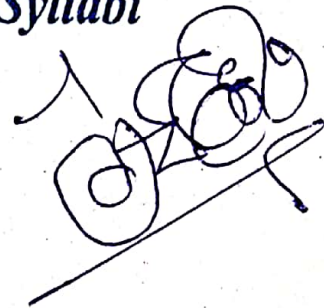


Faculty of Engineering
Scheme of Instruction and Syllabi

of

BE IV - YEAR



OF
FOUR YEAR DEGREE COURSE

IN

MECHANICAL ENGINEERING

(With effect from the Academic Year 2013-2014)



July, 2013

Osmania University
Hyderabad - 500 007.

WITH EFFECT FROM THE ACADEMIC YEAR 2013 - 2014
SCHEME OF INSTRUCTION & EXAMINATION

**B.E. IV - YEAR
(MECHANICAL ENGINEERING)**

SEMESTER - I

Sl. No.	Syllabus Ref. No.	SUBJECT	Scheme of Instruction		Scheme of Examination		
			Periods per week		Duration In Hours	Maximum Marks	
			L	D/P		Univ. Exam	Sessi- orals
1.	ME 401	THEORY Thermal Turbo Machines	4	1	3	75	25
2.	ME 402	Metrology & Instrumentation	4	-	3	75	25
3.	ME 403	Finite Element Analysis	4	1	3	75	25
4.	ME 404	Operations Research	4	-	3	75	25
5.		ELECTIVE – I	4	-	3	75	25
		PRACTICALS					
1.	ME 431	Thermal Engineering Lab	-	3	3	50	25
2.	ME 432	Metrology & Instrumentation Lab	-	3	3	50	25
3.	ME 433	CAE Lab	-	3	3	50	25
4.	ME 434	Project Seminar	-	3	-	-	25
		Total	20	14	-	525	225

ELECTIVE – I

- | | |
|--|---|
| ME 406 Neural Networks | ME 412 Computational Fluid Flows |
| ME 407 Automobile Engineering | ME 413 Design for Manufacture |
| ME 408 Non Conventional Energy Sources | ME 452 Composite Materials |
| ME 409 Tool Design | CE 452 Disaster Mitigation and Management |
| ME 411 Entrepreneurship | |

SERVICE COURSE: ME 472 Industrial Administration and Financial Management (Service course to ECE)

ME 401

THERMAL TURBO MACHINES

Instruction	4+1	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

Unit-1

Introduction to compressible flows: Speed of propagation of pressure waves, Mach number, Acoustic velocity and Mach cone, limits of compressibility, pressure field due to a moving source of disturbance, one dimensional compressible flow.

Isentropic flow with variable area, Mach number variation, Area ratio as function of Mach number, flow through nozzles and diffusers.

Flow in constant area ducts with friction-Fanno flow, variation of flow properties, variation of Mach number with duct length, isothermal flow with friction

Unit-II

Flow in constant area duct with Heat Transfer, -The Rayleigh liner, Rayleigh flow relations, variation of flow properties, Maximum heat transfer.

Flow with Shock Waves-Development of Normal Shock waves, governing equations, Prandtl -Meyer relation, Rankine-Hugoniot equations, Stagnation pressure ratio across shock.

Unit-III

Blade nomenclature of an aerofoil, Rotodynamic compressors: Introduction and general classification, Comparison of Reciprocating and Rotary compressors, Positive displacement Rotary compressors, Flow through rotary compressors. Static and total head quantities, Thermodynamic cycles and work done, calculation of various efficiencies. Velocity diagrams and prewhirl. Euler equation for energy transfer between fluid and rotor, Analysis of Centrifugal compressors and analysis of axial flow compressors, Chocking, Surging and Stalling.

Unit-IV

Steam Turbines: Classification, flow over blades, pressure velocity variations, Compounding of steam turbines- pressure compounding, velocity compounding and pressure-velocity compounding, Impulse turbine with several blade rings, Nozzle efficiency, Blade efficiency and Gross stage

efficiency of Impulse turbine, Velocity diagrams for Impulse turbine-De Laval Turbine, blade efficiency of Impulse turbine, Optimum blade speed ratio, Maximum work done and blade efficiency of Impulse turbine, Degree of reaction of Reaction turbine, Parson Reaction turbine, Velocity diagram for Parson Reaction turbine, blade efficiency of Parson Reaction turbine, Maximum work done and blade efficiency of Parson Reaction turbine, Height of blades of Reaction turbine, Balancing of End thrust,

Unit-V

Gas Turbines: Applications and Classification of Gas Turbines- constant pressure and constant volume gas turbines, Joule cycle-configuration diagram and temp-entropy diagram, Thermal efficiency of Joules cycle, Maximum pressure ratio in terms of temperature ratio, optimum pressure ratio for maximum work output with and without considering machine efficiencies, Improvement of gas turbine plant performance- Inter-cooling, Reheating and Regeneration. Simple Problems on Joule cycle.

Air Craft Propulsion: Air craft engine types, air craft propulsion theory, Turbo jet engines, Ramjet engines, Pulse jet engines, Rocket Propulsion: Types of Propellants, Types of Rocket engines, Rocket propulsion theory- Rocket applications.

Suggested Reading:

1. Yahya S M, *Fundamentals of Compressible Flow*, New Age International Publishers, Third Edition, 2007.
2. Mathur ML, & Mehta F S, *Thermal Engineering*, Jain Brothers, New Delhi, 2003
3. Dennis G Shepherd, *Aerospace Propulsion*, Elsevier Publishing Company, New York, 1995.
4. Cohen H Rogers G F C, Saravana Mutto H I H, *Gas Turbine Theory*, Longman 5th Edition, New York, 2004.
5. Ganeshan V, *Gas Turbines*, Tata Me Graw Hills, New Delhi, 2003
6. Yadav, R *Steam and Gas Turbines*, Central Publishing House Ltd, Allahabad, 2003.

WITH EFFECT FROM THE ACADEMIC YEAR 2013 - 2014

ME 402

METROLOGY AND INSTRUMENTATION

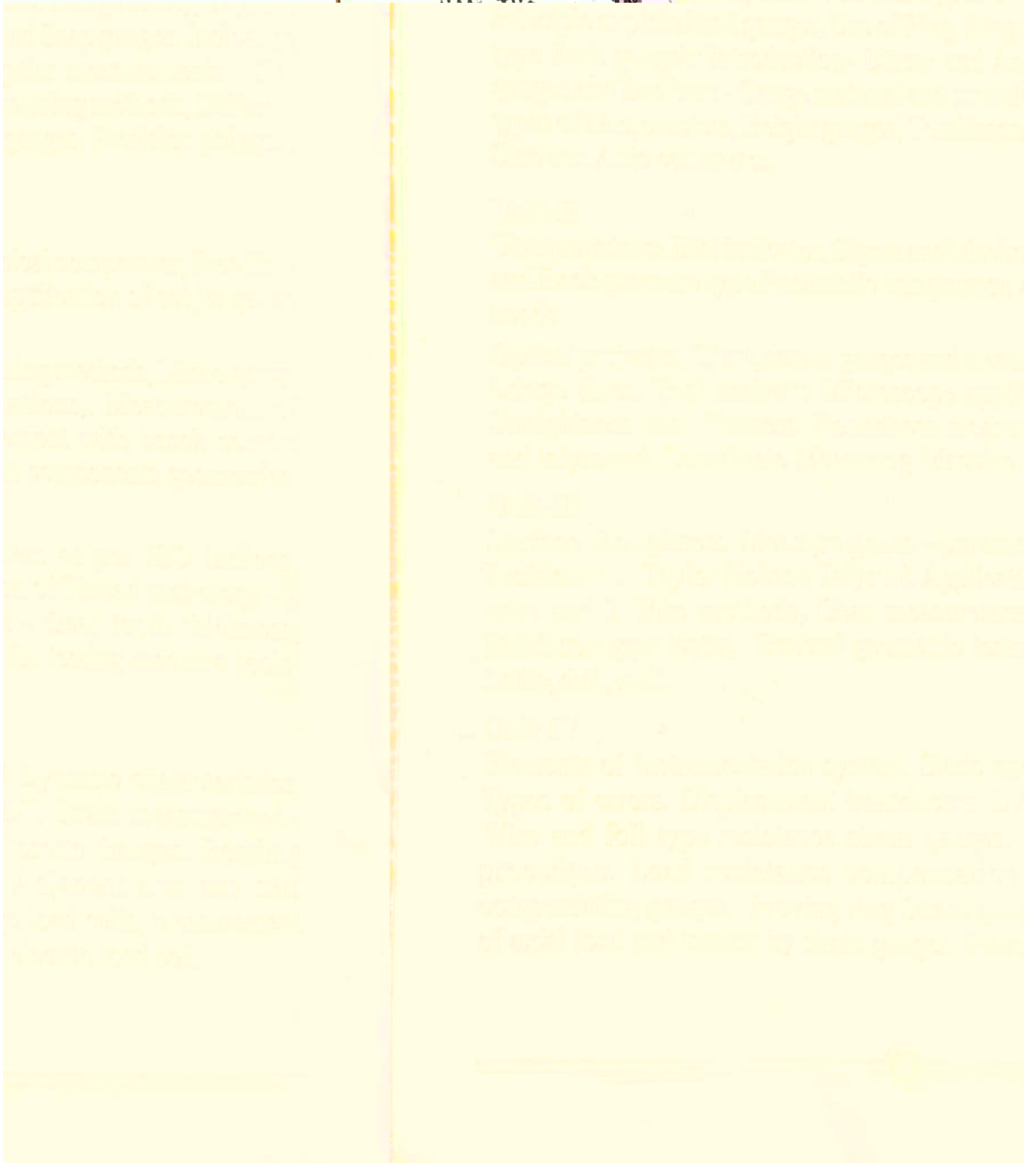
Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

Unit-I

ACADEMIC YEAR 2013 - 2014

WITH EFFECT FROM THE ACADEMIC

ME 402



Unit-V

Introduction to Seismic Transducers - displacement and acceleration measurement, Pressure measurement - Bourdon pressure gauge, bulk modulus gauge, pirani gauge, Temperature measurement by thermo couples. Laws of thermo electricity. Types of materials used in thermocouples. Protection tubes Extension wire. Series and parallel circuits. Ambient temperature compensation.

Suggested Reading:

1. I C Gupta-*Engineering Metrology*, Danpat Rai Publications, New Delhi.
2. Rega Rajendra, *Principles of Engineering Metrology*, Jaico Publishing House, Mumbai.
3. V S R Murti, *Metrology and Surface Engineering Frontline Publications*, 2011
4. R.K Jain, *Engineering Metrology*, Khanna Publications, 1996
5. Doebelin, *Measurement Systems Application and Design*, Tata McGraw Hill, 5th ed., 2004.
6. Beckwith, Buck, Lienhard, *Mechanical Measurements*, Pearson Education Asia.

