecture	Lab	Tutorials	Credits
M MA – 1003	Computational Mathematics (Breadth Paper)	3	0	0	3
MCD – 1001	System Analysis and Design	3	0	0	3
MCD – 1003	Engineering Elasticity & Plasticity	3	0	1	4
B. ELECTIVE SUBJECTS (ANY TWO)					
MCD – 1005	Advanced Dynamics and Vibration	3	0	0	3
MCD – 1007	Mechanics of Composite Materials	3	0	0	3
MCD – 1009	Fracture Mechanics & Theory of Failures	3	0	0	3
MCD – 1011	Nanotechnology	3	0	0	3
MCD – 1013	Hydraulic & Pneumatic Controls	3	0	0	3
MSE – 1007	Software Engineering (Breadth Paper)	3	0	0	3
C. LABORATORY					
MCD – 1016	Computer Programming and Software Lab	0	2	0	2
MCD –1002	Computer Aided Analysis & Design lab-I	0	2	0	2

Total Minimum number of credits to be Registered in First Semester 20.0

Prerequisite: CS-312 UNIX & C Programming: Non-Credit Course

SECOND SEMESTER

THEORY:

A. COMPULSORY SUBJECTS		Lectures	Lab	Tutorials	Credits
MCD – 2001	Finite Element Method in Solids & Structures	3	0	1	4
MCD – 2003	Computer-Aided Design	3	0	0	3

B. ELECTIVE SUBJECTS (ANY THREE)

MCD – 2005	Computer-Aided Manufacturing Systems	3	0	0	3
MCD – 2007	Theory of Optimization and Design	3	0	0	3
MCD – 2009	Modeling Analysis & Simulation	3	0	0	3
MCD – 2011	Mechatronics	3	0	0	3
MCD – 2013	Virtual Prototyping & Manufacturing	3	0	0	3
MCD – 2015	Thermal Engineering & Tribology	3	0	0	3
TCS – 7052	Artificial Intelligence & Intelligent Systems (Breadth paper)	3	0	0	3
MEE – 2001	Soft Computing Techniques (Breadth paper)	3	0	0	3

C. LABORATORY					
MCD – 2002	Computer Aided Analysis & Design Lab.-II	0	2	0	2
MCD – 2006	Automation & Robotics Lab	0	2	0	2

Total Minimum Number Credits to be Registered in Second Semester 20.0

THIRD SEMESTER

MCD – 3001	THESIS	15.0

FOURTH SEMESTER

MCD – 4001	THESIS	20.0

Total no of Credits ***20.0 + 20.0 + 15.0 + 20.0 = 75.0***

DETAILED SYLLABI:

MMA - 1003 COMPUTATIONAL MATHEMATICS

- **Partial Differential Equations:** Classification of partial differential equations. Its characteristics and reduction to canonical forms. Affine transformation. Solution of higher order p.d.e. with variable coefficients by Monge's method. Boundary value problems. Two-dimensional heat conduction equation. Laplace's equation in different coordinate systems. Vibrating membrane.
- **Calculus Of Variations**: Extrema of functions of several variables, Lagrange's multipliers. External properties of characteristic values of (A-B) X = 0. The Euler equation of variations, The extrema of integrals under constraints. Sturm-Liouville problems. Hamilton's principle and Lagrange's equations.
- **Eigen values and Eigen vectors of matrices**: Basic properties of eigen values and eigen vectors. The power method. The Rayleigh quotient. Inverse iteration. Jacobi's methods, Given and Householder's methods. Leverriar-Faddeeva method. Sylvester's expansion theorem and computation of f(A).
- **Numerical Methods**: Finite difference method for parabolic, elliptic and hyperbolic equations. Explicit and implicit schemes. Convergence and stability of schemes.
- **Introduction to finite element method**: Concept of functionals. Raleigh-Ritz and Galerkin's techniques. Application to two dimensional problems. Finite element method for one dimensional problems. Application to two-dimensional problems.

