ENGINEERING ECONOMY

Subject Code	:	**10ME71**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1
INTRODUCTION: Engineering Decision-Makers, Engineering and Economics, Problem solving and Decision making, Intuition and Analysis, Tactics and Strategy. Engineering Economic Decision, Maze. Law of demand and supply, Law of returns, Interest and Interest factors: Interest rate, Simple interest, Compound interest, Cash - flow diagrams, Personal loans and EMI Payment, Exercises and Discussion.

08 Hours

UNIT - 2
PRESENT-WORTH COMPARISONS: Conditions for present worth comparisons, Basic Present worth comparisons, Present-worth equivalence, Net Present-worth, Assets with unequal lives, infinite lives, Future-worth comparison, Pay-back comparison, Exercises, Discussions and problems.

06 Hours

UNIT - 3
EQUIVALENT ANNUAL-WORTH COMPARISONS: Equivalent Annual-Worth Comparison methods, Situations for Equivalent Annual-Worth Comparisons, Consideration of asset life, Comparison of assets with equal and unequal lives, Use of shrinking fund method, Annuity contract for guaranteed income, Exercises, Problems.

06 Hours

UNIT - 4
RATE-OF-RETURN CALCULATIONS AND DEPRECIATION: Rate of return, Minimum acceptable rate of return, IRR, IRR misconceptions, Cost of capital concepts. Causes of Depreciation, Basic methods of computing depreciation charges, Tax concepts, corporate income tax.

06 Hours

PART - B

UNIT - 5
Estimating and Costing: Components of costs such as Direct Material Costs, Direct Labor Costs, Fixed Over-Heads, Factory cost, Administrative Over-Heads, First cost, Marginal cost, Selling price, Estimation for simple components.

05 Hours

UNIT - 6
INTRODUCTION, SCOPE OF FINANCE, FINANCE FUNCTIONS: Statements of Financial Information: Introduction, Source of financial information, Financial statements, Balance sheet, Profit and Loss account, relation between Balance sheet and Profit and Loss account. Simple Numericals

08 Hours

UNIT - 7
FINANCIAL RATIO ANALYSIS: Introduction, Nature of ratio analysis, Liquidity ratios, Leverage ratios, Activity ratios, Profitability ratios, Evaluation of a firm's earning power. Comparative statements analysis. Simple numericals

06 Hours

UNIT - 8

FINANCIAL AND PROFIT PLANNING: Introduction, Financial planning, Profit planning, Objectives of profit planning, Essentials of profit planning, Budget administration, type of budgets, preparation of budgets, advantages, problems and dangers of budgeting. Introduction to Bench Marking of Manufacturing Operation.

07 Hours

TEXT BOOKS:

1. **Engineering Economy,** Riggs J.L., , McGraw Hill, 2002

2. **Engineering Economy,** Thuesen H.G. PHI , 2002

REFERENCE BOOKS:

1. **Engineering Economy,** Tarachand, 2000.

2. **Industrial Engineering and Management**, OP Khanna, Dhanpat Rai & Sons. 2000

3. **Financial Mangement,** Prasanna Chandra, TMH, 2004

4. **Finacial Management,** IM PANDEY, Vikas Publisahing House, 2002

MECHANICAL VIBRATIONS

Subject Code	: 10ME72	**I.A. Marks**	: 25
No. of Lecture Hrs./ Week	: 04	**Exam Hrs.**	: 03
Total No. of Lecture Hrs.	: 52	**Exam Marks: 100**	

PART- A

Unit - 1
Introduction: Types of vibrations, Definitions, Simple Harmonic Motion (S.H.M.), Work done by harmonic force, Principle of super position applied to SHM, Beats, Fourier theorem and problems.   **06 Hours**

Unit -2
Undamped (Single Degree of Freedom) Free Vibrations: Derivations for spring mass systems, Methods of Analysis, Natural frequencies of simple systems, Springs in series and parallel, Torsional and transverse vibrations, Effect of mass of spring and Problems.
07 Hours

Unit - 3
Damped free vibrations (1DOF): Types of damping, Analysis with viscous damping - Derivations for over, critical and under damped systems, Logarithmic decrement and Problems.   **06 Hours**

Unit - 4
Forced Vibrations (1DOF): Introduction, Analysis of forced vibration with constant harmonic excitation - magnification factor, rotating and reciprocating unbalances, excitation of support (relative and absolute amplitudes), force and motion transmissibility, Energy dissipated due to damping and Problems.   **07 Hours**

PART – B

Unit – 5
Vibration Measuring Instruments and Whirling of shafts: Seismic Instruments – Vibrometers, Accelerometer, Frequency measuring instruments and Problems. Whirling of shafts with and without damping, discussion of speeds above and below critical speeds and Problems.   **06 Hours**

Unit – 6
Systems with two degrees of Freedom: Principle modes of vibrations, Normal mode and natural frequencies of systems (without damping) – Simple spring mass systems, masses on tightly stretched strings, double pendulum, torsional systems, combined rectilinear and angular systems, geared systems and Problems. Undamped dynamic vibration absorber and Problems.   **06 Hours**

Unit - 7
Numerical Methods for multi degree freedom of systems: Introduction, Maxwell's reciprocal theorem, Influence coefficients, Rayleigh's method, Dunkerley's method, Stodola method, Holzer's method, Orthogonality of principal modes, method of matrix iteration and Problems.   **09 Hours**

Unit – 8
Modal analysis and Condition Monitoring: Signal analysis, dynamic testing of machines and structures, Experimental modal analysis, Machine condition monitoring and diagnosis.
05 Hours

TEXT BOOKS:

1. **Mechanical Vibrations,** S. S. Rao, Pearson Education Inc, 4th edition, 2003.
2. **Mechanical Vibrations,** V. P. Singh, Dhanpat Rai & Company, 3rd edition, 2006.

REFERENCE BOOKS:

1. **Theory of Vibration with Applications,** W. T. Thomson, M. D. Dahleh and C. Padmanabhan, Pearson Education Inc, 5th edition, 2008.
2. **Mechanical Vibrations:** S. Graham Kelly, Schaum's outline Series, Tata McGraw Hill, Special Indian Edition, 2007.
3. **Theory and Practice of Mechanical Vibrations:** J. S. Rao & K. Gupta, New Age International Publications, New Delhi, 2001.
4. **Mechanical Vibrations,** G. K.Grover, Nem Chand and Bros, 6th edition, 1996.

OPERATION RESEARCH

Subject Code	:	**10ME73**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART- A

UNIT -1

INTRODUCTION: Evolution of OR, definition of OR, scope of OR, application areas of OR, steps (phases) in OR study, characteristics and limitations of OR, models used in OR, linear programming (LP) problem-formulation and solution by graphical method.

04 Hours

UNIT -2

SOLUTION OF Linear Programming PROBLEMS: The simplex method-canonical and standard form of an LP problem, slack, surplus and artificial variables, big M method and concept of duality, dual simplex method.

08 Hours

UNIT -3

TRANSPORTATION PROBLEM: Formulation of transportation problem, types, initial basic feasible solution using different methods, optimal solution by MODI method, degeneracy in transportation problems, application of transportation problem concept for maximization cases. Assignment Problem-formulation, types, application to maximization cases and travelling salesman problem.

08 Hours

UNIT -4

INTEGER PROGRAMMING: Pure and mixed integer programming problems, solution of Integer programming problems-Gomory's all integer cutting plane method and mixed integer method, branch and bound method, Zero-One programming.

06 Hours

PART- B

UNIT -5

PERT-CPM TECHNIQUES: Introduction, network construction - rules, Fulkerson's rule for numbering the events, AON and AOA diagrams; Critical path method to find the expected completion time of a project, floats; PERT for finding expected duration of an activity and project, determining the probability of completing a project, predicting the completion time of project; crashing of simple projects.

08 Hours

UNIT -6

QUEUING THEORY: Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), empirical queuing models – M/M/1 and M/M/C models and their steady state performance analysis.

06 Hours

UNIT -7

GAME THEORY: Formulation of games, types, solution of games with saddle point, graphical method of solving mixed strategy games, dominance rule for solving mixed strategy games.

06 Hours

UNIT -8

SEQUENCING: Basic assumptions, sequencing 'n' jobs on single machine using priority rules, sequencing using Johnson's rule-'n' jobs on 2 machines, 'n' jobs on 3 machines, 'n' jobs on 'm' machines. Sequencing 2 jobs on 'm' machines using graphical method.

06 Hours

TEXT BOOKS

1. **Operations Research,** P K Gupta and D S Hira, Chand Publications, New Delhi - 2007
2. **Operations Research,** Taha H A, Pearson Education

REFERNCE BOOKS

1. **Operations Research,** A P Verma, S K Kataria &Sons, 2008
2. **Operations Research,** Paneerselvan, PHI
3. **Operations Research,** A M Natarajan, P Balasubramani, Pearson Education, 2005
4. **Introduction to Operations Research,** Hiller and Liberman, McGraw Hill
5. **Operations Research** S.D. Sharma, Ledarnath Ramanath & Co, 2002

HYDRAULICS AND PNEUMATICS

Sub Code   : 10ME74   **IA Marks**   : 25
Hrs/Week   : 04   **Exam Hours** : 03
Total Hrs   : 52   **Exam Marks** : 100

PART - A

UNIT -1

Introduction to Hydraulic Power: Definition of hydraulic system, advantages, limitations, applications, Pascal's law, structure of hydraulic control system, problems on Pascal's law.

The source of Hydraulic Power: Pumps Classification pumps, Pumping theory of positive displacement pumps, construction and working of Gear pumps, Vane pumps, Piston pumps, fixed and variable displacement pumps, Pump performance characteristics, pump Selection factors, problems on pumps.