ME 403

FINITE ELEMENT ANALYSIS

Instruction	4+1 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Introduction to Finite Element Method for solving field problems, Stress and Equilibrium, Boundary conditions, Strain, Displacement, Stress-Strain relations.

One dimensional problems:

Finite element modeling coordinates and shape functions, Potential Energy approach: Assembly of Global stiffness matrix and load vector, Finite element equations, Treatment of boundary conditions, Galerkin's approach, Quadratic shape functions.

Unit-II

Analysis of trusses and frames: Element stiffness matrix for a truss member, Analysis of plane truss with two at each node. Analysis of frames with two translations and a rotational degree of freedom at each node, Analysis of Beams: Element stiffness matrix for two nodes (two degrees of freedom per node).

Unit-III

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions. Finite element modeling of axi-symmetric solids subjected to axi-symmetric loading with triangular elements.

Unit-IV

Two dimensional four noded iso-parametric elements and numerical integration. Steady state heat transfer analysis: One dimensional analysis of a fin and two dimensional analysis of thin plate, Analysis of circular shaft subjected to torsion.

Unit-V

Dynamic Analysis: Formulation of finite element model, element matrices, Evaluation of Eigen values and Eigen vectors for a stepped bar and a beam, Time dependent field problems: Application to one dimensional heat flow in

a rod. Introduction to finite element formulation of three dimensional problems in stress analysis, Convergence requirements. Introduction to Finite Element Analysis Software.

Suggested Reading:

1. G. Ramamurthy, *Applied Finite Element Analysis*, I.K. International Publishing House Pvt. Ltd., New Delhi, 2009
2. Tirupathi R, Chandraputla and Ashok D Belagundu, *Introduction to Finite Elements in Engineering*, Practice Hall of India, 1997.
3. Rao S S, *The Finite Element Method in Engineering*, Pergamon Press, 1989.
4. Segerlind L J, *Applied Finite Element Analysis*, Wiley Eastern, 1984.
5. Reddy JN, *An Introduction to Finite Element Method*, McGraw-Hill, 1984.

ME 404

OPERATIONS RESEARCH

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

Unit-I

Introduction : Definition and Scope of Operations Research.

Linear Programming: Introduction, Formulation of linear programming problems, graphical method of solving LP problem, simplex method, maximization and minimization, Degeneracy in LPP, Unbounded and, Infeasible solutions.

Unit-II

Duality : Definition, Relationship between primal and dual solutions, Economic Interpretation, Post optimal of sensitivity analysis, Dual Simplex Method.

Unit-III

Transportation Models : Finding an initial feasible solution - North West corner method, Least cost method, Vogel's Approximation method, Finding the optimal solution, optimal solution by stepping stone and MODI methods, Special cases in Transportation problems - Unbalanced Transportation problem.

Assignment Problems : Hungarian method of Assignment problem, Maximization in Assignment problem, unbalanced problem, problems with restrictions, travelling salesman problems.

Unit-IV

Replacement Models : Introduction, replacement of items that deteriorate ignoring change in money value, replacement of items that deteriorate considering change in money value with time, replacement of items that fail suddenly - Individual replacement policy, Group replacement policy.

Game Theory: Introduction, 2 person zero sum games, Maximin - Minimax principle, Principle of Dominance, Solution for mixed strategy problems, Graphical method for $2 \times n$ and $m \times 2$ games.

Unit-V

Sequencing Models : Introduction, General assumptions, processing n jobs through 2 machines, processing ' n ' jobs through m machines, Processing 2 jobs through m machines.

Queuing Theory : Introduction, single channel - poisson arrivals - exponential service times with infinite population & finite population, Multi channel - poisson arrivals - Exponential service times with infinite population.

Introduction to optimization Techniques: Single objective & Multi objective optimization Techniques like G.A, NSGA, P.Q.O. & MPSO Techniques.

Suggested Reading :

1. Hamdy, A. Taha, *Operations Research-An Introduction*, Sixth Edition, Prentice Hall of India Pvt. Ltd., 1997.
2. S.D. Sharma, *Operations Research*, Kedarnath, Ramnath & Co., Meerut, 2009.
3. Hrvey M. Wagner, *Principles of Operations Research*, Second Edition, Prentice Hall of India Ltd., 1980.
4. V.K. Kapoor, *Operations Research*, S. Chand Publishers, New Delhi, 2004.
5. R. Paneer Selvam, *Operations Research*, Second Edition, PHI Learning Pvt. Ltd., New Delhi, 2008.
6. Data Reconciliation by Prof. Shanker Narasimha.

ME 406

NEURAL NETWORKS
(ELECTIVE - I)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Introduction: Knowledge - based information processing. A general view of knowledge based algorithm. Neural information processing. Hybrid intelligence. Artificial neuron.

Unit-II

Basic Neural Computation Models: Basic concepts of Neural network - Network properties, node properties, sigmoid functions. System dynamics. Inference and learning algorithm. Data representation. Functional classification models - single layer perceptions. Multilayer perceptions.

Unit-III

Learning supervised and unsupervised statistical learning. AI learning. Neural network Learning - Back propagation algorithm and derivation. Stopping criteria. Complexity of Learning Generalization.

Unit-IV

Self-organizing Networks: Introduction, The Kohonen algorithm, weight initialization, weight training, associative memories, bi-directional associative memories.

Unit-V

Hopfield Networks: Introduction: The Hopfield model. Hopfield network algorithm. Boltzman's machine algorithm. Neural applications.

Suggested Reading:

1. Limin Fu, *Neural Networks in Computer Intelligence*, Mc-Graw Hill, 1995.
2. Bart Kosho, *Neural Networks and Fuzzy Systems*, Prentice Hall of India, 1994.
3. James A. Freeman, *Simulating, Neural Networks*, Addison Wesley Publications, 1995.

WITH EFFECT FROM THE ACADEMIC YEAR 2013 - 2014

ME 407

AUTOMOBILE ENGINEERING
(ELECTIVE - I)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

Unit-I

Types of automobiles: Normal, Hybrid and Hydrogen Fuel vehicles. Engine location" and its- components, chasis layout; crank shaft proportion, firing order, piston and piston rings, cylinder liners, valves and operation mechanism, inlet and exhaust manifolds, carburetion and fuel injection system, Mechanical Fuel Injection system & Electronic Fuel Injection system.

Unit-II

Lubricating systems: Wet sump, dry sump and petrol systems.

Cooling systems: Water pumps, radiators, thermostat control anti freezing compounds.

Types of Ignition Systems, Modern Ignition systems, Types of batteries and charging systems, starting motors, lighting and electrical accessories, automobile air-conditioning.

Unit-III

Steering systems: Linkage arrangements and its components modified Ackerman linkage-Wheel alignment, caster and camber. Rack and pinion assembly - Recent Trends.

Wheel and lyres: Tyre construction, specification. Tyre wear and causes, wheel balancing, Types q/" Suspension system, independent suspension, coil and leaf springs, torsion bar, shock absorbers.

Unit-IV

Power Train: Clutches, gear and gearbox manual, semi-automatic and automatic gearboxes. Torque converter, propeller shaft, universal coupling differential, Four-wheel drive system.

Brakes Systems: Description and operation of hydraulic brake, leading and trailing shoe layout, disc brakes, master cylinder, hand brake linkage -Recent Trends.

Unit-V

Maintenance; Pollution control, trouble shooting and servicing procedure overhauling, engine tune up, tools and equipment for repair and overhaul, testing equipment, pollution control technologies used for petrol and diesel engines, types and study of catalytic converters, Euro norms 2 & 3 and Bharat Norms - Recent Trends.

Suggested Reading:

1. CROUSE & Anglin, *Automotive Mechanics*, Tata McGraw Hill, Publishing Co. Ltd., New Delhi, Tenth Edition - 2004.
2. Kirpal Singh., *Automobile Engineering*, Vol. I & II Standard Publishers, Delhi.
3. Joseph-Heitner, *Automotive Mechanics*, Affiliated East West Pvt. Ltd.
4. C.P. Nakra, *Basic Automobile Engineering*, Dhanpat Rai Publishing Co.(P) Ltd., New Delhi, 2003.

ME 408

NON CONVENTIONAL ENERGY SOURCES
(ELECTIVE - I)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

Unit-1

Statistics on conventional energy sources and supply in developing countries, Definition-Concepts of NCES, Limitations of RES, Criteria for assessing the potential of NCES. Classification of NCES-Solar, Wind, Geothermal, Bio-mass, Ocean Energy Sources, comparison of these energy sources.

Unit-II

Solar Energy-Energy available from Sun, Solar radiation data, Solar energy conversion into heat, Flat plate and Concentrating collectors, Mathematical analysis of Flat plate collectors and collector efficiency, Principle of Natural and Forced convection, Solar engines-Stirling, Brayton engines, Photovoltaic, p-n junction, solar cells, PV systems, Stand-alone, Grid connected solar power satellite.

Unit-III

Wind energy conversion, General formula -Lift and Drag- Basis of wind energy conversion -Effect of density, frequency variances, angle of attack, and wind speed. Windmill rotors- Horizontal axis and vertical axis rotors. Determination of torque coefficient, Induction type generators- working principle.

Unit-IV

Nature of Geothermal sources, Definition and classification of resources, Utilization for electric generation and direct heating, Well Head power generating units, Basic features- Atmospheric exhaust and condensing, exhaust types of conventional steam turbines.

Pyrolysis of Biomass to produce solid, liquid and gaseous fuels, Biomass gasification, Constructional details of gasifier, usage of biogas for chulhas, various types of chulhas for rural energy needs.

Unit-V

Wave, Tidal and OTEC energy- Difference between tidal and wave power generation, Principles of tidal and wave power generation, OTEC power

plants, Operational of small cycle experimental facility, Design of 5 Mw OTEC pro-commercial plant, Economics of OTEC, Environmental impacts of OTEC. Status of multiple product OTEC systems.

Suggested Reading:

1. Ashok V Desai, *Non-Conventional Energy*, Wiley Eastern Ltd, New Delhi, 2003.
2. Mittal K M, *Non-Conventional Energy Systems*, Wheeler Publishing Co. Ltd, New Delhi, 2003.
3. Ramesh R & Kumar K U, *Renewable Energy Technologies*, Narosa Publishing House, New Delhi, 2004
4. Wakil MM; *Power Plant Technology*, Mc Graw Hill Book Co, New Delhi, 2004.