Text and Reference Books:

1. *Introductory Methods of Numerical Analysis", S.S. Shastry*
2. *"Advanced Engineering Mathematics", E. Kreyszig*

MCD - 1001 SYSTEM ANALYSIS & DESIGN

- **Systems concepts and systems environment**: Definition, Characteristics of a system, Elements of a system, Types of system.

- **System development life cycle**: Recognition of need, Feasibility study, Analysis, Design, Implementation, Post implementation and maintenance, considerations for candidate systems.
- **Roles of the system analyst**: Change agent, Investigator and monitor, Architect, Psychologist, Salesperson, Motivator, politician, The analyst /User interface-behavioural issues, conflict resolution, MIS organization.
- **System Analysis**: System planning and the initial investigation, Information gathering, The tools of structured analysis, Feasibility study, Cost/benefit analysis, System proposal.
- **Systems Design**: Application architecture and modeling, Database design, Output design and prototyping, Input design and prototyping, Processor design and prototyping, User interface design.
- **Advanced Analysis and Design Methods:** Object-oriented analysis and modeling, Object-oriented design and modeling.
- **Application of System Analysis and Design**: Mechanical, electrical, electronics, information and other systems. Design philosophy- fail safe and safe life.

Text & Reference Books:

1. *System Analysis and Design, Kennethe Kendall & Juliee Kendal, Prentice-Hall of India Pvt. Ltd, Newdelhi, fifth edition 2005.*
2. *System Analysis and Design, Elias M. Awad, Galgotia Publications (P) Ltd, New Delhi, 1998.*
3. *System Analysis and Design Methods, J. L. Whitten, L. D. Bently, K. C. Dittman, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, fifth edition, 2001*

MCD-1003 ENGINEERING ELASTICITY AND PLASTICITY

- Components of stress at a point, tensorial character, Cauchy's stress relations, Principal stresses and stress invariants. Octahedral stress components.

Homogeneous and deviatoric stress components. Equilibrium equations. Boundary conditions.

- Components of strain at a point. Tensorial character. Principal strains and strain invariants.Strain –displacement relations. Compatibility conditions. Generalised Hooke's law. Engineering and Lemi's elastic constants.Plane stress and plane strain problems. Biharminic equation.
- Principle of superposition. Uniqueness theorem. St. Venant's principle. Stress functions. Plane problems in Cartesian co-ordinates. Solutions by polynomials. Plane problems in polar coordinates. Complex stress functions.
- Semi-inverse method. Torsion of bars of circular and noncircular cross sections. Membrane analogy. Thin-walled open cross-sections.
- Strain energy.Principle of virtual work. Minimum potential energy principle. Problems of strings, beams and plates.
- Yield criteria. Stress space. Tresca's and Von Mises' theories of failure. Yield curves on Π-plane. Conventional and natural stress and strain. Stress –strain relations in restricted and unrestricted plasticity. Idealised stress-strain diagrams and dynamic models of mechanical behaviour.
- Elasto-plastic problems. Spherical and cylindrical pressure vessels. Rotating discs. Mechanics of metal forming. Sinking of thin walled tubes, wire drawing and other problems. Slip-line field theory. Stress and displacement equations

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Text & Reference Books:

1. *Theory of Elasticity: Timosenko and Goodier*
2. *Plasticity for Engineers: Johnson & Mellor*
3. *Fundamentals of Theory of Plasticity: L.M. Kachanov*
4. *Elasticity in Engineering: Ernest E. Sechler, Dover Publications Inc., 1968*
5. *Applied Elasticity: C.T. Wang, McGraw Hill Book Co. 1953.*

MCD - 1005 ADVANCED DYNAMICS AND VIBRATIONS

- Introduction, Brief history of vibrations classification of vibration and vibrating system some basic definition Axioms Hamilton principle, principle of virtual work, Lagrange equations.