07 Hours

UNIT -2

Hydraulic Actuators and Motors: Classification cylinder and hydraulic motors, Linear Hydraulic Actuators [cylinders], single and double acting cylinder, Mechanics of Hydraulic Cylinder Loading, mounting arrangements, cushioning, special types of cylinders, problems on cylinders, construction and working of rotary actuators such as gear, vane, piston motors, Hydraulic Motor Theoretical Torque, Power and Flow Rate, Hydraulic Motor Performance, problems, symbolic representation of hydraulic actuators (cylinders and motors).

06 Hours

UNIT - 3

Control Components in Hydraulic Systems: Classification of control valves, Directional Control Valves- Symbolic representation, constructional features of poppet, sliding spool, rotary type valves solenoid and pilot operated DCV, shuttle valve, check valves, Pressure control valves - types, direct operated types and pilot operated types. Flow Control Valves - compensated and non-compensated FCV, needle valve, temperature compensated, pressure compensated, pressure and temperature compensated FCV, symbolic representation.

07 Hours

UNIT - 4

Hydraulic Circuit Design And Analysis: Control of Single and Double Acting Hydraulic Cylinder, Regenerative circuit, Pump Unloading Circuit, Double Pump Hydraulic System, Counter balance Valve Application, Hydraulic Cylinder Sequencing Circuits, Automatic cylinder reciprocating system, Locked Cylinder using Pilot check Valve, Cylinder synchronizing circuit using different methods, factors affecting synchronization, Hydraulic circuit for force multiplication, Speed Control of Hydraulic Cylinder, Speed Control of Hydraulic Motors, Safety circuit, Accumulators, types, construction and applications with circuits.

06 Hours

PART – B

UNIT - 5

Maintenance of Hydraulic System: Hydraulic Oils - Desirable properties, general type of Fluids, Sealing Devices, Reservoir System, Filters and Strainers, wear of Moving Parts due to solid -particle Contamination, temperature control (heat exchangers), Pressure switches, trouble shooting.

06 Hours

UNIT - 6

Introduction to Pneumatic Control: Definition of pneumatic system, advantages, limitations, applications, Choice of working medium. Characteristic of compressed air. Structure of Pneumatic control System, fluid conditioners and FRL unit.

Pneumatic Actuators: Linear cylinder - Types, Conventional type of cylinder- working, End position cushioning, seals, mounting arrangements- Applications. Rod - Less cylinders types, working, advantages, Rotary cylinders- types construction and application, symbols.

07 Hours

UNIT-7

Pneumatic Control Valves: DCV such as poppet, spool, suspended seat type slide valve, pressure control valves, flow control valves, types and construction, use of memory valve, Quick exhaust valve, time delay valve, shuttle valve, twin pressure valve, symbols. 3Hrs Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, speed control of cylinders - supply air throttling and Exhaust air throttling and Exhaust air throttling.

Signal Processing Elements: Use of Logic gates - OR and AND gates in pneumatic applications. Practical Examples involving the use of logic gates, Pressure dependant controls- types - construction - practical applications, Time dependent controls principle. Construction, practical applications.

07 Hours

UNIT-8

Multi- Cylinder Application: Coordinated and sequential motion control, Motion and control diagrams. Signal elimination methods, Cascading method- principle, Practical application examples (up to two cylinders) using cascading method (using reversing valves).

Electro- Pneumatic Control: Principles - signal input and out put, pilot assisted solenoid control of directional control valves, Use of relay and contactors. Control circuitry for simple signal cylinder application.

06 Hours

Compressed Air: Production of compressed air- Compressors Preparation of compressed air- Driers, Filters, Regulators, Lubricators, Distribution of compressed air Piping layout.

TEXT BOOKS:

1. **"Fluid Power with Applications",** Anthony Esposito**,** Sixth edition, Pearson Education, Inc, 2000.
2. **'Pneumatics and Hydraulics',** Andrew Parr, Jaico Publilishing Co

REFERENCE BOOKS:

1. **'Oil Hydraulic systems', Principles and Maintenance** S. R. Majurr, Tata Mc Graw Hill Publishing Company Ltd. - 2001
2. **'Industrial Hydraulics', Pippenger, Hicks"** McGraw Hill, New York
3. **'Hydraulic & Pneumatic Power for Production'**, Harry L. Stewart
4. **'Pneumatic Systems',** S. R. Majumdar, Tata Mc Graw Hill Publish 1995
5. **Power Hydraulics'** Michael J Pinches & John G Ashby, Prentice Hall

DESIGN LABORATORY

Subject Code	: **10MEL77**	IA Marks	:	25
No. of Practical Hrs./ Week	: 03	Exam Hours	:	03
Total No. of Practical Hrs.	: 42	Exam Marks	:	50

PART - A

1. Determination of natural frequency, logarithmic decrement, damping ratio and damping coefficient in a single degree of freedom vibrating systems (longitudinal and torsional)
2. Balancing of rotating masses.
3. Determination of critical speed of a rotating shaft.
4. Determination of Fringe constant of Photoelastic material using.
    a) Circular disc subjected to diametral compression.
    b) Pure bending specimen (four point bending)
5. Determination of stress concentration using Photoelasticity for simple components like plate with a hole under tension or bending, circular disk with circular hole under compression, 2D Crane hook.

PART - B

6. Determination of equilibrium speed, sensitiveness, power and effort of Porter/Prowel /Hartnel Governor. (only one or more)
7. Determination of Pressure distribution in Journal bearing.
8. Determination of Principal Stresses and strains in a member subjected to combined loading using Strain rosettes.
9. Determination of stresses in Curved beam using strain gauge.
10. Experiments on Gyroscope (Demonstration only)

Scheme of Examination:
One question from Part A   -   20 Marks (05 Write up +15)
One question from Part B   -   20 Marks (05 Write up +15)
Viva - Voce   -   10 Marks

          Total: **50 Marks**

CIM & AUTOMATION LAB

Subject Code	:	**10MEL78**	IA Marks	:	25
No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

PART - A

CNC part programming using CAM packages. Simulation of Turning, Drilling, Milling operations. 3 typical simulations to be carried out using simulation packages like Master-CAM, or any equivalent software.

PART - B

(Only for Demo/Viva voce)
1. FMS (Flexible Manufacturing System): Programming of Automatic storage and Retrieval system (ASRS) and linear shuttle conveyor Interfacing CNC lathe, milling with loading unloading arm and ASRS to be carried out on simple components.
2. Robot programming: Using Teach Pendent & Offline programming to perform pick and place, stacking of objects, 2 programs.

PART - C

(Only for Demo/Viva voce)
Pneumatics and Hydraulics, Electro-Pneumatics: 3 typical experiments on Basics of these topics to be conducted.

Scheme of Examinations

Two questions from Part A – 40 Marks (10 Write up +30)
                    Viva Voce – 10 Marks
                           Total – 50 Marks

ELECTIVE-II (GROUP B)

MECHANISM DESIGN

Sub Code	**: 10ME751**	**IA Marks**	**: 25**
Hrs/Week	**: 04**	**Exam Hours**	**: 03**
Total Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT-1

Planar Mechanisms and Geometry of Motion: Definitions and basic concepts, Classification of links, Classification of pairs, Mechanism and machine, Inversions, Grashof's law, Transmission of torque and force in mechanisms, Mobility, Degree of freedom permitted by joints other than turning and sliding, Equivalent mechanisms, Unique mechanisms.

07 Hours

UNIT-2

Number Synthesis: Effect of even or odd number of links on degree of freedom, Minimum number of binary links in a mechanism, Minimum possible number of turning pairs, Enumeration of kinematic chain, Degree of freedom of special mechanisms.

06 Hours

UNIT-3

Synthesis of Linkages: Type, Number and dimensional synthesis, Function generation, Path generation and body guidance, Precision positions, Structural error, Chebychev spacing, Two position synthesis of slider crank mechanisms, Crank-rocker mechanisms with optimum transmission angle.

07 Hours

UNIT-4

Motion Generation: Poles and relative poles, Relative poles of 4-bar mechanism, Relative poles of slider crank mechanism.   0**6 Hours**

PART - B

UNIT-5

Graphical Methods of Dimensional Synthesis: Two position synthesis of crank and rocker mechanisms, Three position synthesis, Four position synthesis (point position reduction), Overlay method.   **06 Hours**

UNIT-6

Coupler Curves: Equation of coupler curves, Synthesis for path generation, Graphical synthesis for path generation, Robert-Chebyshev theorem (cognate linkages), Coupler curves from 5-bar mechanisms, Examples.   **07 Hours**

UNIT-7

Analytical Methods of Dimensional Synthesis: Freudenstein's equation for 4-bar mechanism and slider crank mechanism, Examples, Bloch's method of synthesis.   **06 Hours**

UNIT-8

Cams: Introduction, Pressure angle, Parameters affecting pressure angle, Effect of offset follower motion, Radius of curvature and undercutting, Cams with specified contours.

07 Hours

TEXT BOOKS:

1. **"Theory of Machines & Mechanisms",** J.J. Uicker, , G.R. Pennock, J.E. Shigley. OXFORD 3rd Ed.

2. **'Mechanism & Machine Theory'**, A.G. Ambekar, PHI, 2007

REFERENCE BOOKS:

1. **'Kinematics, Dynamics & Design of Machinery'**, K. J. Waldron, G. L. Kinzel, Wiley India, 2007.

2. **'Advanced Mechanism Design'**, Erdman sandoor, Vol-l PHI, 2006,

3. **"Kinematics & Dynamics of Machinery"** H.H. Mabie, F.W. Ocvirk, John Wiley & Sons, New York, 3rd Ed.