ME 409

**TOOL DESIGN
(ELECTIVE - I)**

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

Unit-I

Cutting tool materials and processes: Desired properties, Types, major constituents, relative characteristics, latest developments, ISO: Classification and coding of carbide tools, Coated tools. Principles of working and applications of USM, EDM, ECM, AJM, LBM, and EBM. Superfinishing processes: Honing, Lapping Burnishing, Ballizing, Polishing.

Unit-II

Design of single point cutting tools, Form Tools: Design of flat and circular Form Tools and tool holding methods.

Design of Multi Point Cutting tools: Milling Cutters: Major types, design and manufacturing of peripheral, end and face milling cutters, forces and power estimation. Grinding of milling cutters.

Broaches: Pull and Push types. Internal and External broaches, geometry and design and manufacturing of Pull type and push type broaches.

Unit-III

Multi point cutting tools:

Twist Drill geometry, Design and manufacturing of twist drill. Effect of variation of different angles on torque and thrust forces. Types and design of shanks. Sharpening of twist drill.

Reamers: Types, geometry, Reaming allowance, tolerance disposition, Design and manufacture of twist drills.

Taps and Dies: Types, Geometry, Design and manufacturing of Taps and Dies.

Unit-IV

Design of Press tools: Die set elements. Design of Die Set for simple components in Blanking, Piercing, bending, Drawing, Forging and Spinning. Plastic Tools; Plastic Dies for simple components.

Unit-V

Jigs & Fixtures: Design principles and construction features. Locating methods associated with flat, cylindrical, internal and external surfaces. Type of locating pins. Requirements and choice of locating systems. Redundant location, fool proofing. Setting blocks, types of clamping devices and their basic elements. Quick action clamps and nuts. Equalising and multiple clamping pneumatics. Hydraulic, magnetic, electrical and vacuum clamping. Types of drill jigs and their classification. Types of jig bushes, jig feet, Indexing jigs. Design of Fixtures for Turning, grinding, welding and Milling. Economic analysis of Jigs and Fixtures.

Suggested Reading:

1. Donaldson, Leain and Goold, *Tool Design*, Tata Me Graw Hill, New Delhi, 1983.
2. Rodin, *Design of Cutting Tools*, Mir Publications, Moscow.
3. AmitabhaBattacharya and Inyong Ham, *Design of Cutting Tool, Use Of Metal Cutting Theory*, ASTME Publication Michigan USA, 1969.
4. Surender Keshav & Umesh Chandra, *Production Engineering Design (Tool Design)*, Satya Prakashan, New Delhi-1994.

ME 411

ENTREPRENEURSHIP
(ELECTIVE - I)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

Unit-I

Indian Industrial Environment-competence, Opportunities and Challenges. Entrepreneurship and Economic growth. Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries. Types of enterprises.

Unit-II

Identification and characteristics of entrepreneurs. Emergence of First generation entrepreneurs, environmental influence and women entrepreneurs. Conception and evaluation of ideas and their sources. Choice of Technology - Collaborative interaction for Technology development.

Unit-III

Project formulation, Analysis of market demand, Financial and profitability analysis and Technical analysis, project financing in India.

Unit-IV

Project Management during construction phase, project organization, project planning and control using CPM, PERT techniques. Human aspects of project management. Assessment of tax burden.

Unit-V

Behavioural aspects of entrepreneurs: Personality - determinants, attributes and models. Leadership concepts and models. Values and attitudes. Motivation aspects. Change behaviour. Time Management: Various approaches of time management, their strengths and weaknesses. The urgency addiction and time management matrix.

Suggested Reading:

1. Vasant Desai, "*Dynamics of Entrepreneurial Development and Management*", Himalaya Publishing House, 1997.

2. Prasanna Chandra, "*Project-Planning, Analysis, Selection, Implementation and Review*", Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. Stephen R. Covey and A. Roger Merrill, "*First Things First*", Simon and Schuster Publication, 1994.
4. G.S. Sudha, "*Organizational Behaviuor*", 1996.
5. Robert D. Hisrich, Michael P. Peters, "*Entrepreneurship*", Tata Me Graw Hill Publishing Company Ltd., 5th Ed., 2005.

ME 412

COMPUTATIONAL FLUID FLOWS
(ELECTIVE - I)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-1

Review of the basic fluid dynamics: Continuity, Momentum and Energy equations-Navier Stokes equations, Reynolds and Favre averaged N-S equations. Heat transfer conduction equations for steady and un-steady flows, Steady convection -diffusion equation

Unit-II

Introduction to turbulence, Mixing length model, K-epsilon turbulence model. Classification of Partial differential equations - Elliptic, parabolic and hyperbolic equations. Initial and boundary value problems

Unit-III

Concepts of Finite difference methods-forward, backward and central difference. Finite difference solutions-Parabolic partial differential equations-Euler, Crank Nicholson, Implicit methods. Errors, consistency, stability analysis -Von Neumann analysis. Convergence criteria.

Unit-IV

Elliptical partial differential equations- Jacobi, Gauss Seidel and ADI methods. Viscous incompressible flow, Stream function-Vorticity method Introduction to grid generation-Types of grid-O,H,C.

Unit-V

Introduction to finite volume method. Finite volume formulations for diffusion equation, convection diffusion equation. Solution algorithm for pressure velocity coupling in steady flows Staggered grid, simple. Algorithm

Suggested Reading:

1. Pradip Niyogi, Chakrabartty S K, Laha M K, *Introduction to Computational Fluid Dynamics*, Pearson Education, 2005.
2. Muralidhar K, Sundararajan T, *Computational Fluid Flow and Heat Transfer*, Narosa Publication House, New Delhi, 2003

3. Chung TJ, *Computational Chiid Dynamics*, Cambridge University Press, New York, 2002.
4. John D Anderson, *Computational Fluid Dynamics*, Me Graw Hill Inc., New York, 2003.
5. Patankar S V, *Numerical Heat Transfer and Fluid flow*, Hemisphere Publishing Company, New York, 1980.
6. H.K.Versteeg, W. Malalasekara, *An Introduction to Computational Fluid Dynamics*, Pearson Education, 2nd Ed.2007.

ME 413

**DESIGN FOR MANUFACTURE
(ELECTIVE - I)**

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Introduction: General design principles for manufacturability, strength and mechanical factors, mechanisms selection, evaluation method, geometrical tolerances, tolerances control and utilization. Economic Use of Raw Materials: Ferrous steel, hot rolled steel, cold finished steel, stainless steel, non ferrous materials aluminium, copper, brass, non metallic materials, plastics, rubber and composites.

UNIT-II

Metallic Components Design: Metal extrusion, metal stamping, fine blanking, four slide parts, spring and wire forms, spun metal parts, cold headed parts, extruded parts, tube and section bends, rolled formed parts, power metal parts, forging electro forming parts, specialized forming methods, turned parts, machined round holes, drilled parts, milled parts.

UNIT-III

Metallic Components Design: Planned shaped and slotted parts, screw threaded contoured and internal ground parts, center less ground, electrical discharged, rolled furnished parts, electro chemical and advanced machine parts, Sand cast, diecast, investment cast and other cast products.

UNIT-IV

Non Metallic Component Design: Thermosetting plastic, injection moduled and rotational moulded parts, blow moulded, welded plastic articles, ceramics. Assembled Parts Design: Welded parts, arc, resistance, brazed and soldered parts, gear box assembly, bearing assembly.

UNIT-V

Assembled Parts Design: Retension, bolted connection, screwed connections, flanged connections, centered connections, press fitted connections, surface finishing, plated

parts, heat treated parts, NC machining, group technology, low cost automation, computer aided manufacture, product design requirements.

Case Studies: Identifications of economical design and redesign for manufacture

Suggested Reading:

1. James G. Bralla, *Hand book of product design for Manufacturing* McGraw Hill Co., 1986
2. K.G. Swift *Knowledge based design for Manufacture* , Kogan page Limited, 1987.

ME 452

COMPOSITE MATERIALS
(ELECTIVE - I)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT-I

Introduction: Definition and classification of Composites (PMC, MMC, CMC), FRP Composites, Fiber Reinforcements: Fiber Types and its properties, Fiber Forms, Matrix materials and its properties: Thermoset Matrices, Thermoplastic Matrices, Applications of Composite Materials.

UNIT-II

Manufacturing Processes: Hand-Lay-up, Prepreg Lay-up, Bag Molding, Autoclave processing, Compression Molding, Resin Transfer Molding, Pultrusion, Filament Winding, Gel time test for resins, Curing Cycle. Measurement of basic composite properties: Fiber and matrix tests, Tensile test, Compressive test, in-plane shear test, interlaminar shear test, flexure test.

UNIT-III

Micromechanics of Composites:

Basic Concepts: Volume and Mass fraction, Heterogeneous, Anisotropic, Orthotropic, Transversely Isotropic and Isotropic Materials.

Mechanical Properties: Prediction of Elastic constants, micromechanical approach, Stress Partitioning Parameter, Halpin-Tsai equations.

Thermal Properties: Thermal Expansion, Moisture Expansion, Transport Properties.

UNIT-IV

Macromechanics of Composites:

Elastic constants of a lamina, relations between engineering constants and reduced stiffness and compliances, variation of lamina properties with orientation, Classification of Laminated composites, analysis of laminated composites, stresses and strain with orientation, Interlaminar stresses and edge effects.

UNIT-V

Strength of Orthotropic lamina: Tensile and compressive strength of natural fiber" composites, fracture modes in compos: es, delamination failure, Maximum stress theory, Max.mum S Tsai-Hill Criterion, Tsai-Wu Criterion. Laminate strength: Hrst Ply Failure, Fiber Failure, Timcated-MaMmum-Strain Criterion.

Suggested Reading:

1. Ronald F.Gibson *Principles of Composite Materials Mechanics* McGraw-Hill, Inc, 1994.
2. Krishna, K,Chewla, *Composite Materials*, Springer -Verlag. 1987.
3. Carl T.Herakovich, *Mechanics of Fibrous Composites*, John Wiley Sons Inc. 1998.
4. Ever J. Barbero, *Introduction to Composite Materials*, I Taylor & Francis, 1999.
5. Jones, R.M., *Mechanics of Composite Materials*, UcGrw-1 Co., 1967.

CE 452

DISASTER MITIGATION AND MANAGEMENT
(ELECTIVE - I)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT-I

Introduction - Natural, human induced and human made disasters international decade of disaster reduction.

UNIT-II

Natural Disasters - Hydrometeorological based disasters - Tropical cyclones, floods, drought and desertification - Zones Geographical based disasters - Earth quake, Tsunamis, Landslides and avalanches.