- Free Vibration analysis of single degree of freedom (SDF) Undamped transnational and tensional systems, Damped vibrations of SDF, Different types of damping used in practice.
- Forced vibrations of SDF systems, formulations for rotating unbalance, whirling of rotating shaft base excitation, transmissibility and vibration isolations, introduction to vibration measuring instruments.
- Linear theory of free and forced vibrations of two – Degree-of-freedom systems, coordinate coupling, principal coordinates and orthogonality of modes.
- Vibration analysis of multi – degree-of-freedom systems, influence coefficients, matrix formulation, numerical techniques in determination of natural frequencies multi-degree-of-freedom systems.
- Free vibrations of continuous systems, strings, bars shafts and beams, Effect of rotary inertia, approximate methods, Raleigh's method, Rayleigh – Ritz method, collocation method, Galerkin's method used to determine natural modes.

Text & Reference Books:

1. *Structural Dynamics, Theory and Computations: Mario Paz, CBS Publishers & Distributors, Delhi, 1987*
2. *Theory of Vibration with Application: W.T. Thomson*
3. *Mechanical Vibration Analysis: P. Srinivasan*
4. *Elements of Vibrational Analysis: Leonard Meirovitch, McGraw Hill Book Co, 1986*

MCD - 1007 MECHANICS OF COMPOSITE MATERIALS & STRUCTURE

- Introduction, various reinforcements and matrix materials. Strength and stiffness properties. Effective moduli calculation. Three-dimensional anisotropy constitutive theory. Edge effects and interlaminar stresses. Temperature dependent properties.

- Laminates: Laminated plates. Analysis of strength and design with composites. Pressure vessels design with composites.
- Life Prediction: Prediction of strength and life of composite materials and structures, Micro mechanics, effects of damage accumulations, damage mechanics, life prediction concepts and methods.

Text & Reference Books:

1. *Mechanic of composite materials: R.M.Jones*
2. *Mechanic of composite materials: R.M. Christensen*
3. *Structural Stability of Columns & Plates: N.G.R. Iyenger.*
4. *Analysis and Performance of Fiber Composites: B. D. Agarwal & L. J. Bruteman.*

MCD - 1009 FRACTURE MECHANICS AND THEORY OF FAILURES

- Linear elastic and elastoplastic models of local stress fields around crack tips. Concepts of stress intensity and strain energy release rate, Strain energy density.

Concepts of crack opening displacement and J integral fracture criteria. Correlation of mathematical models with fracture toughness testing, Fracture safe designing of structures and machine components, failure analysis.

Text & Reference Books:

1. *Engineering Fracture Mechanics: David Broak*
2. *Fundamentals of Fracture Mechanics: J.F. Knott*
3. *Fracture Mechanics: R. L. Carlson, Orient Longmans 1998.*

MCD - 1011 NANOTECHNOLOGY.

- **Introduction to Physics of Solid State:** Structure, Energy bands, Localized particles**.**
- **Methods of Measuring Properties**: Atomic structures, Crystallography, Microscopy, Spectroscopy.
- **Properties of Individual Nanoparticles**: Metal nano-clusters, Semi-conducting nano-particles, Methods of synthesis.
- **Carbon Nanostructures**: Carbon molecules, Carbon clusters, Carbon nanotubes, Application of carbon nanotubes.
- **Bulk Nanostructured Materials**: Solid disordered nanostructures, Nanostructured crystals.
- **Nanostructured Ferromagnetism**: Basics of ferromagnetism, Effects of bulk nanostructuring of magnetic properties, Dynamics of nanomagnets, Nanopore containment of magnetic particles, Nanocarbon ferromagnets.
- **Optical and Vibrational Spectroscopy**: Infrared frequency range, Luminescence, Nanostructures in Zeolite Cages.
- **Quantum Wells, Wires, and Dots**: Preparation of quantum nanostructures, Size and dimensionality effects, Excitrons, Single electron Tunneling, Applications-infrared detectors, quantum dot lasers, Superconductivity.
- **Self Assembly and Catalysis**: Process of self-assembly, Semiconductor islands, Monolayers, Catalysis-Nature of catalysis, Surface area of nanoparticles, porous materials, pillored clays, colloids.
- **Organic compounds and Polymers:** Forming and characterizing polymers, Nanocrystals, Polymers-conductive and block copolymers, Supramolecular structures.
- **Nanomachines and Nanodevices:** MEMS, NEMS, Molecular and supramolecular switches.