THEORY OF PLASTICITY

Subject Code	:	**10ME752**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1
FUNDAMENTAL OF ELASTICITY: Concept of stress, stress transformation laws, spherical and deviator stress tensors, equilibrium equations, octahedral stresses, concept of strain, deviator and spherical strain tensors, strain transformation laws, octahedral strains, generalized Hooke's law, elastic strain energy, compatibility equations, theories of strength. problems.

07 Hours

UNIT - 2
PLASTIC DEFORMATION OF METALS: Crystalline structure in metals, mechanism of plastic deformation, factors affecting plastic deformation, strain hardening, recovery, recrystallization and grain growth, flow figures or luder's cubes.

06 Hours

UNIT - 3
CUBICAL DILATION, TRUE STRESS AND STRAIN: Strain tensor, principal strain, plane strain, spherical and deviator strain, octahedral strain and representative strain, problems.

07 Hours

UNIT - 4
STRESS STRAIN RELATIONS: Introduction, types of materials, empirical equations, theories of plastic flow, experimental verification of St.Venant's theory of plastic flow, the concept of plastic potential, the maximum work hypothesis, mechanical work for deforming a plastic substance.

06 Hours

PART - B

UNIT - 5
YIELD CRITERIA: Introduction, yield or plasticity conditions, Von Mises and Tresca criteria, Geometrical representation, yield surface, yield locus (two dimensional stress space), experimental evidence for yield criteria, energy required to change the shape with basic principle problems

07 Hours

UNIT - 6
SLIP LINE FIELD THEORY: Introduction, basic equations for incompressible two dimensional flow, continuity equations, stresses in conditions of plain strain, convention for slip lines, solutions of plastic deformation problem, Geometry of slip line field, Properties of the slip lines, construction of slip line nets

07 Hours

UNIT - 7
BENDING OF BEAMS: Analysis for stresses, Non linear stress strain curve, shear stress distribution, residual stresses in plastic bending, problems.

06 Hours

UNIT - 8
TORSION OF BARS: Introduction, plastic torsion of a circular bar, elastic perfectly plastic material, elastic work hardening of material, residual stresses and problems

06 Hours

TEXT BOOKS:

1. '**Theory of Plasticity',** Chakraborty 3rd Edition Elsevier.
2. **'Engineering Plasticity',** W. Johnson and P. B. Mellor D Van N.O Strand Co. Ltd 2000

REFERENCE BOOKS:

1. **Basic Engineering Plasticity,** DWA Rees 1st Edition Elsevier.
2. **Theory of Plasticity,** L. S. Srinath TMH,
3. **Theory of Plasticity,** Sadhu Singh, Kanna publisher

ENGINEERING DESIGN

Sub Code	**: 10ME753**	**IA Marks** : 25
Hrs/Week	**: 04**	**Exam Hours : 03**
Total Hrs	**: 52**	**Exam Marks : 100**

PART A

UNIT 1:
Design Process: Introduction, History of Design Process, Design by innovation, inadequacies of traditional design methods, product Design process, product cost, quality and time to market

Detailed description of Design process:
Conceptual design, embodiment design, detail design, planning for manufacture, planning for distribution, planning for use planning for retirement, marketing, organization for design, designing to codes and standards, design renew product and process cycles, environmentally responsible design.

07 Hours

UNIT 2:
Need Identification and Problem Definition: Introduction, identifying customer needs, gathering information from customers needs, generation of specifications.

07 Hours

UNIT 3:
Concept Generation and Evaluation: Introduction, creativity, problem solving, creativity methods, conceptual decomposition, Concept Generation Methods: Brain storming, 6-3-5 method, use of analogies, use of extremes and inverses, Morphological methods. Theory of inventive problem solving (TRIZ)
Concept Evaluation Methods: Based on feasibility judgment, assessment of technology readiness based on go-no-go screening, Pugh's method

06 Hours

UNIT 4:
Embodiment Design & Detail Design : Introduction product architecture, brief introduction to Configuration Design and parametric design.
Detail Design: Importance of Drawings, Drawings produced during Design process. Bill of materials: Brief introduction to modeling and simulations, prototypes and testing, rapid prototyping .Final Design Review.

06 Hours

Part B

UNIT 5:
Materials Selection and Materials in Design : Introduction, general criteria for material selection, performance characteristics of materials, material selection process, illustration of Ashby charts, methods of material selection, material performance indices, decision matrices, Pugh's selection method, Weighted property index method, Value analysis.

06 Hours

UNIT 6:
Design For X (DFX): General introduction, Design for Manufacture (DFM):Introduction, DFM guidelines, Specific Design Rules. Design for Assembly(DFA): Introduction, DFA guidelines. Design for Reliability (DFR): Introduction, Bath-tub curve, Mean life, MTTF and MTBF, Failure rate(Constant and Variable), Exponential and Weibull reliability functions, System reliability concepts-Series and Parallel systems.
Design for Environment (DFE):Introduction, DFE practices, Introduction to Design for Test and Maintenance(Serviceability),Introduction to Industrial Design.

07 Hours

UNIT 7:
Cost Considerations and Human Factors in Engineering Design:

06 Hours

UNIT 8:
Robust and Quality Design: Introduction, concept of total quality control and assurance, Taguchi's quality loss functions, Robust design: Parameter design and tolerance design.

07 Hours

<u>TEXT BOOKS</u>

1. **Engineering Design: A Materials and Processing Approach:** George E. Dieter, Mc Graw Hill, 1991.

2. **The Mechanical Design Process**, David G. Ullman, Mc Graw Hill, 2003

<u>REFERENCE BOOKS</u>

1. **Product Design & Development:** Karl T. Ulrich & Steven D, Epinger, Tata Mc Graw Hill, 3rd Edition, 2003

2. **Engineering Design Principles:** Ken Hurst, Elsevier, 2010

3. **An introduction to Engineering Design Method:** V Gupta and P Murthy, Tata Mc Graw Hill, 2000

4. **Introduction of Engineering Design:** T. Woodson, McGraw Hill, 2001

5. **Design & Planning of Engineering systems:** D. D. Meredith, K.W. Wong, R.W.Woodhead & K. K.Worthman,2000

6. **Introduction to Design:** M.A. Asimov, Prentice Hall, 1996

7. **Product Design and Manufacturing:** A.C. Chitale and R.C. Gupta, PHI 4TH edition 2007

NON-CONVENTIONAL ENERGY RESOURCE

Subject Code	:	**10ME754**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

Will be sent Latter

GAS DYNAMICS

Subject Code	:	**10ME755**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1
FUNDAMENTAL EQUATIONS OF STEADY FLOW: Continuity and momentum equations, The thrust function, The dynamic equation and Euler's Equation. Bernoulli's Equation. Steady flow energy equation.

08 Hours

UNIT - 2
ISENTROPIC FLOW: Acoustic velocity, Mach number, Mach cone and Mach angle. Flow parameters, stagnation temperature, pressure, and density.

06 Hours

UNIT - 3
ADIABATIC FLOW: Stagnation temperature change. Rayleigh line, Pressure ratio and temperature ratio, Entropy considerations, maximum heat transfer.

06 Hours

UNIT - 4
FLOW WITH FRICTION: The fanning equation, Friction factor and friction parameter, Fanno line, Fanno equations.

06 Hours

PART - B

UNIT - 5
WAVE PHENOMENA: Classification of wave phenomena, analysis of shock phenomena, Hugoniot equation. Weak waves, compression waves, Normal shock waves, oblique shock waves, Entropy considerations, Rayleigh Pilot equations, detonation and deflageration.

06 Hours

UNIT - 6
VARIABLE AREA FLOW: Velocity variation with Isentropic flow, Criteria for acceleration and deceleration. Effect of pressure ratio on Nozzle operation. Convergent nozzle and convergent divergent nozzle. Effect of back pressure on nozzle flow. Isothermal flow functions. Comparison of flow in nozzle. Generalized one dimensional flow.

07 Hours

UNIT - 7
Applications of dimensional analysis and similitude to gas dynamic problems.

06 Hours

UNIT - 8
INTRODUCTION TO FLAMES AND COMBUSTION: Flame propagation, diffusion flames, premixed flames, flame velocity, theories of flame propagation, ignition for combustible mixture, flame stabilization.

07 Hours

TEXT BOOKS:

1. **Fundamentals of Compressible flow**: Yahya, 2nd Edn. 1991; Wieley Eastern.

2. **Gas Dynamics,** E Radhakrishnan PHI-2006

REFERENCE BOOKS:

1. **Introduction to Gas Dynamics:** Rolty, wiley 1998

2. **Elements of Gas Dynamics:** Liepmann and roshko, Wiley 1994.

3. **The dynamics and thermodynamics of compressible fluid flow:** Shapiro Ronold press. 1994.

4. **Compressible Fluid Flow**, J. F. Anderson

MANAGEMENT INFORMATION SYSTEM

Subject Code	:	**10ME756**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

The Information Age: An Overview: The purpose, data, information, and information systems and their types, ethical and societal issues, information systems in business functions, web empowered enterprises.

05 Hours

UNIT - 2

Strategic Uses of Information Systems: Strategies and Strategic moves, Achieving a competitive advantage, creating and maintaining strategic information systems, Business Functions and Supply Chains – effectivenss and efficiency, accounting, finance, engineering, supply chain management, Human resource management, Enterprise resource planning.

05 Hours

UNIT - 3

Information Technology: Business Hardware – components, classification of computers, output devices, storage media, and purchasing,, Business Software – programming languages and software development tools, language translation, compilers and interpreters, system software, open source software, software licensing, ethical issues,

08 Hours

UNIT - 4

Business Networks and Telecommunication: Telecommunication in Business and Daily Use, Bandwiths and Media, networks, protocols, internet networking services, Telecommuting – pros and cons, Future of Networking Technologies.