UNIT-III

Human induced hazards - chemical industrial hazards, major power breakdowns, traffic accidents, etc.

UNIT-IV

Use of remote sensing and GIS disaster mitigation and management

UNIT - V

Risk and vulnerability to disaster - mitigation and management options warning and forecasting

Suggested Reading:

1. Rajib, S and Krishna Murthy, R. R (2012) *Disaster Management global Challenges and Local Solutions* Universities Press, Hyderabad.
2. Navele, P & Raja, C. K (2009), *Earth and atmospheric Disasters Management, Natural and Manmade*, B. S. publications, Hyderabad.
3. Fearn-Banks, K (2011), *Crises computations approach: A case book approach*. Route ledge Publishers, Special Indian Education, New York & London.
4. Battacharya, T. (2012), *Disaster Science and Management*, Tata McGraw hill Company, New Delhi.

ME 431

THERMAL ENGINEERING LAB

Instruction	3	Periods per week
Duration of University Examination	3	Hours
University Examination	50	Marks
Sessional	25	Marks

1. Determination of COP of the Air Conditioning system.
2. Determination of percentage relative humidity and study of humidification and dehumidification process in Air Conditioning systems.
3. Determination of COP of Refrigeration systems using capillary tube/thermostatic expansion valve.
4. Determination of overall efficiency of centrifugal blower.
5. Determination of overall efficiency of axial flow fan.
6. Pressure distribution on symmetrical and non-symmetrical specimen in wind tunnel
7. Measurement of lift and drag force of the models in wind tunnel test section.
8. Determination of thermal conductivity of metal bar.
9. Determination of the efficiency of pin-fin subjected to natural and forced convection.
10. Determination of effectiveness of heat parallel flow and counter flow heat exchanger.
11. Determination of emissivity of given test plate.
12. Determination of Stefan-Boltzman constant

ME 432

METROLOGY AND INSTRUMENTATION LAB

Instruction	3	Periods per week
Duration of University Examination	3	Hours
University Examination	50	Marks
Sessional	25	Marks

1. Measurement with inside, outside and depth micrometers.
2. Measurement with height gauges, height masters, etc.
3. Measurement of Linear and Angular dimensions with Tool Maker's Microscope - Flat specimens plain, cylindrical specimens with centers and threaded components
4. Measurement with - Dial Indicator / Electrical Comparator / Mechanical Comparator / Dial Bore Gauges, etc.
5. Measurement of angles with Sinebar, Bevel protractor and Precision level, Block level, etc.
6. Measurement of roundness errors with bench centres.
7. Geometrical tests on Lathe machine.
8. Measurement of flatness errors (surface plate) with precision level.
9. Measurement with optical projector.
10. Checking machined components with plug gauges, adjustable snap gauges, indicating gauges, etc.
11. Force measurement with strain gauge type load cell / proving ring / piezoelectric load cell etc.
12. Temperature measurement with thermocouples

ME 433

CAE LAB

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks

1. Analysis of Plane Truss & Spatial Truss with various cross sections and materials to determine member forces, member strains & stresses, joint deflections under static, thermal and combined loading
2. 2D & 3D beam analysis with different sections, different materials for different loads (forces and moments) with different end supports
3. Static analysis of plate with a hole to determine the deformations, the Stresses to study the failure behavior and SCF.
4. Plane stress, plane strain and axisymmetric loading on the in plane members with in plane loading to study the stresses and strains.
5. Static analysis of connecting rod with tetrahedron and brick elements
6. Static Analysis of flat and curved shell due to internal pressure and moments to estimate the strains, stresses and reactions forces and moments with different boundary conditions
7. Buckling analysis of plates, shells and beams to estimate BF and modes
8. Modal analysis of beams, plates and shells for natural frequencies and mode shapes
9. Harmonic analysis of a Shaft subjected to periodic force and transient analysis of plate subjected to stepped and ramped loading with varying time
10. Steady state heat transfer Analysis Cross section of chimney and transient heat transfer analysis of solidification of castings.
11. Non linear analysis of cantilever beam with non-linear materials at tip moment and post Buckling analysis of shells for critical loads
12. Coupled field analysis.
13. Flow analysis of pipe with different fluids/gasses/air for velocity and pressure gradients

14. CFD analysis of aerofoil design
15. CFD analysis of ducts/impeller/fan
16. Use of MATLAB for finding B matrix, stiffness matrix and loading matrices of beam/in plane/solid elements and interfacing with CAE software's

Note:

1. Any of FEA software ANSYS/ABAQUS/NASTRAN/NISA/CAEFEM/ADINA may be used
2. Any 12 experiments to be conducted

ME 434

PROJECT SEMINAR

Instruction 3 Periods per week
Sessional 25 Marks

The objective of the project seminar is to actively involve the student in the initial work required to undertake the final year project. It may comprise of:

- Problem definition and specifications.
- A broad understanding of the available techniques to solve a problem of interest.
- Presentation (Oral and Written) of the project.

The Department can initiate the work related to project allotment at the end of III year II semester and complete it in the first two weeks of the fourth year I semester.

First 4 weeks of IV year 1st semester will be spent on special lectures by faculty members, research scholar speakers from industries and R&D institutions. The objective of these talks is to be expose students to real like / practical problems and methodologies to solve them.

A seminar schedule will be prepared by the coordinator for all the students. It should be from the 5th week to the last week of the semester and should be strictly adhered to,

Each student will be required to

1. Submit a one page synopsis of the seminar to be delivered for display on notice board.
2. Give a 20 minutes presentation followed by 10 minutes discussion.
3. Submit a technical write up on the talk delivered.

At least two teachers will be associated with the evaluation of the project seminar for the award of the Sessionals marks which should be on the basis of performance on all the three items stated above.

Note: Three periods of contact load will be assigned to each project guide

ME 472

**INDUSTRIAL ADMINISTRATION &
FINANCIAL MANAGEMENT**
(SERVICE COURSE TO ECE)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

Unit-I

Industrial Organisation: Types of various business organizations. Organisation structures and their relative merits and demerits. Functions of management. Plant location and layouts: Factors affecting the location of plant and layout. Types of layouts and their merits and demerits.

Unit-II

Work study, Definitions, objectives of method study and time study. Steps in conducting method study. Symbols and charts used in method study. Principles of motion economy. Calculation of standard time by time study and work sampling. Performance rating factor. Types of ratings. Jobs evaluation and performance appraisal. Wages, incentives, bonus, wage payment plans.

Unit-III

Inspection and quality control: Types and objectives of inspection S.Q.C., its principles. Quality control by chart and sampling plans. Quality circles, introduction to ISO.

Production planning and control: Types of manufacture. Types of production. Principles of PPC and its function. Production control charts.

Unit-IV

Optimisation: Introduction to linear programming and graphical solutions. Assignment problems.

Project Management: Introduction to CPM and PERT. Determination of critical path..

Material Management: Classification of materials. Materials planning. Duties of purchase manager. Determination of economic ordering quantities. Types of materials purchase.

Unit-V

Cost accounting: Elements of cost. Various costs. Types of overheads. Break even analysis and its applications. Depreciation. Methods of calculating depreciation fund. Nature of Financial management. Time value of money. Techniques of capital budgeting and methods.

Cost of capital. Financial leverage.

Suggested Reading:

1. Pandey I.M. *Elements of Financial Management*, Vikas Publ. House, New Delhi, 1994.
2. Khanna O.P., *Industrial Engineering and Management*, Dhanapat Rai & Sons.
3. Everrete E. Adama & Ronald J. Ebert, *Production & Operations Management*, Prentice Hall of India, 5th Edition, 2005.
4. S.N. Chary, *Production and Operations Management*, Tata McGraw Hill, 3rd Edition, 2006.
5. Paneer Selvam, *Production and Operations Management*, Pearson Education, 2007.

WITH EFFECT FROM THE ACADEMIC YEAR 2012 - 2013
SCHEME OF INSTRUCTION & EXAMINATION

**B.E. IV - YEAR
(MECHANICAL ENGINEERING)**

SEMESTER - II

Sl. No.	Syllabus Ref. No.	SUBJECT	Scheme of Instruction		Scheme of Examination		
			Periods per week		Duration In Hours	Maximum Marks	
			L	D/P		Univ. Exam	Sessi- onals
		THEORY					
1.	ME 450	Production Drawing	-	6	3	75	25
2.	ME 461	Production and Operations Management	4	-	3	75	25
3.		ELECTIVE – II	4	-	3	75	25
4.		ELECTIVE – III	4	-	3	75	25
		PRACTICALS					
1.	ME 481	Seminar	-	3	-	-	25
2.	ME 482	Project	-	6	Viva Voce	Gr*	50
		Total	12	15	-	300	175

ELECTIVE-II

- EC 441 Microprocessor Applications
- ME 453 Artificial Intelligence and Expert Systems
- ME 454 Machine Tool Design
- ME 455 Manufacturing Systems and Simulations
- ME 456 Mechatronics
- LA 454 Intellectual Property Rights
- ME 462 Nano Materials & Technology
- ME 463 Power Plant Engineering
- CS 403 Information Security

ELECTIVE-III

- ME 457 Robotics.
- ME 458 Product Design and Process Planning
- ME 459 Modern Machining and Forming Methods
- ME 460 Plastics Engineering & Technology
- CS 452 Computer Graphics
- CS 408 Internet Programming
- ME 464 Fuels & Combustion
- ME 465 Rapid Prototyping Technologies
- ME 467 Total Quality Management

SERVICE COURSE :

- ME 472 Industrial Administration and Financial Management
(Service course to EE & EIE)

ME 450

PRODUCTION DRAWING

Instruction	6	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

Unit-I

Format of drawing sheet, title block, columns for materials, processes, part list, etc., conventional representation of parts (Screwed joints, Welded joints, Springs, Gears, elements of Electrical, Hydraulic and Pneumatic circuits, machine tool elements). Methods of indicating notes on drawing.

Unit-II

Limits and Fits: Basic definition of terms, alpha numeric designation of limits/fits. Types of Fits. Interchangeability and selective Assembly. Exercises involving selection/interpretation of fits and calculation of limits. Dimensional chains.

Unit-III

Production Drawing: Conventional practices of indicating tolerances on size and geometrical form, Surface finish, surface treatments, Part drawing from assembled drawings. Specification and indication of above features on the drawings. Calculation of limits suggesting suitable fits for mating parts.

Unit-IV

Assignments: Sketches of conventional representation of parts described with syllabus at (1) Process sheets, Tolerances and finishes obtainable from different processes. Study of I.S.:2709 on limits and fits.

N.B.: Tolerance charts to be provided in the examination Hall for calculation of limits.