Text & Reference Books:

1. *Introduction to Nanotechnology, Chalrles P. Poole,Jr., Frank J. Owens, Wiley-Interscience,Hoboken, New Jersey, 2003.*

2. *Nanotechnology -An Introduction to Nanostructuring Techniques, Michael Kohler, Wolfgang Fritzsche,wiley-VCH Verlag GmbH & Co., First Edition, 2004.*
3. *Nanotechnology, Gregory Timp Ed. , Springer-Verlag, New York, 1999*
4. *Nanoscale Materials, Luis M. Liz-Marzan & Prashant V. Kamat Eds., Kluwer Academic Publishers, Boston, 2003.*
5. *Science of Fullerenes & Carbon Nanotubes, M. S. Dresselhaus, P. C. Eklund, Academic Press, New York, 1996.*

MCD - 1013 HYDRAULIC & PNEUMATIC CONTROLS

- Generation and utilization of fluid power, Fluid power components and circuits, Positive displacement pumps and motors, pump losses and efficiency, linear actuators, different control valves, servo valves, proportional valves, computer interfacing of hydraulic drive, hydraulic drive cards, programmable logic controllers, online data acquisition system.
- Transfer function and block diagram for hydraulic system, Steady state and transient response analysis for servo valves and motors, stability analysis, Routh's and Nyquist criterion, fluidic valves and Boolean operations.
- Hydraulic Reservoirs & Accumulators; General valve analysis, valve coefficients, Modeling on valve control and pump control actuator, modeling of electro-hydraulic servo valve, Stability analysis of hydro-mechanical servo and relief valve, Matlab-Simulink Modeling of hydraulic systems; Design of Hydraulic Circuits; Seals & Packings; Hydraulic Pipes, Hoses and Fittings.
- Introduction to Pneumatic Control; Control Principles; Interacting Circuits; Some Applications of Basic Pneumatic Circuits; Sequences and Piloting Devices; Negative Feedback Control; Standard Ancillary Valve Arrangements and its Application; Pneumatic Circuit Design.

Text & Reference Books:

1. *D. McCloy and H. R. Martin," Control of Fluid Power, Analysis ,Design and Control", John Wiley & Sons*
2. *F. X. Kay, " Pneumatic Circuit Design", Machinery Publishing Co. Ltd, London, 1966*
3. *H. E. Merrit, " Hydraulic Control System", John Wiley & Sons.*
4. *J. F. Blackburn., G . Reethof, J. L. Shearer, " Fluid Power Control", Tech Press of MIT and John Wiley & Sons.*
5. *S. R. Majumdar, " Oil Hydraulic Systems-Principles & Maintenance", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2001.*
6. *B. Lall, "Oil Hydraulics at The Service of Machine", Durga Prasad Yugal Kishore Baranwal Publishing, Mazaffarpur, 1978.*

MSE - 1007 Software Engineering Principles & Practices

- **Introduction to Software Engineering**. Project size and its categories. Planning a software project. Software development life cycle. Planning and organizational structure.
- **Software cost Estimation**: Cost factors, cost estimation techniques, Maintenance cost estimation. Software requirements, specifications. Formal specification techniques.
- **Verification and validation techniques**: Quality assurance, walkthroughs and inspections. Testing fundamentals, types of testing, testing tools, automated testing, formal verification. Software tools. Overview of CASE.
- **Software Maintenance**: Maintenance characteristics and tasks, side effects, reverse engineering techniques.
- **Software reliability**: Software errors, faults, repair and availability, availability models, software maintenance. Management aspects of maintenance, maintenance tools and techniques.