08 Hours

PART - B

UNIT - 5

Web Enabled Commerce: Web enabled enterprises – web business and technologies, web enabled business, Challenges of Global Information Systems – Multinational organizations, international commerce, ethical issues.

07 hours

UNIT - 6

Decision Support and Business intelligence: Decision support and expert systems – decision support and decision making process, structured and unstructured problems, decision support systems, expert systems, geographical systems, Business Intelligence and Knowledge Mangement – Date Mining and online analysis, knowledge management,

06 Hours

UNIT - 7

Planning, Acquisition, and Control: Systems Planning and Development –Planning Information sytems, systems development life cycle, agile methods, systems integration, ethical issues – IS professionals certification.

07 Hours

UNIT - 8

Choices in Systems Acquisition: Options and Priorities, outsourcing, licensing applications, software as a service, user application development, ethical issues- computer use policies for employees.

06 Hours

TEXT BOOK

1. **Management Information Systems**, Effy Oz, Cengage Learning, INDIA EDITION, 2009.

2. **Management Information Systems**, James A O'Brien, Irwin McGraw Hill, Fifth Edition.

REFERENCE BOOKS:

1. **Mangement Information Systems,** Laudon & Laudon, PHI 1998 Ed. ISBN 81-203-1282-1

2. **Managaement Information systems,** S.Sadagopan, Prentice Hall of India, 1998 Ed. ISBN 81-203-1180-9

3. **Information sytems for Modern managaement** G.R.Murdick PHI 2002.

AUTOMATION IN MANUFACTURING

Subject Code	:	**10ME757**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1
INTRODUCTION: Production System Facilities, Manufacturing Support systems, Automation in Production systems, Automation principles & Strategies

05 Hours

UNIT - 2
MANUFACTURING OPERATIONS: Manufacturing Operations, Product/Production Relationship, Production concepts and Mathematical Models & Costs of Manufacturing Operations

07 Hours

UNIT - 3
INDUSTRIAL CONTROL SYSTEM: Basic Elements of an Automated System, Advanced Automation Functions & Levels of Automation, Continuous versus Discrete control, Computer Process control, Forms of Computer Process Control.

07 Hours

UNIT - 4
AUTOMATED MANUFACTURING SYSTEMS: Components of a Manufacturing systems, Classification of Manufacturing Systems, overview of Classification Scheme, Single Station Manned Workstations and Single Station Automated Cells.

07 Hours

PART - B

UNIT - 5
GROUP TECHNOLOGY & FLEXIBLE MANUFACTURING SYSTEMS: Part Families, Parts Classification and coding, Production Flow Analysis, Cellular Manufacturing, Flexible Manufacturing Systems: What is an FMS, FMS Components, FMS Applications & Benefits, and FMS Planning & Implementation Issues.

08 Hours

UNIT - 6
QUALITY CONTROL SYSTEMS: Traditional and Modern Quality Control Methods, Taguchi Methods in Quality Engineering. Introduction to SQC Tools.

04 Hours

UNIT - 7
INSPECTION TECHNOLOGIES: Automated Inspection, Coordinate Measuring Machines Construction, operation & Programming, Software, Application & Benefits, Flexible Inspection System, Inspection Probes on Machine Tools, Machine Vision, Optical Inspection Techniques & Noncontact Nonoptical Inspection Technologies

06 Hours

UNIT - **8**
MANUFACTURING SUPPORT SYSTEM: Process Planning, Computer Aided Process Planning, Concurrent Engineering & Design for Manufacturing, Advanced Manufacturing Planning, Just-in Time Production System, Basic concepts of lean and Agile manufacturing. Basic Concepts of Lean and Agile manufacturing, Comparisons of Lean & Agile Manufacturing.

08 Hours

TEXT BOOKS:

1. **Automation, Production Systems and Computer Integrated Manufacturing,** M. P. Groover, Pearson education. Third Edition, 2008
2. **Principles of CIM,** Vajpayee, PHI.

REFERENCE BOOKS:

1. **Anatomy of Automation**, Amber G.H & P. S. Amber, Prentice Hall.
2. **Performance Modeling of Automated Manufacturing Systems,** Viswanandham, PHI
3. **Computer Based Industrial Control**, Krishna Kant, EEE-PHI

TOTAL QUALITY MANAGEMENT

Sub Code : 10ME758   **IA Marks** : 25
Hrs/Week : 04   **Exam Hours** : 03
Total Hrs : 52   **Exam Marks** : 100

PART - A

UNIT - 1
Principles and Practice: Definition, basic approach, gurus of TQM, TQM Framework, awareness, defining quality, historical review, obstacles, benefits of TQM.

06 Hours

UNIT - 2
Leadership: Definition, characteristics of quality leaders, leadership concept, characteristics of effective people, ethics, the Deming philosophy, role of TQM leaders, implementation, core values, concepts and framework, strategic planning communication, decision making,

06 Hours

UNIT - 3
Customer Satisfaction and Customer Involvement: Customer Satisfaction : customer and customer perception of quality, feedback, using customer complaints, service quality, translating needs into requirements, customer retention, Case studies.
Employee Involvement – Motivation, employee surveys, empowerment, teams, suggestion system, recognition and reward, gainsharing, performance appraisal, unions and employee involvement, case studies.

07 Hours

UNIT - 4
Continuous Process Improvement: process, the Juran trilogy, improvement strategies, types of problems, the PDSA Cycle, problem-solving methods, Kaizen, reengineering, six sigma, case studies.
Tools and Techniques: Benching marking, information technology, quality management systems, environmental management system, quality function deployment, quality by design, failure mode and effect analysis, product liability, total productive maintenance.

07 Hours

PART - B

UNIT - 5
Quality Management Tools : Why Why, forced filed analysis, nominal group technique, affinity diagram, interrelationship digraph, tree diagram, matrix diagram, prioritization matrices, process decision program chart, activity network diagram.

07 hours

UNIT - 6
Statistical Process Control : Pareto diagram, process flow diagram, cause-and-effect diagram, check sheets, histograms, statistical fundamentals, Control charts, state of control, out of control process, control charts for variables, control charts for attributes, scatter diagrams, case studies.

06 Hours

UNIT - 7
Building and Sustaining Performance Excellence in Organizations : Making the commitment to total quality, organizational culture and total quality, change management, sustaining the quality organization, self-assessment processes, implementing ISO 9000, Baldrige, and sis sigma, a view toward the future.

07 Hours

UNIT - 8
Design for Six Sigma: Tools for concept development, tools for design development, tools for design optimization, tools for design verification, problems.

06 Hours

TEXT BOOKS:

1. **Total Quality Management:** Dale H. Bester field, Publisher - Pearson Education India, ISBN: 8129702606, Edition 03/e Paperback (Special Indian Edition)

2. **Total Quality Management for Engineers:** M. Zairi, ISBN: 1855730243, Publisher: Wood head Publishing

REFERENCE BOOKS:

1. **A New American TQM, four revolutions in management,** Shoji Shiba, Alan Graham, David Walden, Productivity press, Oregon, 1990

2. **100 Methods for Total Quality Management**: Gopal K. Kanji and Mike Asher, ISBN: 0803977476, Publisher: Sage Publications, Inc.; Edition – 1

3. **Organisational Excellence through TQM, H**. Lal, New age pub, 2008

ELECTIVE-II (GROUP C)

EXPERIMENTAL STRESS ANALYSIS

Sub Code	: 10ME761	**IA Marks**	: 50
Hrs/Week	: 04	**Exam Hours**	: 03
Total Hrs	: 52	**Exam Marks**	: 100

PART - A

UNIT-1

Electrical Resistance Strain Gages: Strain sensitivity in metallic alloys, Gage construction, Adhesives and mounting techniques, Gage sensitivity and gage factor, Performance'Characteristics, Environmental effects, Strain Gage circuits. Potentiometer, Wheatstone's bridges, Constant current circuits.

06 Hours

UNIT-2

Strain Analysis Methods: Two element, three element rectangular and delta rosettes, Correction for transverse strain effects, Stress gage, Plane shear gage, Stress intensity factor gage.

06 Hours

UNIT-3

Photoelasticity: Nature of light, Wave theory of light - optical interference , Stress optic law – effect of stressed model in plane and circuclar polariscopes, Isoclinics & Isochromatics, Fringe order determination Fringe multiplication techniques , Calibration photoelastic model materials

08 Hours

UNIT-4

Two Dimensional Photoelasticity: Separation methods: Shear difference method, Analytical separation methods, Model to prototype scaling, Properties of 2D photoelastic model materials, Materials for 2D photoelasticity

06 Hours

PART -B

UNIT-5

Three Dimensional Photo elasticity: Stress freezing method, Scattered light photoelasticity, Scattered light as an interior analyzer and polarizer, Scattered light polariscope and stress data Analyses.

06 Hours

UNIT-6

Photoelastic (Birefringent) Coatings : Birefringence coating stresses, Effects of coating thickness: Reinforcing effects, Poission's, Stress separation techniques: Oblique incidence, Strip coatings

08 Hours

UNIT-7

Brittle Coatings: Coatings stresses, Crack patterns, Refrigeration techniques, Load relaxation techniques, Crack detection methods, Types of brittle coatings, Calibration of coating. Advantages and brittle coating applications.