Suggested Reading:

1. P. Narasimha Reddy, T.A. Janardhan Reddy and C. Srinivasa Rao, *Production Drawing Practice*, Hi-Tech Publishers, 2001
2. R.L. Murthy, *Precision Engineering in Manufacturing*, New Age International (P) Ltd., 1996.
3. K.L. Narayana, P. Kannaiah and K. Venkat Reddy, *Production Drawing*, New Age International (P) Ltd., Revised edition 1997
4. R.K.Jain, *Engineering Metrology*, itHwrna.Publishers, 8 edition, 1985

ME 461

PRODUCTION AND OPERATIONS MANAGEMENT

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Production & Operations Management: Introduction, Types of Production Systems - Job shop, Batch, Flow shop.

Plant location and Layout: Factors affecting plant location, Break even analysis, Plant layout objectives, Types of layouts, Merits and demerits.

Work Study: Introduction to Method study and Work measurement, Standard time calculations, Methods of rating, Work sampling, Wages and Incentives, Types of incentive plans.

UNIT-II

Forecasting: Introduction, Forecasting objectives and uses, Demand patterns, Qualitative models - Market survey, Delphi, Quantitative models - Moving average, Weighted moving average, Simple exponential smoothing, Trend adjusted exponential smoothing, Least square method, Simple regression, multiple regression.

Forecast Errors: Mean Absolute Deviation (MAD), Mean Square Error (MSE), Mean Forecast Error (MFE), Mean Absolute Percentage Error (MAPE)

UNIT-III

Aggregate planning and master scheduling: Introduction, Objectives of aggregate planning, Cost in aggregate planning, Strategies in aggregate planning, Master production scheduling

Materials requirement planning MRP.1: Importance of MRP, MRP system inputs and outputs, MRP calculations

Manufacturing Resource Planning MRP.2 & Enterprise Resource Planning (ERP): features of ERP packages like SAP, BANN, People soft etc.,

UNIT-IV

Inventory Control: Importance of inventory control, types of inventory models, Inventory costs Deterministic inventory models - basic EOQ model,

Production model without shortages, Purchase model with instantaneous replenishment and with shortages, Production model with shortages, Inventory model with price breaks, Fixed order quantity system, Periodic review system, Inventory model with probabilistic demand.

UNIT-V

Project Management: Network fundamentals, Differences between PERT and CPM, Scheduling the activities, Fulkerson's rule, Earliest and Latest times, Determination of ES and EF in forward path, LS & LF in backward path, Determination of critical path, Free float, Independent float, Total float, Program evaluation and review technique, Crashing of network.

Suggested Reading :

1. Joseph Monk, *Operations Management*, TMH Publishers, New Delhi, 2004.
2. Buffa Elwood S, *Modern Production /Operations Management* , John Wiley Publishers, Singapore, 2002
3. Everett E Adam, Jr and Ronald J. Ebert, *Production and Operations Management- Concepts, Models and Behavior*, 5th Ed. 1998, (EEE), Prentice Hall of India(P) Ltd., New Delhi.
4. Panneer Selvam R, *Production and Operations Management*, Second Edition, PHI Learning Pvt. Ltd., New Delhi, 2006.
5. S.D. Sharma, *Operations Research*, Kedarnath, Ramnath & Co., Meerut, 2009.

EC 441

MICROPROCESSOR APPLICATIONS
(ELECTIVE - II)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

Unit-I

Basic Concepts: Evolution of microprocessors - organization of microcomputers - microprocessor programming - digital logic - timing diagram conventions.

Data Representation: Introduction- positional number systems - the binary number system - representation of integers - Representation of real number - Binary arithmetic - other number systems - Character representation.

Unit-II

Programming microprocessor: Introduction - organization of the 8085 Instruction set of the 8085 - programming the 8085 - Assembler Programming -language for writing. Algorithms - programming examples - the ZilogSO.

Unit-III

Semi conductor memories: Introduction - characteristics of memories static rams - dynamic RAMS.

Reprogrammable ROMS - Memory system reliability.

Microprocessor Timings: Introduction - timing and control unit - timings of Intel 8085 - timing of Zilog Z80 - register organization.

Unit-IV

Interfacing memory and I/O Devices: Introduction address space partitioning - memory interfacing -data transfer schemes - programmed data transfer - direct memory access data transfer - serial data transfer. Interfacing Devices: Introduction - types of interfacing devices - address decoding for I/O - INPUT/OUTPUT ports - programmable interrupt controller - programmable DMA controller - communication interface -analog input devices - analog output devices - analog input subsystems -analog output subsystems.

Unit-V

Application of micro processors: Temperature monitoring system - Automotive applications- closed loop process control.

Suggested Reading:

1. Aditya P. Mathur, *Introduction to Microprocessors*, Tata Me Graw Hill Publisher company Ltd.,New Delhi.2002
2. Ram B, *Fundamentals of Microprocessors and Micro-computers* , Dhanpat Rai & Sons -2000.
3. M. Rafiq - uz - Zamon, *Microprocessors theory and applications* ., PHI, 2001.

ME 453

ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS
(ELECTIVE - II)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

Unit-I

Introduction: Intelligence, definition, types, cognitive aspects approach, measuring intelligence, early efforts. IQ and AI, aspects of intelligence, learning, problem solving, creativity, behaviour and biology.

Unit-II

Cognitive Psychology: The mind, information and cybernetics, components for thought, modes of perception, visual, auditory and other systems, memory mechanisms, problem solving - planning search, the GPS systems, types of learning - route parameters methods and concept, game playing, reasoning.

Unit-III

Knowledge Engineering: Introduction, role of knowledge engineer, knowledge representation, psychology, production rules, logic and programming, common sense and fuzzy logic, semantic networks, learning systems.

Unit-IV

Visual Perception: Introduction, biology of vision, computation aspects, towards artificial vision, picture processing - identifying real objects; vision programmed, factory vision systems. Robotics: AI impact, robot sensors, factory robots, personal robots, future robot.

Unit-V

Expert Systems: Introduction, knowledge acquisition for expert systems; features of expert systems, system structure, inference engines, uncertainties; memory mechanism, range of applications, actual expert systems - VP expert.

Suggested Reading:

1. E. Rich, Kevin Knight, *Artificial Intelligences*, 2nd Edition, TMH.
2. Charnaik E. and McDermott D., *Introduction to Artificial Intelligence*, Addison Wesley, 1995.
3. *Artificial Intelligence in Business Science and Industry*, Vol.2 Applications, PH. 1985.
4. PH Winston, *Artificial Intelligence*, Addison Wesley.

WITH EFFECT FROM THE ACADEMIC YEAR 2013 - 2014

ME 454

MACHINE TOOL DESIGN
(ELECTIVE - II)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

Unit-1

Classification of machine tools. Mechanisms used for converting rotary to linear motion and intermittent motion. Kinematic structures of machine tools - general purpose, special purpose, automatic screw cutting machines. Basic features of transfer machines. Numerical Control of machine tools, advantages and limitations. Schematic diagrams of NC systems.

Unit-II

Drives of machine tools; selection of range of speeds and feeds. Speed layout in GP, AP and logarithmic progression. Standardization of speeds and feeds. Productivity loss.

Selection of highest and lowest speeds, range ratio. Design of ray diagram and structural diagrams for machine tool gear boxes. Determination of number of teeth and module of gears in gear box design. Rules for layout of gear box having sliding clusters. Sliding cluster and clutched drives, Ruppert drive.

Unit-III

Feed gear boxes: Norton and Meander gear boxes. Stepped and step less regulation of speeds.

Strength and Rigidity design analysis. Design of beds, frames, Columns and Guide ways.

Materials for structures. Methods to improve the rigidity of structures. Overall compliance of machine tool. Thermal effects - functional accuracy of machine tool.

Unit-IV

Spindle units; Spindles of lathe, Drilling, Milling and Grinding machines materials for spindles. Spindle design. Effect of clearance on the rigidity of spindle.

Hydro-dynamic and Hydro-static bearings; Requirements of spindle bearings.

Unit-V

Hydraulic controls: various controls used in machine tools. Hydraulic and Pneumatic systems used in machine tools. Positive displacement pumps. Power pack. Relief valves, check valves, flow control valves, multi position direction control valves, Filters, Accumulators. Speed regulation of surface grinding machine. Hydro- copying systems.

Suggested Reading:

1. G C Sen & Bhattacharya, *Principles of machine tools*, New Central Book Agency, Calcutta.
2. N K Mehta, *Machine Tool Design and Numerical Control*, Tata McGraw-Hill Publishing co. Ltd.
3. S.K.Basu, *Design of machine tools*, Allied Publishers
4. S R Majumdar, *Hydraulic Systems- Principles & Maintenance*, Tata Mc.Graw-Hill Publishing Company Limited; New Delhi

ME 455

MANUFACTURING SYSTEMS AND SIMULATIONS

(ELECTIVE - II)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

Unit-I

Manufacturing Systems: Definition of systems; basic concepts and problems concerning systems; Systems design: Decision making procedures; Structural, Transformational and procedural aspects of manufacturing; Modes of production. Process systems for manufacturing; logistic systems; material flow & technological information flow. Management and information systems for manufacturing; Managerial information flow in manufacturing systems.

Unit-II

Information Systems: Fundamentals of information technology, information systems, information networking, parts oriented production information systems, and computerized production scheduling, online production control systems. Computer based production management systems. Automation systems for manufacturing: Industrial automation, kinds of automation, principles of CIM, effectiveness of CIM, factory automation, automatic machine tools for mass production, NC machine tools, computer controlled manufacturing systems, FMS, automated assembly, automatic material handling, automatic inspection and testing, computer integrated automation systems - unmanned factory.

Unit-III

System Models: Concepts, continuous and Discrete systems, systems modeling, type of models, subsystems, corporate model, system study. System simulation: Techniques, comparison of simulation and analytical methods, types of simulation, distributed log model, cobweb models.

Unit-IV

Continuous system simulation: Numerical solution of differential equation, analog computers, hybrid computers, continuous system simulation languages CSMP, system dynamic growth models, logistic curves. Discrete systems simulation: Events generation of arrival patterns, simulation programming tasks, analysis of simulation output. Queuing theory: Arrival pattern distribution, service times, queuing disciplines, and measure of queues.

Unit-V

GPSS and SIMSCRIPT: General description of GPSS and SIMSCRIPT, programming in GPSS Simulation Programming Techniques: Data structures, implementation of activities, event and queues, event scanning, simulation algorithms in GPSS and SIMSCRIPT.