Text & Reference Books:

1. *Software Engineering Concepts, R. Fairley, McGraw Hill, 1992.*
2. *Software Engineering, R.S.Pressman, McGraw Hill, 1996*
3. *Software Engineering Concept, T.G. Lewis, McGraw Hill, 1992*

MCD - 2001 FINITE ELEMENT METHOS IN SOLIDS & STRUCTURES

- **Introduction to FEM, integral formulations**: Variational method, weighted residual methods. Elements types and properties. One dimensional element, Shape functions for one and two dimensional elements- triangular and quadrilateral elements, Boundary conditions.
- **Element matrices**: Galerkin formulation, Two-dimensional grids, linear triangular and bilinear rectangular elements.
- **Coordinate systems**: Local coordinate systems, natural coordinate systems, area coordinate system, global coordinate systems.

- **Energy methods**: Solution techniques. Mesh refinement. Convergence criterion. Application to frames, beams and axial elements. Plane stress. Plane strain. Axi-symmetric problems. Application to vibrational problems.

Text & Reference Books:

1. *Applied Finite Elements Analysis :- Larry J. Segerlind.*
2. *An Introduction to the Finite Element Method:- J.N. Reddy*
3. *Finite Element Method for* Engineers: *H. K. Huebner, John Wiley & Sons, 1975.*
4. *Text Book of Finite Element Analysis- P. Seshu, Prentice- Hall of India Private Ltd, New Delhi, 2004.*

MCD-2003 COMPUTER AIDED DESIGN

- **CAD/ CAM systems**: Introduction, 3D modeling and viewing, Modeling aids and tools, Engineering drawings, CAD/CAM programming.
- **Geometric modeling**: Curves, Surfaces, NURBS, Solids, features.
- **Computer Graphics**: Graphic display, Transformations, Visualization, Computer animation.
- **Product Design and Development**: Mass Properties, Assembly modeling, Product data exchange, Data exchange standards, Database for CAD/CAM, Collaborative design.
- **Product Manufacturing and Management**: Engineering tolerances, Computer aided Process planning, PART programming, Product life cycle Management. Development of CNC controllers and machine tool robots as material handling devices.

Text & Reference Books:

1. *Mastering CAD/CAM: Ibrahim Zeid, Tata McGraw-Hill Publishing Co. Ltd, New Delhi, 2007*
2. *CAD, CAM and Robotics: M. P. Grover, Prentice-Hall of India, 1994*
3. *Computer Control of Machines and Manufacturing System, Y. Koren*
4. *Knowledge Intensive CAD: - Mantyle & Finger.*
5. *Computer Aided Design: - V. Ramamurti, TMH, New Delhi.*

MCD – 2005 COMPUTER AIDED MANUFACTURING SYSTEMS

- **INTRODUCTION TO MANUFACTURING AUTOMATION:** Fundamentals of manufacturing systems and automation need for system approach in manufacturing, types and needs of manufacturing automation, basic elements of an automated manufacturing system.
- **NUMERICAL CONTROL MANUFACTURING**: Problems with conventional numerical control, principle of operation of CNC, features and advantages of CNC, direct numerical control (DNC), types and functions of DNC, advantages of DNC, Adaptive control machining system, types and benefits adaptive control.
- **ROBOT TECHNOLOGY**: Robot anatomy and physical configuration of industrial robot, basic robot motions, specification of robots, robot end effectors / grippers, tools.
- **FLEXIBLE MANUFACTURING SYSTEM**: Classification, structure and operation of FMS, types of flexibility in FMS, design aspects of FMS, benefits of FMS.
- **PROCESS PLANNING**: Computer aided process planning, variant and generative approach, situational case studies and analysis.
- **COMPUTER NETWORKS FOR MANUFACTURING**: Hierarchy of computers in manufacturing, benefits of hierarchical structure, local area networks (LAN), manufacturing automation protocol (MAP), technical and office protocol (TOP).
- **COMPUTER INTEGRATED MANUFACTURING**: Evolution of CIM, key challenges in CIM, subsystems of CIM, Computer integrated manufacturing wheel.