06 Hours

UNIT-8

Moire Methods: Moire fringes produced by mechanical interference .Geometrical approach, Displacement field approach to Moire fringe analysis ,0ut of plane displacement measurements, Out of plane slope measurements .Applications and advantages

06 Hours

TEXT BOOKS:

1. **"Experimental Stress Analysis",** Dally and Riley, McGraw Hill.
2. **"Experimental Stress Analysis".** Sadhu Singh, Khanna publisher.
3. **Experimental stress Analysis**, Srinath L.S tata Mc Graw Hill.

REFERENCES BOOKS :

1. **"Photoelasticity Vol I and Vol II,** M.M.Frocht, John Wiley & sons.
2. **"Strain Gauge Primer",** Perry and Lissner,
3. **"Photo Elastic Stress Analysis",** Kuske, Albrecht & Robertson John Wiley & Sons.
4. **"Motion Measurement and Stress Analysis",** Dave and Adams,

TOOL DESIGN

Subject Code	:	**10ME762**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

Will be sent Latter

CRYOGENICS

Subject Code	:	**10ME763**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION TO CRYOGENIC SYSTEMS: Applications Areas of Cryogenic Engineering
Low temperature properties of engineering materials – Mechanical properties, Thermal properties, Electrical properties.
Introduction The Thermodynamically Ideal system Production of low temperatures – Joule Thompson Effect, Adiabatic expansion.

06 Hours

UNIT - 2

GAS LIQUIFICATION SYSTEMS: Liquification systems for Air Simple Linde – Hampson System, Claude System, Heylndt System, Dual pressure, Claude.
Liquefaction cycle Kapitza System. Comparison of Liquefaction Cycles Liquefaction cycle for hydrogen, helium and Neon, Critical components of liquefaction systems.

07 Hours

UNIT - 3

GAS CYCLE CRYOGENIC REFRIGERATION SYSTEMS: Classification of Cryo coolers Stirling cycle Cryo – refrigerators, Ideal cycle – working principle. Schmidt's analysis of Stirling cycle Various configurations of Stirling cycle refrigerators Integral piston Stirling cryo-cooler, Free displacer split type Stirling Cryo coolers, Gifford Mcmahon Cryo-refrigerator, Pulse tube refrigerator, Solvay cycle refrigerator, Vuillimier refrigerator, Cryogenic regenerators.

06 Hours

UNIT - 4

GAS SEPARATION AND GAS PURIFICATION SYSTEMS: Thermodynamic ideal separation system, Properties of mixtures, Principles of gas separation, Linde single column air separation. Linde double column air separation, Argon and Neon separation systems. Adsorption Process, PSA systems.

07 Hours

PART - B

UNIT - 5

ULTRA LOW TEMPERATURE CRYO – REFRIGERATORS: Magneto Caloric Refrigerator ^{3}He-^{4}He Dilution refrigerator. Pomeranchuk cooling.
Measurement systems for low temperatures, Temperature measurement at low temperatures, Resistance thermometers, Thermocouples, Thermistors, Gas Thermometry. Liquid level sensors.

06 Hours

UNIT - 6

VACUUM TECHNOLOGY: Fundamental principles. Production of high vacuum, Mechanical vacuum pumps, Diffusion pumps, Cryo-pumping, Measurement of high vacuum level.
Cryogenic Insulation: Heat transfer due to conduction, Evacuated porous insulation Powder & Fibers Opacified powder insulation, Gas filled powders & Fibrous materials Multilayer super-insulation, Composite insulation.

07 Hours

UNIT - 7
CRYOGENIC FLUID STORAGE AND TRANSFER SYSTEMS: Design of cryogenic fluid storage vessels, Inner vessel, Outer Insulation, Suspension system, Fill and drain lines. Cryogenic fluid transfer, External pressurization, Self pressurization, Transfer pump.

07 Hours

UNIT - 8
APPLICATION OF CRYOGENIC SYSTEMS: Cryogenic application for food preservation – Instant Quick Freezing techniques 11.2 Super conductive devices, Cryogenic applications for space technology.

06 Hours

TEXT BOOKS:

1. **Cryogenic Systems,** Randall Barron – Oxford Press, 1985

2. **Cryogenic Engineering,** Thomas M. Flynn, Marcel Dekker, Inc N.Y. Basal 1997

REFERENCE BOOK:

1. **Cryogenic Process Engineering,** Klaus D. Timmerhaus & Thomas M. Flynn, Plenum Press, New York & London 1989.

SMART MATERIALS

Subject Code	:	**10ME764**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Characteristics of composites and ceramics materials, Dynamics and controls, concepts, Electro-magnetic materials and shape memory alloys-processing and characteristics

06 Hours

UNIT - 2

SENSING AND ACTUATION: Principals of electromagnetic, acoustics, chemical and mechanical sensing and actuation, Types of sensors and their applications, their compatibility writer conventional and advanced materials, signal processing, principals and characterization.

07 Hours

UNIT - 3

CONTROL DESIGN: Design of shape memory alloys, Types of MR fluids, Characteristics and application, principals of MR fluid value designs, Magnetic circuit design, MR Dampers, Design issues.

06 Hours

UNIT - 4

OPTICS AND ELECTROMAGNETIC: Principals of optical fiber technology, characteristics of active and adaptive optical system and components, design and manufacturing principles.

07 Hours

PART - B

UNIT - 5

STRUCTURES: Principles of drag and turbulence control through smart skins, applications in environment such as aerospace and transportation vehicles, manufacturing, repair and maintainability aspects.

07 Hours

UNIT - 6

Controls: Principles of structural acoustic control, distributed, amalog and digital feed back controls, Dimensional implications for structural control.

06 Hours

UNIT - 7

PRINCIPLES OF VIBRATION AND MODAL ANALYSIS: PZT Actuators, MEMS, Magnetic shape Memory Alloys, Characteristics and Applications.

07 Hours

UNIT - 8

INFORMATION PROCESSING: Neural Network, Data Processing, Data Visualisation and Reliability – Principals and Application domains.

06 Hours

TEST BOOKS:

1. **Analysis and Design',** A. V. Srinivasan, 'Smart Structures –Cambridge University Press, New York, 2001, (ISBN : 0521650267)

2. **'Smart Materials and Structures',** M V Gandhi and B S Thompson Chapmen & Hall, London, 1992 (ISBN : 0412370107)

REFERENCE BOOKS:

1. **'Smart Materials and Structures',** Banks HT, RC Smith, Y Wang, Massow S A, Paris 1996

2. **G P Gibss'Adaptive Structres',** Clark R L, W R Saunolers, Jhon Wiles and Sons, New York, 1998

3. **An introduction for scientists and Engineers',** Esic Udd, Optic Sensors : Jhon Wiley & Sons, New York, 1991 (ISBN : 0471830070)

AGILE MANUFACTURING

Subject Code	:	**10ME765**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

AGILE MANUFACTURING: Definition, business need, conceptual frame work, characteristics, generic features.

06 Hours

UNIT - 2

DEVELOPING AGILE MANUFACTURING: Enterprise, Strategies, integration of organization, workforce and technology, reference models, examples.

07 Hours

UNIT - 3

INTEGRATION OF PRODUCT /PROCESS DEVELOPMENT: Principles, Robust design approach, Approaches to enhance ability in manufacturing, Role of QFD, Managing people in Agile orgnisation, Approaches.

06 Hours

UNIT - 4

APPLICATION OF IT/IS CONCEPTS IN AGILE MANUFACTURING: Strategies, Management of complexities and information. flow, approaches, applications of multimedia to improve agility in manufacturing, system concepts.

07 Hours

PART - B

UNIT - 5

AGILE SUPPLY CHAIN MANAGEMENT: Principles, IT/IS concepts in supply chain management, enterprise integration and management in agile manufacturing, concepts, Agility, Adaptability and learners – comparison of concepts.

07 Hours

UNIT - 6

COMPUTER CONTROL OF AGILE MANUFACTURING: CAPP for Agile Manufacturing, Aggregate capacity planning and production line design / redesign in Agile manufacturing, Cellular manufacturing, concepts, examples.

07 Hours

UNIT - 7

CORPORATE KNOWLEDGE MANAGEMENT IN AGILE MANUFACTURING: Strategies, strategic options in Agile manufacturing, Role of standards.

06 Hours

UNIT - 8

DESIGN OF SKILL & KNOWLEDGE: Enhancing technology for Machine tool system, Resumption of design requirement geometry, definition, methods, decision support for selection of cutting parameters, design enhancements, parametric approach only.