Suggested Reading:

1. David Bedworth & James Bailey, *Integrated production control system management, analysis & design*, 2nd ed., John Wiley & Sons Ltd.
2. Ronald Zskin & Charles Standridge, *Modeling and Analysis of Manufacturing Systems*, John Wiley & Sons Ltd.
3. Geofery Gordan, *Systems Simulation*, Prentice Hall, 1980.
4. Deo. N., *System Simulation with Digital Computers*, Prentice Hall, 1980.

ME 456

MECHATRONICS
(ELECTIVE - II)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

Unit-I

Introduction to mechanization & automation. Need of interface of electrical & electronic devices with mechanical elements. The concept of Mechatronics: Flow chart of mechatronics system, elements of mechatronics system, drive mechanisms, actuators, feedback devices and control system. Application in industries and systems development.

Unit-II

Drive mechanisms: Feeding and indexing, orientation, escapement and sorting devices, conveyor systems. Introduction to electrical actuators: A.C servo motors, D.C. servomotors, stepper motors.

Unit-III

Introduction to fluid power systems: Industrial pneumatics and hydraulics. Merits of fluid power. Pneumatic and hydraulic elements symbols. Study of hydraulic control valves, pumps & accessories. Hydraulic circuits and mechanical servo control circuits, Electro-hydraulic and Hydro-pneumatic circuits

Unit-IV

Introduction to industrial electronic devices: Diodes, Transistors, Silicon controlled Rectifiers (SCR), Integrated Circuits (IC), Digital Circuits. Measurement systems & Data acquisition systems: sensors, digital to analog and analog-to-digital conversion. Signal processing using operational amplifiers. Introduction to micro processor & micro controller. Temperature measurement interface and LVDT interface. Systems Response.

Unit-V

Design of Modern CNC machines and mechatronics elements: machine structures, guide ways, spindles, tool monitoring systems, adaptive control systems. Flexible manufacturing systems. Multipurpose control machines. PLC programming

Suggested Reading:

1. W.Bolton Mechatronics Pearson Education Ltd.
2. HMT Limited, *Mechatronics*, 1998 Tata Mc.Graw-Hill publishing Company Limited; New Delhi,
3. Michaels Hestand & David G, Alciatore, *Introduction to Mechatronics and Measurement Systems*, Tata McGraw-Hill International edition.
4. S RMajumdar, *Oil hydraulic systems- Principles & Maintenance*, Tata Mc.Graw-Hill Publishing Company Limited; New Delhi.

LA 454

INTELLECTUAL PROPERTY RIGHTS
(ELECTIVE - II)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

Unit-I

Introduction: Meaning of Intellectual property - Nature of I.P. Rights -Kinds of Intellectual property rights -International conventions of Intellectual property rights. Patent Treaty 1970, GATT 1970, GATT 1994, TRIPS & TRIMS International organization for protection of IPR-WTO,WIPO, UNESCO.

Unit-II

Patents: Meaning of Patents -Commercial significance -Obtaining of patent Patentable subject- matter-rights and obligations of patentee -Specification Registration of patents -Compulsory licensing and licenses of rights Revocation.

Unit-III

Industrial Designs: Definition of designs -Registration of design -Rights and duties of Proprietor of design -Piracy of registered design.

Unit-IV

Trade Marks -Meaning of trade marks -Purpose of protecting trademarks, Registered Trademark -Procedure -passing off-Assignment and licensing of trade marks -Infringement of trademarks.

Unit-V

Copy Right -Nature, scope of copy right -subject matter of copyright -rights conferred by copyright -Publication- Broad-Casting, telecasting -Computer programme -Database write -Assignment -Transmission of copyright, Infringement of copy right.

Suggested Reading:

1. Cronish W.R1 *Intellectual Property; Patents, copyright, Trad and Allied rights*, Sweet & Maxwell, 1993,
2. P.Narayanan, *Intellectual property law*, Eastern Law Edn.,1997.
3. Robin Jacob and Daniel Alexander, *A Guide Book to Intellectual property patents, Trade Marks, Copy rights and designs* , Sweet, Maxwell 4th Edition. 1993.

ME 462

NANO MATERIALS AND TECHNOLOGY
(ELECTIVE - II)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Introduction: Nanoscale, Properties at Nanoscale, advantages and disadvantages, importance of Nano Technology, Bottom-up and Top-down approaches, challenges in Nano Technology, Proximal probe technologies.

Unit-II

Materials of Nano Technology: Introduction-Si-based materials, Ge-based materials, metals, Ferroelectric materials, Polymer materials, GaAs & InP (III-V) group materials, Nano tribology and Materials, characterization using Scanning Probe Microscope, AFM, FFM.

Unit-III

Nano Structures: Zero dimensional Nano structure (Nano Particles)- Synthesis procedure, characterization techniques, properties and applications of Nano Particles

One dimensional Nano structures (Nano Wires, Nano Tubes)- Various Synthesis procedure, characterization procedure and principles involved, properties and applications of Nano Wires, Types of Nano Tubes, Synthesis procedure, characterization properties and applications of Nano Tubes.

Unit-IV

Nano Fabrication: Introduction, Basic fabrication techniques (Lithography, thin film deposition, and doping) MEMS fabrication techniques, Nano fabrication techniques (E-beam Nano-imprint fabrication, Epitaxy and strain engineering, Scanned probe techniques).

Unit-V

Special Nano Materials Nano Composites: Introduction, Synthesis procedures, various systems (metal-polymer, metal-ceramics and polymer-Ceramics), Characterization procedures, applications. Nano Biomaterials: Introduction, Biocompatibility, anti-bacterial activity, principles involved, applications.

Suggested Reading:

1. A.K.Bandyopadhyay, *Nano Materials*, New Age Publications.
2. T. Pradeep, *Nano Essentials*, TMH
3. Carl C. Koch, *Nano Materials Synthesis, Properties and Applications*, Jaico Publishing House.
4. Willia Tllsey Atkinson, *NanoTechnology*, Jaico Publishing House.
5. George W. Hanson, *Fundamentals of Nanoelectronics*, Pearson Education, 2009.

ME 463

POWER PLANT ENGINEERING
(ELECTIVE - II)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

Unit-1

Introduction to Sources of Energy-Resources and Development of Power in India.

Steam Power Plant: Plant layout, working of different Circuits, Fuel and handling equipment, types of coal, coal handling, choice of handling equipment, coal storage, ash handling systems.

Unit-II

Combustion Process: Properties of coal- overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers, and heat rejection, corrosion and feed water treatment.

Gas Turbine Power Plant: Introduction -classification-Layout with auxiliaries-Principles of working of closed and open cycle gas turbines

Unit-III

Hydro Electric Power Plant: Water power-Hydrological cycle, flow measurement- drainage area characteristics-Hydrographs-storage and pondage- classification of dams and spill ways.

Unit-IV

Nuclear Power Station: Nuclear fuel-breeding and fertile materials -Nuclear reactor-reactor operation-Pressurized water reactor, boiling water reactor, sodium-graphite reactor, fast breeder reactor, homogeneous reactor, gas-cooled reactor.

Radiation hazards and shielding -radio active waste disposal.

Unit-V

Power Plant Economics and Environmental Considerations: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, average load and load factor, delivery factor-related

exercises Effluents from power plants and impact on environment -Pollutants and Pollution Standards -Methods of pollution control

Suggested Reading:

1. Rajput, RK, *A Text Book of Power Plant Engineering* , 3rd Edition. Laxmi Publications, New Delhi, 2005.
2. Arora SC, Domkundwar S, *A Course in Power Plant Engineering*, Dhanapat Rai & Sons, New Delhi, 2005.
3. YadavR, *Steam & Gas Turbines and Power Plant Engineering*, 7th Edition, Central Publishing House, Allahabad, 2007.
4. Nag P K, *Power Plant Engineering*, 2nd Edition, Tata Mc Graw Hills Co. Ltd, New Delhi, 2002.
5. Wakil M M, *Power Plant Technology*, Me Graw Hill Publications, New york, 2005.

CS 403

INFORMATION SECURITY
(ELECTIVE - II)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Introduction: History, critical characteristics of information, NSTISSC security model, Components of an information system, Securing the components, balancing security and access, The SDLC, The security SDLC
Need for Security: Business needs, Threats, Attacks-secure software development

UNIT-II

Legal, Ethical and Professional Issues: Law and ethics in information security, relevant U.S laws-international laws and legal bodies, Ethics and information security

Risk Management: Overview, Risk Identification, risk assessment, Risk Control strategies, selecting a risk control strategy, Quantitative versus qualitative risk control practices, Risk management discussion points, recommended risk control practices

UNIT-III

Planning for Security: Security policy, Standards and practices, Security blue print, Security education, Continuity strategies, Security Technology: Firewalls and VPNs: Physical design, firewalls, protecting remote connections.

UNIT-IV

Security Technology: Intrusion detection, Access control and other security tools:

Intrusion detection and prevention systems, Scanning and analysis tools, Access control devices.

Cryptography: Foundations of cryptology, cipher methods, cryptographic Algorithms, Cryptographic tools, Protocols for secure communications, Attacks on cryptosystems

UNIT-V

Implementing Information Security: information security project management, technical topics of implementation, Non- technical aspects of implementation, Security certification and accreditation Security and Personnel: Positioning and staffing security function, Employment policies and practices, internal control strategies. Information security Maintenance: Security management models. The maintenance model, Digital forensics

Suggesting Reading:

1. Michael E. Whitman and Hebert J Mattord, *Principles of Information Security*, 4th editionEd. Cengage Learning 2011
2. Thomas R Peltier, Justing Peltier, John Blackley, *Information Security. Fundamentals*, Auerbacj Publications 2010
3. Detmar W Straub, Seymor Goodman, Richard L Baskerville, *Information Security. Policy Proceses and Practices*, PHI 2008.
4. Marks Merkow and Jim Breithaupt, *Information Security. Principle and Practices*, Pearson Education, 2007.

ME 457

ROBOTICS
(ELECTIVE - III)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Robots: History and evolution of robots, Laws of robotics, Basic configuration, degree of freedom, work envelope, motion control methods! Application in industry - material handling, loading & unloading, processing, welding & painting applications, assembly and inspection, Robot specification requirements.

Unit-II

Rotation matrix: Homogenous transformation matrix. Denavit - Hartenberg convention. Euler angles, RPY representation. Direct and inverse Kinematics for industrial robots for position and orientation. Redundancy.

Unit-III

Manipulator Jacobian: Joint - End effector velocity - direct and inverse velocity analysis, Trajectory planning, interpolation, cubic polynomial, linear segments with parabolic blending, static force and moment transformation, Solvability, Stiffness, Singularities.