Text & Reference Books:

1. *Tien-Chen Chong, R. A. Wysk, Hsu-Pin Wang, " Computer-Aided Manufacturing" Second Edition, Printice-Hall Inc., Englewood Cliffs, New Jersey, 1998.*
2. *Chris McMahan & Jimmie Brown, " CAD/CAM Principles, Practice and Manufacturing Management",Pearson Education Asia, Second Edition, 2001*
3. *Surender Kumar & A. K. Jha, Technology of CAD/CAM*
4. *P. Radhakrishnan, S. Subramanyanan and V. Raju, "CAD/CAM/CIM".*

5. *P. N. Rao, N. K. Tewari and T. K. Kundra, " Computer-Aided Manufacturing", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007.*
6. *Mastering CAD/CAM: Ibrahim Zeid, Tata McGraw-Hill Publishing Co. Ltd, New Delhi, 2007*

MCD - 2007 THEORY OF OPTIMIZATION AND DESIGN

- **Introduction to optimization**: Statement of an optimization problem, Classification of optimization problems, **Optimization techniques**: Classical techniques, Linear programming, Nonlinear programming with equality and inequality constraints Geometric programming, Dynamic programming, Integer programming, Stochastic programming.

Text & Reference Books:

1. *Engineering Optimization Theory & Practice, Singiresu S. Rao*
2. *Principles of Operations Research with Applications: H.M. Wagner*
3. *Analytical Decision Making in Engineering Design: Siddal*
4. *Combinatorial optimization: Algorithms & Complexity: C.H. Papadimitron*

MCD - 2009 MODELLING ANALYSIS AND SIMULATION

- **Introduction to modeling & simulation:** Modeling and model types, Needs and techniques of simulation.
- **Probability Theory & Distribution**: Review of probability and statistics, random variates-discrete & continuous distribution function, distribution fitting.
- **Modeling:** Mathematical representation of processes, problem identification, model construction, testing and calibration, evaluation and applications.
- **Modeling applications to engineering system:** Population process, traffic flow, structural systems, hydrodynamic processes and other physical systems. Econometric models, Network models.
- **Simulation Techniques**: Monte Carlo & retrospective simulation. Random event representation. Discrete & continuous process simulation. Event scan & time scan techniques. Statistical evaluation of simulation output - transient and steady state response. Upper and lower confidence limit etc.

- **Special purpose languages & Simulation Application**: Various simulation languages and software typical examples and case studies of simulation experiments.

Text & Reference Books

1. *Simulation Modeling and Analysis, Averill M. Law and W. David Kelton, Third edition, McGraw-Hill International series, 2000.*
2. *A First Course in Mathematical Modeling, Frank R. Giordano, Maurice D. Weir and William P. Fox, Third edition, Thomson Publications, 2003.*
3. *Discrete-Event System Simulation, Jerry Banks, John S. Carson II, Barry L. Nelson, David Nicol, Fourth edition, Pearson Education India, 2004.*
4. *System Simulation, Geoffrey Gordon, Second edition, Prentice Hall PTR, 2004.*

MCD-2011 MECHATRONICS

- **Introduction:** Control of mechanical systems, Interfacing micro-controllers with a mechanical system, Overview of sensors, transducers, micro controllers and computer monitoring.
- **Sensors and transducers:** Sensors and transducers for measuring displacement, velocity, force, pressure, liquid flow, temperature, stress & strain etc.
- **Signal conditioning:** Signal conditioning, operational amplifiers, protection, filtering, wheatstone bridge, analogue and digital signals, multiplexers, pulse modulation.
- **Data presentation systems**: Data presentation elements, magnetic recording displays, Data acquisition systems, measurement systems, testing and calibration.
- **Various Actuation systems:**
    a) Hydraulic and pneumatic systems
       Circuits, pumps, valves, linear and rotary actuators
    b) Mechanical systems
       Cam, gear trains, belt and chain drives, bearings
    c) Electrical systems
       D.C motors, A.C motors, stepper motors, solenoids