06 Hours

TEXT BOOKS:

1. **'Agile Manufacturing**- Forging Mew Frontiers'*, **Poul T Kidd,** Amagow Co. UK, ISBN-0-201-63163-6, 1994

2. **''Agile Manufacturing'',** A Gunasekharan, the 21st Century Competitive strategy, ISBN -13 978-0-08-04 3567-1, Elsevier Press, India

REFERENCE BOOKS:

1. **O Levine Transitions to Agile Manufacturing,** Joseph C Moutigomery and Lawrurence – Staying Flexible for competitive advantage, ASQC quality press, Milwaukee. Wisconsiw, USA 1996

2. **Agile Development for Mass Customization,** David M Andeson and B Joseph Pine, Irwin Professional Publishing, Chicogo USa 1997

ROBOTICS

Subject Code	: 10ME766	**IA Marks**	: 25
No. of Lecture Hrs.l Week	: 04	**Exam Hours**	: 03
Total No. of Lecture Hrs.	: 52	**Exam Marks**	: 100

PART - A

UNIT - 1

Introduction and Mathematical Representation of Robots: History of Robots, Types of Robots, Notation, Position and Orientation of a Rigid Body, Some Properties of Rotation Matrices, Successive Rotations, Euler Angles For fixed frames X- Y -Z and moving frame ZYZ. Transformation between coordinate system, Homogeneous coordinates, Properties of A/BT, Types of Joints: Rotary, Prismatic joint, Cylindrical joint, Spherical joint, Representation of Links using Denvit - Hartenberg Parameters: Link parameters for intermediate, first and last links, Link transformation matrices, Transformation matrices of 3R manipulator, PUMA560 manipulator, SCARA manipulator   **07 Hours**

UNIT - 2

Kinematics of Serial Manipulators: Direct kinematics of 2R, 3R, RRP, RPR manipulator, puma560 manipulator, SCARA manipulator, Stanford arm, Inverse kinematics of 2R, 3R manipulator, puma560 manipulator.   **06 Hours**

UNIT - 3

Velocity and Static's of Manipulators: Differential relationships, Jacobian, Differential motions of a frame (translation and rotation), Linear and angular velocity of a rigid body, Linear and angular velocities of links in serial manipulators, 2R, 3R manipulators, Jacobian of serial manipulator, Velocity ellipse of 2R manipulator, Singularities of 2R manipulators, Statics of serial manipulators, Static force and torque analysis of 3R manipulator, Singularity in force domain.   **07 Hours**

UNIT - 4

Dynamics of Manipulators: Kinetic energy, Potential energy, Equation of motion using Lagrangian, Equation of motions of one and two degree freedom spring mass damper systems using Lagrangian formulation, Inertia of a link, Recursive formulation of Dynamics using Newton Euler equation, Equation of motion of 2R manipulator using Lagrangian Newton-Euler formulation.   **06 Hours**

PART-B

UNIT - 5

Trajectory Planning: Joint space schemes, cubic trajectory, Joint space schemes with via points, Cubic trajectory with a via point, Third order polynomial trajectory planning, Linear segments with parabolic blends, Cartesian space schemes, Cartesian straight line and circular motion planning   **07 Hours**

UNIT - 6

Control: Feedback control of a single link manipulator- first order, second order system, PID control, PID control of multi link manipulator, Force control of manipulator, force control of single mass, Partitioning a task for force and position control- lever, peg in hole Hybrid force and position controller.   **08 Hours**

UNIT - 7

Actuators: Types, Characteristics of actuating system: weight, power-to-weight ratio, operating pressure, stiffness vs. compliance, Use of reduction gears, comparision of hydraulic, electric, pneumatic actuators, Hydraulic actuators, proportional feedback control, Electric motors: DC motors, Reversible AC motors, Brushles DC motors, Stepper motors- structure and principle of operation, stepper motor speed-torque characteristics   **06 Hours**

UNIT - 8

Sensors: Sensor characteristics, Position sensors- potentiometers, Encoders, LVDT, Resolvers, Displacement sensor, Velocity sensor-encoders, tachometers, Acceleration sensors, Force and Pressure sensors piezoelectric, force sensing resistor, Torque sensors, Touch and tactile sensor, Proximity sensors-magnetic, optical, ultrasonic, inductive, capacitive, eddy-current proximity sensors.   **05 Hours**

<u>**TEXT BOOKS:**</u>

1. **Fundamental Concepts and Analysis,** Ghosal A., Robotics, Oxford,2006

2. **Introduction to Robotics Analysis, Systems, Applications**, Niku, S. B., Pearso Education, 2008

<u>**REFERENCE BOOKS:**</u>

1. **Introduction to Robotics: Mechanica and Control,** Craig, J. J., 2nd :J?:dition, Addison-Welsey, 1989.

2. **Fundamentals of Robotics, Analysis and Control**, Schilling R. J., PHI, 2006

FINANCIAL MANAGEMENT

Subject Code	:	**10ME767**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1
INTRODUCTION TO FINANCIAL MANAGEMENT: Forms of organization, direct and indirect taxes. Statutory Registration- excise Duty, central sales tax, VAT, service tax, international fund availability.

06 Hours

UNIT - 2
RISK AND REQUIRED RETURN: Risk and return relationship, methods of measuring the risk, Business risk, financial risk, calculation of expected rate of return to the portfolio, numerical problems.

06 Hours

UNIT - 3
WORKING CAPITAL MANAGEMENT: Definition, need and factors influencing the working capital requirement. Determination of operating cycle, cash cycle and operating cycle analysis. Calculation of gross working capital and net working capital requirement.

07 Hours

UNIT - 4
LONG TERM FINANCING: Raising of finance from primary and secondary markets. Valuation of securities, features of convertible securities and warrants. Features of debt, types of debt instruments, return on investment(ROI) and credit rating of units. Shares, debentures.

07 Hours

PART - B

UNIT - 5
INTRODUCTION: Book keeping – systems of book keeping, journal and ledger posting. Financial Statement, Preparation of Trial balance, profit and Loss Account, Balance Sheet with adjustments.

07 Hours

UNIT - 6
RATIO ANALYSIS / ACCOUNTING RATIO: Liquidity ratio – Current ratio, quick ratio, turnover ratio, capital structure ratio- Debt – equity ratio, Coverage ratio, Profitability ratio, Profit margin, Return on assets, Activity ratios – Inventory turnover ratio, Debtors Turnover ratio. Preparation of the balance sheet from various ratios. Analysis of any one published balanced sheet.

07 Hours

UNIT - 7
COSTING: Classification of cost, preparation of cost sheet, absorption and variable costing, job costing, process costing. Classification of the variances analysis – material, labour and overhead variances.

06 Hours

UNIT - 8
BUDGETING: Types of budgets – Flexible budgets, preparation of cash budgets, purchase and production budgets and master budget, Budgetory control, advantages & limitations of budgeting.

06 Hours

TEXT BOOKS:

1. **Financial Management,** Khan & Jain, text & problems TMH ISBN 0-07-460208-A. 20001

2. **Financial Accounting, Costing and Management Accounting,** S. M. Maheshwari, 2000

REFERENCE BOOKS:

1. **Financial Management,** I. M. Pandey, Vikas Publication House ISBN 0-7069-5435-1. 2002

2. **Financial Management,** Abrish Gupta, Pearson.

3. **Financial Decision Making,** Humpton. 2000

4. **Financial Management,** Theory and Practice, Prasanna Chandra TMH ISGN -07-462047-9, 3rd edition 2002

MICRO AND SMART SYSTEMS TECHNOLOGY

Subject Code	:	**10ME768**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1
INTRODUCTION TO MICRO AND SMART SYSTEMS:
a) What are smart-material systems? Evolution of smart materials, structures and systems. Components of a smart system. Application areas. Commercial products.
b) What are microsystems? Feynman's vision. Micromachined transducers. Evolution of micro-manufacturing. Multi-disciplinary aspects. Applications areas. Commercial products.

05 Hours

UNIT - 2
MICRO AND SMART DEVICES AND SYSTEMS: PRINCIPLES AND MATERIALS:
a) Definitions and salient features of sensors, actuators, and systems.
b) Sensors: silicon capacitive accelerometer, piezo-resistive pressure sensor, blood analyzer, conductometric gas sensor, fiber-optic gyroscope and surface-acoustic-wave based wireless strain sensor.
c) Actuators: silicon micro-mirror arrays, piezo-electric based inkjet print-head, electrostatic comb-drive and micromotor, magnetic micro relay, shape-memory-alloy based actuator, electro-thermal actuator
d) Systems: micro gas turbine, portable clinical analyzer, active noise control in a helicopter cabin

08 Hours

UNIT - 3
MICROMANUFACTURING AND MATERIAL PROCESSING:
a) Silicon wafer processing, lithography, thin-film deposition, etching (wet and dry), wafer-bonding, and metallization.
b) Silicon micromachining: surface, bulk, moulding, bonding based process flows.
c) Thick-film processing:
d) Smart material processing:
e) Processing of other materials: ceramics, polymers and metals
f) Emerging trends

07 Hours

UNIT - 4
MODELING:
a) Scaling issues.
b) Elastic deformation and stress analysis of beams and plates. Residual stresses and stress gradients. Thermal loading. Heat transfer issues. Basic fluids issues.
c) Electrostatics. Coupled electromechanics. Electromagnetic actuation. Capillary electro-phoresis. Piezoresistive modeling. Piezoelectric modeling. Magnetostrictive actuators.

06 Hours

PART - B

UNIT - 5
COMPUTER-AIDED SIMULATION AND DESIGN:
Background to the finite element element method. Coupled-domain simulations using Matlab. Commercial software.

08 Hours

UNIT - 6
ELECTRONICS, CIRCUITS AND CONTROL:
Carrier concentrations, semiconductor diodes, transistors, MOSFET amplifiers, operational amplifiers. Basic Op-Amp circuits. Charge-measuring circuits. Examples from microsystems. Transfer function, state-space modeling, stability, PID controllers, and model order reduction. Examples from smart systems and micromachined accelerometer or a thermal cycler.

08 Hours

UNIT - 7
INTEGRATION AND PACKAGING OF MICROELECTRO MECHANICAL SYSTEMS:
Integration of microelectronics and micro devices at wafer and chip levels. Microelectronic packaging: wire and ball bonding, flip-chip. Low-temperature-cofired-ceramic (LTCC) multi-chip-module technology. Microsystem packaging examples.

06 Hours

UNIT - 8
CASE STUDIES:
BEL pressure sensor, thermal cycler for DNA amplification, and active vibration control of a beam.

04 Hours

PART - C

UNIT - 9
Mini-projects and class-demonstrations (not for Examination)

09 Hours

a) CAD lab (coupled field simulation of electrostatic-elastic actuation with fluid effect)
b) BEL pressure sensor
c) Thermal-cycler for PCR
d) Active control of a cantilever beam

TEXT BOOKS AND A CD-SUPPLEMENT:
1. A course-pack with matter taken from the following books including some newly written material. (This is until the textbook is ready. Chapter-wise resource material is indicated below.)
2. **MEMS & Microsystems: Design and Manufacture,** Tai-Ran Tsu, Tata Mc-Graw-Hill.