Unit-IV

Robot dynamics: Lagrangian formulation, link Inertia tensor and manipulator Inertia tensor, Newton - Euler formulation for RR & RP Manipulators. Control: Individual joint, computed torque.

Unit-V

End effectors, Position and velocity measurement. Sensors: Proximity and range, tactile, force and torque. Drives for robots; Electrical, hydraulic and pneumatic. Robot vision: Introduction to technique, image acquisition and processing. Introduction to robot programming languages.

Suggested Reading:

1. Spong and Vidyasagar, *Robot Dynamics and Control*, John Wiley and Sons, 1990

2. R.K. Mittal, IJ. Nagrath, *Robotics and Control*, Tata McGraw- Hill 2003.
3. Groover, *Industrial Robotics*, McGraw-Hill.
4. Asada and Siotine, *Robot Analysis and Intelligence*, Wiley Interscience, 1986.
5. Fu.K.S. GonZalezRC., LeeC.S.G., *Robotics, Control Sensing Vision and Intelligence*, McGraw Hill, Int. Ed., 1987.

ME 458

PRODUCT DESIGN AND PROCESS PLANNING
(ELECTIVE - III)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Product Design and Process Design functions. Selection of right product. Systematic procedure of product innovation. Factors contributing to successful technological innovation - need for creativity and innovation. Techniques of innovation like brain storming and Delphi techniques.

Unit-II

Project Selection and Evaluation: Function of design - Design with Human Machine Interaction (HMI). Collection of ideas and purpose of project. Selection criteria - screening ideas for new products using evaluation techniques. Principles of ergonomics.

Unit-III

New Product Development: Research and new product development. Patents, definitions, patent search, patent laws, international code for patents -Intellectual Property Rights (IPR).

Unit-IV

New Product Planning : Interaction between the functions of design; manufacture, quality, testing and marketing. Steps for introducing new products after evaluation.

Unit-V

Process Planning : Process planning, process sheets, selection of manufacturing process, estimation of machining time in various cutting operations - estimation of costs for manufacture. Value engineering in product design, group technology, concepts of concurrent engineering.

Suggested Reading:

1. Niebel BW & Draper AB: *Production Design & Process Engg*, McGraw Hill, Kogakusha, 1974.
2. Harry Nystrom, *Creativity and Innovation*, John Wiley & Sons,
3. Brain Twiss, *Managing Technological Innovation*, Pittrnan Publications, 1992.
4. Harry, B.Waton, *New Product Planning*, Prentice Hall Inc., 1992.
5. Chitale, A. K. & Gupta RC., *Product Design & Manufacturing*, PHI, 1997.

ME 459

**MODERN MACHINING AND FORMING METHODS
(ELECTIVE - III)**

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Ultrasonic Machining (USM): Introduction, process description, abrasive slurry, Abrasive materials and their characteristics. Functions of liquid medium in slurry, Types of Transducers, effect of process parameters, applications and limitations. **Abrasive Jet Machining (AJM):** Principle of operation, process details, process variables and their effect on MRR and accuracy.

Equation for MRR. Advantages, disadvantages and applications. **Water Jet Machining (WJM):** Schematic diagram, equipment used, advantages and applications.

Unit-II

Electro Discharge Machining (EDM): Process description with schematic diagram, process parameters, functions and characteristics of dielectric medium, dielectric fluids, over cut and side taper' Flushing, Mechanism of metal removal, crater volume, types of power supply circuits, mathematical analysis of metal removal rate (MRR), characteristics of spark eroded surfaces, advantages, disadvantages and applications. **Wire EDM:** Process description and applications. **Electro-Chemical Machining (ECM):** Schematic of the process parameters, function and characteristics of electrolyte, chemistry of the process, Equation for specific MRR and electrode feed rate, advantages, limitations and applications., Rotary Machining, Hot machining, high speed machining, description of each process, process parameters, advantages and applications.

Unit-III

LASER Beam Machining (LBM): Principle of LASER Beam production, materials used, thermal analysis of the process, process parameters, equations for power density and machining rate, advantages, limitations and applications. **Plasma Arc Machining (PAM):** Introduction equipment used, process description and parameters, types of plasma arc; Transferred arc and non transferred arc and process applications. **Electron Beam Machining (EBM):** Schematic of the process, process parameters, principle of

production of Electron beam, equipment used, Advantages, disadvantages and applications. ION Etching: Process description and applications.

Unit-IV

Rubber Pad Forming: Principle of the process, process details and its types; Guerin, wheelon, Marforming and Hydro forming processes and applications. Electro-Hydraulic forming (EHF): Schematic of the process description and its applications. High Energy Rate Forming (HERF): HERF hammers, principle of explosive forming, Explosive materials, types of explosive forming, stand off operation and contact operation, the pressure pulse, Gas bubble and the process applications.

Unit-V

Stretch Forming: Introduction, types of stretch forming: stretch draw forming, rotary stretch forming or stretch wrapping, compression forming, radial draw forming. Stretch forming equipment and accessories, accuracy and surface finish, process variables and limitations. Tube spinning: Introduction, methods of tube spinning, Backward spinning, Forward spinning, machines and tools used. Machine variables, speeds and feeds, effect of tube spinning on work metal properties and applications. Hydrostatic Forming: Process principle, description and applications. Water Hammer Forming (WHF): Schematic diagram of the process, principle of operation, process variables, work materials, process limitations and applications.

Suggested Reading:

1. P.C. Pandey and H.S. Shah, *Modern Machining Process*, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1980.
2. A. Bhattacharya, *New Technology*, The Institution of Engineers (India), 1984.
3. Davies and Austin, *Developments in High Speed Metal Forming*, The Machinery Publishing Co. Ltd., 1985.
4. *Production Technology*, HMT.

ME 460

PLASTIC ENGINEERING AND TECHNOLOGY
(ELECTIVE - III)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

General properties of plastics: Polymeric Materials, Plastics available to the designer, Engineering Plastics, Thermosets, composites, structural foam, Polymer alloy, selection of plastics, Mechanical properties, Impact Enhancement, Degradation, wear resistance and frictional properties, special properties processing, costs -selection for strength at minimum cost.

Unit-II

Mechanical properties of plastics -Deformation, Viscoelastic behaviour of plastics, short term testing of plastics, long term testing of plastics, Design methods of plastic using deformation data, Mathematical models of viscoelastic behaviour, Intermittent loading, Deformation behaviour of reinforced plastics.

Unit-III

Mechanical properties of plastics -Fracture.

The concept of stress concentration, Energy approach to fracture, Stress Intensity Factor approach to fracture, J-integral approach, General fracture behaviour of plastics, creep failure of plastics. Fatigue of plastics, Impact behaviour of plastics.

Unit-IV

Processing of plastics.

Extrusion -Mechanism of flow, analysis of flow in extruder, Extruder volumetric efficiency, power requirements.

Injection Moulding: Moulds, CAD of moulds, structural foam Injection moulding, Reaction injection moulding, Injection blow moulding, injection moulding of thermosets.

Thermoforming, calendering, Rotation moulding, compression moulding, transfer moulding, automatic processes, die design of plastics, Joining process -Hot air, ultrasonic, and solvent welding.

Unit-V

Analysis of polymer melt flow. General behaviour of polymers melts, Isothermal flow of polymers Melts, Residence and Relaxation times, Experimental Methods used to obtain flow data.

Suggested Reading:

1. Plastics and Rubber, *Engineering Design and Application*, R.J. Crawford.
2. N.A. Waterman, *The selection and use of Engineering Materials*.
3. Rossi, *Welding Engineering*, McGrawHill.

CS 452

COMPUTER GRAPHICS
(ELECTIVE - III)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Overview of Graphics Systems: Refresh CRT, Raster - Scan Displays, random-Scan Systems, Color CRT, Flat Panel Displays, Three Dimensional Viewing Devices, Input Devices, Graphics Software. **Output Primitives:** Line drawing algorithms, Circle Generating Algorithms, Ellipse Generating Algorithm, Pixel Addressing, Fill Area Primitives, Character generation.

Unit-II

Getting Started Drawing Figures Using OpenGL: Getting started making pictures, Drawing basic Graphics Primitives, Making line drawing, Simple interaction with Mouse and Keyboard.

Two Dimensional Geometric Transformations: Basics Transformation, Homogeneous Coordinates, Composite, transformations, other transformations, Transformation between coordinates, Affine transformations, Transformation functions, Raster methods of transformations.

Unit-III

Two Dimensional viewing: Viewing Pipeline, Viewing Transformations & Functions. Clipping operations, Point Clipping, Line Clipping, Polygon Clipping, Curve Clipping, Text Clipping, Exterior Clipping.

Graphical User Interface & Interactive Input, Methods : The user dialogue, logical classification of input devices, Input functions & modes, Interactive picture construction techniques.

Unit-IV

Three Dimensional Concepts : Three Dimensional Display Methods. Three Dimensional Object Representations: Polygon surfaces, Curved line and surfaces, Spline representations, Bezier Curves & Surfaces, B-Spline curves and surfaces, Constructive solid-Geometry Methods, actress, BSP tress, Fractal geometry methods.

Unit-V

Three Dimensional Geometric and Modeling Transformations.

Three Dimensional Viewing: Projections

Visible Surface Detection Methods: Back face detection method, depth buffer method.

Basic illumination methods: Phong & Gourand Shading, Texture Mapping.

Computer Animation: Design of Animation Sequences, General Computer Animation, Raster Animation, Computer - Animation Languages, Key frame systems, Motion specifications.

Suggested Reading :

1. D. Heara, P. Baker, *Computer Graphics - C Version*, 2nd Edition, Pearson Education, 2004.
2. F.S.HuT, *Computer Graphics Using Open GL*, 2nd Edition, Pearson Education, 2003.
3. S.Harrington, *Compter Graphics*, McGraw Hill.
4. James D. Foley, Steven K. Feiner, Adam, F.Hughes John, *Computer Graphics: Principles & Practice*, 2nd Edition, Pearson Education.

CS 408

INTERNET PROGRAMMING
(ELECTIVE - III)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

Unit-I

Introduction to Internet and Intranet HTTP protocol. TCP/IP - Concepts, addressing routing, web application building blocks, HTML, CGI, Integrating ODBC and CGI.

Unit-II

Java programming - Overview of Java, Data types, Variables, Arrays, Operators, Control structures, Classes, Inheritance, packages and interface.

Unit-III

Java programming - Exception handling, multithreaded programming, I/O Applets Networking, AWT, AWT Controls.

Unit-IV

Internet Concepts - Cross - Platform client browser setup, corporate information models, structuring company information resources, document management, workflow software, groupware, case studies.