- **System models and transfer functions:** Mathematical model for the system, transfer function and block diagram for the system, first and second order system.
- **Dynamic responses of the system and stability**: Unit step transient response for first and second order systems, system stability, Routh's criterion, frequency response, Nyquist's criterion.
- **Closed loop controllers**: Proportional, Derivative, Integral and PID controllers, controller tuning
- **Microprocessors:** Control, microcomputer structure, micro controllers.
- **Programmable logic controllers:** Basic structure, programming and ladder diagram, latching, sequencing, timers, Internal Relays, counters.
- **Some Mechatronic systems**: Xerox machine, Robotic control, CNC machines, Rapid prototyping, Mechatronic Cars, Automatic washing machines, ATM, Aircrafts, industrial process controllers etc.

Text & Reference Books:

1. *Mechatronics, Bolton W, Pearson Education, 2nd Edition:*
2. *Mechatonics: N P Mahalik, Tata McGraw Hill Publication*
3. *Mechatonics: Alaiatore D G and Histand M. B, Tata McGraw Hill Publication*

MCD - 2013 VIRTUAL PROTOTYPING & MANUFACTURING

- Principles of Virtual Reality and 3-D Graphics; Application of 3-D Graphics and Virtual Reality in Manufacturing; Automation & Simulation; Virtual Reality Modeling; Motion; Collision Detection; Netwokking and related Issues.

Text & Reference Books:

MCD - 2015 THERMAL ENGINEERING & TRIBOLOGY

- Course overview; Fundamental principles; Transfer phenomena-analogy, momentum, heat and mass transfer; Thermal boundary layer flows; Modeling thermal transport process in typical engineering systems, simplified modeling techniques and experimental interfacing; Convective heat transfer- limiting

condition flows, parallel flows (Hagen-Poiseuille flow, Couette flow, sudden acceleration of a flat plate, stagnation flow, creeping flow (i.e. MEMS microfluidics); Natural convection (similarity solutions); Mass transfer- diffusion & convection; Combined heat and mass transfer; Heat transfer in porous media Tribology overview, friction wear & lubrication; Lubrication-types of lubrication, Shiebeck curve, boundary lubrication, surface film formation &failure, elasto hydrodynamic lubrication, hydrodynamic 7 hydrostatic lubrication; Fluid dynamics in lubrication; Newtonian fluid, Compressible & incompressible fluids; Theory of hydrodynamic lubrication; Lubricants- function, types of lubricants, solid, liquid, semi solid & gaseous, mineral, natural & synthetic lubricants, gaseous lubricants,greases, additives, special purpose lubricants, lubricant properties & testing; Triboelements- bearings types, jounnal bearing, babbits, important steps in design.

Text & Reference Books:

1. *Fundamentals of Heat and Mass Transfer, F. P. Incropera and B. Lavine, Wiley & Sons, Sixth Edition, 2006.*
2. *Fundamentals of Momentum, Heat, and Mass Transfer, J.Welty, C. Wicks, R. Wilson & G. Rorrer, Wiley & Sons, Fourth Edition, 2000.*
3. *Heat & Mass Momentum Transfer, Rehsennow and Choi, Prentice-Hall, 1980*
4. *Basic Lubrication Theory, A, Cemeron*
5. *Introduction to Tribology of Bearings, B. C. Majumdar*

CS - 312 UNIX & C PROGRAMMING

- **Unix:** Unix file, system, directories, permissions and directory hierarchy. Shell, shell commands, variables, looping, filters, grep family, Sed, Awk, shell programming, programming with standard IO, Unix systems calls, low level I/O file system development, inodes, document presentation, Nroff and Troff applications.
- **C Language**: Basics, types of operations and expressions, variable names, data types. Arithmetic, relational and logical operators type conservation. Bit wise logical operators and conditional expressions. Control flow: Statements and blocks,

if-else, else-if, switch, loops, while, and, for, do while, break, continue, go to and labels.