REFERENCE BOOKS:
1. Animations of working principles, process flows and processing techniques, A CD-supplement with Matlab codes, photographs and movie clips of processing machinery and working devices.
2. **Laboratory hardware kits for** (i) BEL pressure sensor, (ii) thermal-cycler and (iii) active control of a cantilever beam.
3. **Microsystems Design,** S. D. Senturia, 2001, Kluwer Academic Publishers, Boston, USA. ISBN 0-7923-7246-8.
4. **Analysis and Design Principles of MEMS Devices,** Minhang Bao, Elsevier, Amsterdam, The Netherlands, ISBN 0-444-51616-6.
5. **Design and Development Methodologies,** Smart Material Systems and MEMS: V. Varadan, K. J. Vinoy, S. Gopalakrishnan, Wiley.
6. **MEMS**- Nitaigour Premchand Mahalik, TMH 2007

OPERATION MANAGEMENT

Subject Code	:	**10ME81**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART – A

UNIT 1
Production and Operations Management: Introduction, Functions within business organizations, the operation management function, Classification of production systems, Productivity, factors affecting productivity, contemporary issues and development

06 Hours

UNIT 2
Decision Making: The decision process, characteristics of operations decisions, use of models, decision making environments, graphical linear programming, analysis and trade-offs.

06 Hours

UNIT 3
Forecasting: Steps in forecasting process, approaches to forecasting, forecasts based on judgment and opinion, analysis of time series data, accuracy and control of forecasts, choosing a forecasting technique, elements of a good forecast,

07 Hours

UNIT 4
Capacity & Location Planning: Importance of capacity decisions, defining and measuring capacity, determinants of effective capacity, determining capacity requirement, developing capacity alternatives, evaluating alternatives, Need for location decisions, nature of locations decisions, general procedure for making locations decisions, evaluating locations decisions, facilities layout – need for layout decisions, types of processing.

07 Hours

PART – B

UNIT 5
Aggregate Planning & Master Scheduling: Aggregate planning – Nature and scope of aggregate planning, strategies of aggregate planning, techniques for aggregate planning – graphical and charting techniques, mathematical techniques. The master production schedule, Master scheduling process, Master scheduling methods.

08 hours

UNIT 6
Inventory Management: Types of Inventories, independent and dependent demand, reasons for holding inventory, objectives of inventory control, requirements for effective inventory management – information, cost, priority system. Inventory control and economic-order-quantity models.

06 Hours

UNIT 7
Material Requirement Planning (MRP): Dependent versus independent demand, an overview of MRP – MRP inputs and outputs, MRP processing, An overview of MRP-II and ERP capacity requirement planning, benefits and limitations of MRP.

07 Hours

UNIT 8
Purchasing and Supply Chain Management (SCM): Introduction, Importance of purchasing and SCM, The procurement process, Concept of tenders, Approaches to SCM, Vendor development, Measures of purchasing and SCM, Make or buy decision, Types of buying, E-procurement.

06 Hours

TEXT BOOK:

1. **Production and Operations Management**, William J Stevenson, Tata McGraw Hill, 8th Edition.

2. **Operations Management-Theory and Practice**, B Mahadevan, Pearson Education, 2007.

REFERENCES:

1. **Production and Operations Management,** Norman Gaither & Greg Frazier,

2. **Operations Management for Competitive Advantage**, R.B.Chase, N.J.Aquilino, F. Roberts Jacob; McGraw Hill Companies Inc., Ninth Edition.

3. **Production & Operations Management**, Everett E.Adams, Ronald J.Ebert, Prentice Hall of India Publications, Fourth Edition.

4. **Production / Operations Management**, Joseph G Monks, McGraw Hill Books

CONTROL ENGINEERING

Subject Code : 10ME82   **IA Marks** : 25
No. of Lecture Hrs./week : 04   **Exam Hours** : 03
Total No. of Lecture Hrs. : 52   **Exam Marks** : 100

PART - A

UNIT - 1

Introduction: Concept of automatic controls, Open loop and closed loop systems, Concepts of feedback, requirements of an ideal control system, Types of controllers- Proportional, Integral Proportional Integral, Proportional Integral Differential controllers.

07 Hrs

UNIT- 2

Mathematical Models: Transfer function models, models of mechanical systems, models of electrical circuits, DC and AC motors in control systems, models of thermal systems, models of hydraulic systems, pneumatic system, Analogous systems: Force voltage, Force current.

06 Hrs

UNIT - 3

Block Diagrams and Signal Flow Graphs: Transfer Functions definition, function, block representation of systems elements, reduction of block diagrams, Signal flow graphs: Mason's gain formula.

07 Hrs

UNIT- 4

Transient and Steady State Response Analysis: Introduction, first order and second order system response to step, ramp and impulse inputs, concepts of time constant and its importance in speed of response. System stability: Routh's-Hurwitz Criterion.

06 Hrs

PART -B

UNIT - 5

Frequency Response Analysis: Polar plots, Nyquist stability criterion, Stability analysis, Relative stability concepts, Gain margin and phase margin, M&N circles.

06 Hrs

UNIT - 6

Frequency Response Analysis Using Bode Plots: Bode attenuation diagrams, Stability analysis using Bode plots, Simplified Bode Diagrams.

07 Hrs

UNIT - 7

Root Locus Plots: Definition of root loci, General rules for constructing root loci, Analysis using root locus plots.

06 Hrs

UNIT 8

System Compensation and State Variable Characteristics of Linear Systems: Series and feedback compensation, Introduction to state concepts, state equation of linear continuous data system. Matrix representation of state equations, controllability and observability, Kalman and Gilberts test.

07 Hrs

TEXT BOOKS :

1. **Modern Control Engineering,** Katsuhiko Ogatta, Pearson Education,2004.
2. **Control Systems Principles and Design,** M.Gopal, TMH,2000.

REFERENCE BOOKS :

1. **Modern Control Systems**, Richard.C.Dorf and Robert.H.Bishop, Addison Wesley,1999
2. **System dynamics & control**, Eronini-Umez, Thomson Asia pte Ltd. singapore, 2002.
3. **Feedback Control System**, Schaum's series. 2001.

ELECTIVE-II (GROUP - D)

TRIBOLOGY

Subject Code	:	**10ME831**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION TO TRIBIOLOGY: Properties of oils and equation of flow: Viscosity, Newton's Law of viscosity, Hagen-Poiseuille Law, Flow between parallel stationary planes, viscosity measuring apparatus. Lubrication principles, classification of lubricants.

06 Hours

UNIT - 2

HYDRODYNAMIC LUBRICATION: Friction forces and power loss in lightly loaded bearing, Petroff's law, Tower's experiments, idealized full journal bearings.

06 Hours

UNIT - 3

MECHANISM OF PRESSURE DEVELOPMENT IN AN OIL FILM: Reynold's investigations, Reynold's equation in two dimensions. Partial journal bearings, end leakages in journal bearing, numerical problems.

07 Hours

UNIT - 4

SLIDER / PAD BEARING WITH A FIXED AND PIVOTED SHOE: Pressure distribution, Load carrying capacity, coefficient of friction, frictional resistance in a pivoted shoe bearing, influence of end leakage, numerical examples.

07 Hours

PART - B

UNIT - 5

OIL FLOW AND THERMAL EQUILIBRIUM OF JOURNAL BEARING: Oil flow through bearings, self-contained journal bearings, bearings lubricated under pressure, thermal equilibrium of journal bearings.

06 Hours

UNIT - 6

HYDROSTATIC LUBRICATION: Introduction to hydrostatic lubrication, hydrostatic step bearings, load carrying capacity and oil flow through the hydrostatic step bearing.

06 Hours

UNIT - 7

BEARING MATERIALS: Commonly used bearings materials, properties of typical bearing materials. **Wear:** Classification of wear, wear of polymers, wear of ceramic materials, wear measurements, effect of speed, temperature and pressure.

07 Hours

UNIT - 8

BEHAVIOR OF TRIBOLOGICAL COMPONENTS: Selection, friction, Wear of ceramic materials, wear measurements, effects of speed, temperature and pressure. Tribological measures, Material selection, improved design, surface engineering

07 Hours

TEXT BOOKS:

1. **Fundamentals of Tribiology** , Basu S K., Sengupta A N., Ahuja B. B., , PHI 2006
2. **Introduction to Tribiology Bearings,** Mujumdar B. C., S. Chand company pvt. Ltd 2008.

REFERENEC BOOKS:

1. **Theory and Practice of Lubrication for Engineers,** Fuller, D., New York company 1998
2. **Principles and Applications of Tribiology,** Moore, Pergamaon press 1998
3. **Tribiology in Industries,** Srivastava S., S Chand and Company limited, Delhi 2002
4. **Lubrication of bearings – Theoretical Principles and Design,** Redzimovskay E I., Oxford press company 2000

FRACTURE MECHANICS

Subject Code	:	**10ME832**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1
FRACTURE MECHANICS PRINCIPLES: Introduction, Mechanisms of Fracture, a crack in structure, the Griffith's criterion, modern design – strengths, stiffness and toughness. Stress intensity approach

06 Hours

UNIT - 2
STRESS ANALYSIS FOR MEMBERS WITH CRACKS: Linear elastic fracture mechanics, Crack tip stress and deformations, Relation between stress intensity factor and fracture toughness, Stress intensity based solutions. Crack tip plastic zone estimation, Plane stress and plane strain concepts. The Dugdale approach, the thickness effect.