Unit-V

Information servers - DNS, Mail Servers, News Servers, Chat, FTP Servers, proxy servers, security and firewalls, search engines.

Suggested Reading:

1. John Desborough, *Intranet Web Development*, New Riders Publ. 1996.
2. Partrik Naughton, Robert Schildt, *The complete reference Java*, TataMc Graw Hill, 1997.

ME 464

FUELS & COMBUSTION
(ELECTIVE - III)

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

Unit-1

Types of fuels-solid, liquid and gaseous fuels, family of coal, origin of coal, analysis and properties of coal, action of heat on coal, oxidation of coal, hydrogenation of coal, efficient use of solid fuels, manufactured fuels, agro fuels, solid fuel handling, properties related to combustion, handling and storage.

Unit-II

Origin and classification of Petroleum, refining and other conversion processes, composition of petroleum with respect to combustion, property and testing of petroleum products, various petroleum products, Nature of Indian Crudes & Petroleum refining in India, storage and handling of liquid fuels, liquid fuels combustion equipment.

Types of gaseous fuels, Natural gases, methane from coal mine, Producer gas, water gas, blast furnace gas, LPG.

Unit-III

Stoichiometry Stoichiometry relations, theoretical air required for complete combustion, calculation of minimum amount of air required for known composition, calculation of dry flue gases if fuel composition is known, calculation of composition of fuel and excess air supplied from exhaust gas analysis, flue gas analysis (O_2 , CO_2 , NO_x , SO_x)

Unit-IV

Burner Design: Ignition and concept of ignition, auto ignition, temperature flame propagation, various methods of flame stabilization, Incorporation in burner design, basic features of solid, liquid and gaseous fuel burner, design consideration of different types of coal, oil and gas burners, recuperative and regenerative burners

Unit-V

Alternate Fuels for 1C Engines: Edible oils and non-edible oils for use in diesel engines, Gaseous fuels like hydrogen, CNG, LPG for use in petrol engine.

Suggested Reading:

1. Sharma S P, *Fuels and Combustion*, Tata Me Graw Hills, New Delhi, 2000.
2. Roger A, *Combustion Fundamentals*, Me Graw Hills, New Delhi, 2000.
3. Shaha AK, *Combustion Engineering & Fuel Technology*, Oxford and IBH Publications, New York, 2003
4. Kenneth K Kou, *Principles of Combustion*, Wiley & Sons Publications, New York, 2002.

ME 465

RAPID PROTOTYPING TECHNOLOGIES
(ELECTIVE - III)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Introduction: Prototyping fundamentals, Historical development, Fundamentals of Rapid Prototyping, Advantages of Rapid Prototyping, Commonly used Terms, Rapid Prototyping Process Chain, 3D Modeling, Data conversion and Transmission, Checking and Preparing, Building, Postprocessing, RP Data formats, Classification of RP process.

Unit-II

Liquid-based Rapid Prototyping Systems: Stereolithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photopolymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

Unit-III

Solid-based Rapid Prototyping Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

Unit-IV

Powder Based Rapid Prototyping Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

Unit-V

Applications of Rapid Prototyping Technology: Functional models, Pattern for investment and vacuum casting, Medical Models, Art Models, Engineering Analysis Models.

Suggested Reading:

1. Chua C.K., Leong K.F. and LIM C.S, *World Rapid prototyping: Principles and Applications*, Scientific Publications, Second edition, 2004.
 2. D.T. Pham and S.S. Dimov, *Springer Rapid Manufacturing*, 2001
 3. Terry Wohlers, *Wholers Report 2000*, Wohlers Associates, 2000.
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WITH EFFECT FROM THE ACADEMIC YEAR 2013 - 2014

ME 467

TOTAL QUALITY MANAGEMENT

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

Unit-I

Strategic Quality Management: Quality policies, quality goals, obstacles to achieving successful strategic quality management.. Organization for quality role of {Top. middle, work force team (Quality Circles). Developing, a quality work culture - Maslow need theory, Herzberg 2 factor theory, theory X, Y & Z. Methods to create and maintain awareness of quality, provide evidence of management leadership, types of self development and empowerment programmes, methods of participations means of inspiring action, recognition and rewards. Supplier quality rating plans (lot plot plan, OC curve; pareto analysis) assignment of supplier capability, Methods of evaluating supplier products, contract management (Joint economic plan, joint technological forecasting).

Unit-II

Design for quality: Basic functional requirements of quality, Design for (reliability, safety cost and product performance) concurrent engineering (DFMA) value engineering. Support for quality improvement processes (Block diagram, brain storming, cause effect analysis, pareto analysis) Quality function deployment, reliability analysis, failure rate, failure pattern of complex products (bath tub curve) weibull distribution relationship between part and the system exponential reliability, availability, FMEA (Fracture mode and Effect Analysis) Design for experiments: Factorial experiments, construction fractional designs.

Unit-III

Technical tools for quality: Comparison of two methods: observation of data, distribution, statistical analysis, chi square test, F test. T test. Hypothesis

testing significance testing, linear correlation and regression. Analysis of variance (ANOVA). 4 factor ANOVA experiment 2 levels. Analysis of means. Techniques for on line quality:: Data collection plan, variable attribute charts, interpreting the control charts, charts for drifting processes, multi variant charts, alternatives to statically process controls. Techniques for offline quality control: Background to Taguchi method (Quality loss and loss function, controllable factor and non controllable factors in parameter performance, tolerance design. Taguchi

Analysis Techniques: Net variation and contribution ratio, estimation of process performance. Accumulating analysis, performance measures-avoiding means variance dependents, choosing noise performance measure, minute analysis and life testing Taguchi tolerance design and tolerance (re) design.

Unit-IV

Quality Information System: Scope of quality information system. Different between QIS and MIS. Creating new software (steps, types, defects) reports on quality (operational and executive reports) Features of QIS software. Software for inspection.

Inspection System: Operational sorting and correction sorting. AQL, LTPD, AOQL. Non destructive test. Audit systems: (quality improvement planning and implementation, describing quality function, process control system. Control of measurement system, material identification and control, drawing and specification control, process corrective action) the concept of POKAYOKE.

Unit-V

Measure of customer needs: The need to measure customer satisfaction. Importance of proper packaging, customer processing and installation of product, dealing with customer complaints, using weibull analysis, field feed back, parameter to measure customer (Dis) satisfaction. Problems with the customer satisfaction system. Beyond TOM: Difficulties in implementing TOM system, rating your quality system. JIT system, the people side of TOM. system integration, Kansei engineering and flexibility in manufacturing.

Suggested Reading:

1. H. G. Menon. *TOM in view Production Manufacturing*, Me Graw Hill, Publishers.
2. N. G. Logothetis, *Managing for total quality*.
3. J.M. Juran & Frank Gryna, *Quality planning and analysis*.
4. Hanson and Ghare, *Quality control and Application*.

ME 481

SEMINAR

Instructional
Sessional

3 Periods per week
25 Marks

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of state of the art topics in a broad area of his/her specialization.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to following aspects of seminar presentations.

Literature survey Organisation of material

Preparation of OHP slides /PC presentation Technical writing

Each student will be required to

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Give a 20 minutes presentation through OHP, PC, Slide projector followed by 10 minutes discussion.
3. Submit a report on the seminar topic with list of references and slides used.

Seminars are to be scheduled from the 3rd week to the last week of the semester and any change in schedule should be discouraged.

The Sessional marks will be awarded to the students by at least 2 faculty members on the basis of an oral and a written presentation as well as their involvement in the discussions.

ME 482

PROJECT

Instruction	6 Periods per week
Duration of University Examination	Viva Voce
University Examination	Gr*
Sessional	50 Marks

Solving a real life problem should be the focus of U.G. project. Faculty members should prepare project briefs well in advance. They should be made available to the students at the Department Library. A project may be classified as hardware / software / modeling / simulation. It should involve elements such as analysis, design and synthesis.

The Department will appoint a project coordinator who will be in-charge of the following

- Grouping of students (Maximum of three in a group).
- Allotment of projects and project guide.
- Project monitoring at regular intervals.

A project allotment is to be completed by the 4th week of 1st semester of IV year so that students get sufficient time for completion of their project.

All the projects are to be checked for progress at least twice in a semester. It should be on the basis of presentation of the students.

Sessionals marks to be based on the Grade / Marks awarded by a monitoring committee comprising of faculty members as well as by the supervisor.

Efforts to be made so that some of the projects are carried out in industries. Projects may also be invited from industries.

Norms of final documentation of the project report are to be provided by the Department.

** Excellent / Very Good / Good / Satisfactory / Unsatisfactory.*

Note : Three periods of contact load will be assigned to each project guide.

ME 472

**INDUSTRIAL ADMINISTRATION &
FINANCIAL MANAGEMENT**
(SERVICE COURSE TO EE & EIE)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Industrial Organisation: Types of various business organizations. Organisation structures and their relative merits and demerits. Functions of management. Plant location and layouts: Factors affecting the location of plant and layout. Types of layouts and their merits and demerits.

Unit-II

Work study, Definitions, objectives of method study and time study. Steps in conducting method study. Symbols and charts used in method study. Principles of motion economy. Calculation of standard time by time study and work sampling. Performance rating factor. Types of ratings. Jobs evaluation and performance appraisal. Wages, incentives, bonus, wage payment plans.

Unit-III

Inspection and quality control: Types and objectives of inspection S.Q.C., its principles. Quality control by chart and sampling plans. Quality circles, introduction to ISO.

Production planning and control: Types of manufacture. Types of production. Principles of PPC and its function. Production control charts.

Unit-IV

Optimisation: Introduction to linear programming and graphical solutions. Assignment problems.

Project Management: Introduction to CPM and PERT. Determination of critical path..

Material Management: Classification of materials. Materials planning. Duties of purchase manager. Determination of economic ordering quantities. Types of materials purchase.

Unit-V

Cost accounting: Elements of cost. Various costs. Types of overheads. Break even analysis and its applications. Depreciation. Methods of calculating depreciation fund. Nature of Financial management. Time value of money. Techniques of capital budgeting and methods.

Cost of capital. Financial leverage.

Suggested Reading:

1. Pandey I.M. *Elements of Financial Management*, Vikas Publ. House, New Delhi, 1994.
2. Khanna O.P., *Industrial Engineering and Management*, Dhanapat Rai & Sons.
3. Everrete E. Adama & Ronald J. Ebert, *Production & Operations Management*, Prentice Hall of India, 5th Edition, 2005.
4. S.N. Chary, *Production and Operations Management*, Tata McGraw Hill, 3rd Edition, 2006.
5. Paneer Selvam, *Production and Operations Management*, Pearson Education, 2007.