- **Functions:** Functions arguments, external, static and register variables, block structure initializations and recursion. Pointers: Pointers and functions, arrays, multidimensional arrays, pointers to array, array of pointers, initialization of pointers, command line arguments.
- **Structures**: Structures, arrays of structures, pointers to structure. Table look up, fields, union, type def. Preprocessors. Input - output - library of functions, formatted input, formatted output, file access line I/O. Unix system interface, file descriptors, low level I/O, read - write, open, create, close, unlink, random access.

Text & Reference Books:

UNIX:

1. *"Design of Unix O.S.", M. Bank, Tata McGraw Hill*
2. *"Programming of Unix", Kernighan & Pike, B. P. B.*
3. *"Advance Unix Programming", S. Plata, Tata McGraw Hill*
4. *"Unix O. S. (System-V)", Sumitava Das, Tata McGraw Hill*

C-Programming:

1. *The Programming Language, B. W. Kernighan & D. M. Ritchie, Prentice Hall, New Delhi*
2. *Data Structures using C, A. M. Tenenbaun, Y. Laugsam & M. J. Augestein, Prentice Hall, New Delhi*
3. *Fundamentals of Data Structures in C, E. Horowitz, S. Sahani & S. Anderson- Freed, Computer Science Press, New York.*
4. *Programming Languages: Design and Implementation, Prentice Hall, New Delhi, Third Edition*
5. *Theory and Problems of Programming with C, Byron S. Gottfried, Tata McGraw hill Publishing Co. Ltd, 1997.*

1. *Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM - Ray F. Egerton.*

TCS - 7052 ARTIFICIAL INTELLIGENCE & INTELLIGENT SYSTEM

- **Introduction to Artificial Intelligence:** the AI problem, the underlying Assumption, what is an AI technique? The level of the model, criteria for success Problems, problem spaces and search: defining the problem as a state space search, production systems, problem characteristic, production system characteristic, issue in the Design of search problems.
- **Heuristic search techniques**: Generate-and –test, hill climbing, best-first-search, problem reduction, constraint satisfaction, means-ends-analysis.
- **Knowledge representation issues**: Representations and mappings, approaches to knowledge representation, issue in knowledge representation, the frame problem.
- **Using predicate logic:** Representing simple facts in logic, representing instance and Iso-relationships, computable function and predicates, resolution, natural deduction.
- **Representing knowledge using rules**: Procedural versus Declarative knowledge, logic programming, forward versus backward reasoning, matching, control knowledge.
- **Expert systems**: Representing and using Domain knowledge, expert system shells, explanation, knowledge acquisition.

Text & Reference Books:

1. *Rich E., Artificial Intelligence*
2. *Charniak E., Introduction of Artificial Intelligence.*
3. *Marcellus, Expert System Programming in TURBO PROLOG.*

MEE - 2001 SOFT COMPUTING TECHNIQUES

- **Introduction:** Structural and Foundation of Single Neutron, Neutral Net Architectures, Neutral Learning Application, Evaluation of Networks, Implementation.
- **Supervised Learning**: Single layers Networks, Perceptions, Linear Separability, Perception, Training Algorithms, Guarantee of Success, Modification.

- **Multilayer Network**: Multilevel Discrimination, Preliminaries, Back-propagation, Algorithm, Setting the Parameter Values, Accelerating the Learning Process, Application.
- **Unsupervised Learning**: Winner takes all the Networks, Learning Vectors Quantities, ART, Topologically Organized Networks.
- **Associate Models**: Non-Iterative Procedures for Association, Hop field Networks, Brain State in a Box Network, BAM, Boltzmann Machines.
- **Optimization Methods**: Optimization using Hopfield Networks, Evolutionary Computation. Discussion of Neutral Networks Application: Areas of Pattern Recognition, Control and Time Series Prediction.

Text & Reference Books:

1. *"Elements of Artificial Neural Networks", Krishan Mehrotra, Chilakuri K. Mohan and Sanjay Ranka, Penvam Publishing International publishing (India).*
2. *"Neural Networks: A Comprehensive Foundation", Siman Haykin, IEEE, Press, Macmillan, N.Y., 1994.*