07 Hours

UNIT - 3
ELASTIC – PLASTIC FRACTURE MECHANICS: Introduction, Elasto–plastic factor criteria, crack resistance curve, J-integral, Crack opening displacement, crack tip opening displacement. Importance of R-curve in fracture mechanics, experimental determination of J-integral, COD and CTOD.

07 Hours

UNIT - 4
DYNAMIC AND CRACK ARREST: Introduction, the dynamic stress intensity and elastic energy release rate, crack branching, the principles of crack arrest, the dynamic fracture toughness.

06 Hours

PART - B

UNIT - 5
FATIGUE AND FATIGUE CRACK GROWTH RATE: Fatigue loading, various stages of crack propagation, the load spectrum, approximation of the stress spectrum, the crack growth integration, fatigue crack growth laws.

07 Hours

UNIT - 6
FRACTURE RESISTANCE OF MATERIALS: Fracture criteria, fatigue cracking criteria, effect of alloying and second phase particles, effect of processing and anisotropy, effect of temperature, closure.

06 Hours

UNIT - 7
COMPUTATIONAL FRACTURE MECHANICS: Overview of numerical methods, traditional methods in computational fracture mechanics – stress and displacement marching, elemental crack advance, virtual crack extension, the energy domain integral, finite element implementation. Limitations of numerical fracture analysis.

07 Hours

UNIT - 8
FRACTURE TOUGHNESS TESTING OF METALS: Specimen size requirements, various test procedures, effects of temperature, loading rate and plate thickness on fracture toughness. Fracture testing in shear modes, fatigue testing, NDT methods.

06 Hours

TEXT BOOKS:

1. **Introduction to Fracture Mechanics**, Karen Hellan McGraw Hill Pub.2000
2. **Fracture of Engineering Brittle Materials,** Jayatilake, Applied Science, London. 2001.

REFERENCE BOOKS:

1. **Fracture Mechanics – Fundamentals and Application,** T.L. Anderson, CRC press 1998
2. **Elementary Engineering Fracture Mechanics**, David Broek, Artinus Nijhoff, London 1999.
3. **Fracture and Fatigue Control in Structures**, Rolfe and Barsom, Printice Hall 2000.
4. **Fundamentals of Fracture Mechanics**, Knott, Bureworth 2000.

POWER PLANT ENGINEERING

Subject Code	:			
No. of Lecture Hrs./ Week	: 04	Exam Hours	:	03
Total No. of Lecture Hrs.	: 52	Exam Marks	:	100

UNIT - 1

STEM POWER PLANT: Different types of fuels used for steam generation, Equipment for burning coal in lump form, strokers, different types, Oil burners, Advantages of using pulverized fuel, Equipment for preparation and burning of pulverized coal, unit system and bin system. Pulverised fuel furnaces, cyclone furnace, coal and ashhanding, generation of steam using forced circulation, high and supercritical pressures, A brief account of L. Mont Benson, Velox, Schmidt, Loeffer and ramson steam generator

14Hours

UNIT - 2

CHIMNEYS: Natural, forced, induced and balanced draft, Calculations involving height of chimney to produce a given draft

02Hours

UNIT – 3

Accessories for the steam generator such as super heaters, desuperheater, control of super heaters, Economisers, Air pre-heaters and re- heaters.

02Hours

UNIT - 4

COOLING TOWERS AND PONDS : Different types of towers.

02Hours

UNIT - 5

DIESEL ENGINE PLANT- ENGINES FOR POWER GENERATION: Method of starting diesel engines, Cooling and lubrication system for the diesel engine. Filters, centrifuges, Oil heaters, and exhaust system, Layout of a diesel power plant.

06Hour

UNIT -6

GAS TURBINE POWER PLANT: Advantages and disadvantages of the gas turbine plant, open and closed cycle turbine plants with the accessories

02Hours

UNIT -7

HYDRO-ELECTRIC PLANTS: Storage and pondage, flow duration and mass curves, hydrographs, Low, medium and high held plants, pumped storage plants, penstock, water hammer, surge tanks, gates and valves, power house, general layout. A broef description of some of the important hydel installation in India.

06Hours

UNIT -8

NUCLEAR POWER PLANT: Principles of release of nuclear energy fusion and fission reactions. Nuclear fuels used in the reactors. Multiplication and thermal utilization factors. Elements of the nuclear reactor , Moderator, control rod, fuel rods, coolants. Brief description of reactors of the following types – pressurized water reactor , boiling water reactor sodium graphite reactor, Fast breeder reactor, Homogeneous graphite reactor and gas cooled reactor, Radiation hazards, Shieldings, Radio active waste dis posal

08Hours

UNIT -9

CHOICE OF SITE: For power station, load estimation, load duration curve, load factor, capacity factor, use factor, diversity factor, demand factor effect of variable of variable load an power plant, selection of the number and size of units

06 Hours

UNIT -10

ECONOMIC ANALYSIS OF POWER PLANT: Cost of energy production. Selectio of plant and generating equipment, performance and operating characteristics of power plants, triffs for electrical energy.

04 Hours

TEST BOOKS:

1. **Power Plant Engineering, P.K.Nag. Tata Mc Graw Hill 2ⁿᵈ ed 2001,.**
2. **Power Plant Engineering., Morse F.T. Van Nstrand.1998**

REFERENCE BOOKS:

1. **Water Power Engg., Edition 3, Barrows, TMH, New Delhi. 1998**
2. **Plant Engg. Hand Book, Stanier, McGraw Hill. 1998**
3. **Hydraulic Machines, Jagadish Lal, Metropollitan Co 1996.**
4. **Principles of Energy Conversion, A.W.Culp Jr., McGraw Hill. 1996**
5. **Power Plant Technology, M.M. El-Wakil, McGraw Hill. International. 1994**
6. **Power Station Engg. Economics, Skrotizke and Vopat. 1994**
7. **Power Plant Engineering Domakundawar, Dhanpath Rai sons.2003**

NANOTECHNOLOGY

Subject Code	:	**10ME834**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

AN OVERVIEW OF NANOSCIENCE & NANOTECHNOLOGY – historical background – nature, scope and content of the subject – multidisciplinary aspects – industrial, economic and societal implications.

05 Hours

UNIT - 2

EXPERIMENTAL TECHNIQUES AND METHODS for investigating and manipulating materials in the nano scale – electron microscope – scanning probe microscope – optical and other microscopes – light scattering – x-ray diffraction.

07 Hours

UNIT - 3

FULLERENES – discovery, synthesis and purification – chemistry of fullerenes in the condensed phase – orientational ordering – pressure effects – conductivity and superconductivity – ferromagnetism – optical properties.

Carbon Nanotubes – synthesis and purification – filling of nanotubes – mechanism of growth – electronic structure – transport properties – mechanical and physical properties – applications.

07 Hours

UNIT - 4

SELF-ASSEMBLED MONOLAYERS – monolayers on gold – growth process – phase transitions – patterning monolayers – mixed monolayers – applications.

GAS PHASE CLUSTERS – history of cluster science – formation and growth – detection and analysis – type and properties of clusters – bonding in clusters.

07 Hours

PART - B

UNIT - 5

SEMICONDUCTOR QUANTUM DOTS – synthesis – electronic structure of nanocrystals – how quantum dots are studied – correlation of properties with size – uses.

05 Hours

UNIT - 6

MONOLAYER-PROTECTED METAL NANOPARTICLES – method of preparation– characterization – functionalized metal nanoparticles – applications – superlattices.

CORE-SHELL NANOPARTICLES – types – characterization – properties – applications.

NANOSHELLS – types – characterization – properties – applications.

08 Hours

UNIT - 7

NANOBIOLOGY – interaction between biomolecules and nanoparticle surfaces – materials used for synthesis of hybrid nano-bio assemblies – biological applications – nanoprobes for analytical applications – nanobiotechnology – future perspectives. **Nanosensors** – what make them possible – nanoscale organization for sensors – characterization – nanosensors based on optical properties – nanosensors based on quantum size effects – electrochemical sensors – sensors based on physical properties – nanobiosensors – sensors of the future.

NANOMEDICINES – approach to development – nanotechnology in diagnostic and therapeutic applications.

08 Hours

UNIT - 8
MOLECULAR NANOMACHINES – covalent and non-covalent approaches – molecular motors and machines – other molecular devices – single molecular devices – practical problems involved.
NANOTRIBOLOGY – studying tribology on the nanoscale – applications.

05 Hours

TEXT BOOKS:

1. **NANO: The Essentials – Understanding Nanoscience and Nanotechnology;** T Pradeep (Professor, IIT Madras); Tata McGraw-Hill India (2007)

2. **Nanotechnology:** Richard Booker & Earl Boysen; Wiley (2005).

REFERENCE BOOKS:

1. **Introduction to Nanoscale Science and Technology [Series: Nanostructure Science and Technology],** Di Ventra, et al (Ed); Springer (2004)

2. **Nanotechnology Demystified,** Linda Williams & Wade Adams; McGraw-Hill (2007)

3. **Introduction to Nanotechnology,** Charles P Poole Jr, Frank J Owens, Wiley India Pvt. Ltd., New Delhi, 2007.

ORGANISATIONAL BEHAVIOUR & PROFESSIONAL COMMUNICATION

Subject Code	:	**10ME835**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1
INTRODUCTION: Definition of Organization Behaviour and Historical development, Environmental context (Information Technology and Globalization, Diversity and Ethics, Design and Cultural, Reward Systems).
06 Hours

UNIT - 2
THE INDIVIDUAL: Foundations of individual behaviour, individual differences. Ability. Attitude, Aptitude, interests. Values.
07 Hours

UNIT - 3
LEARNING: Definition, Theories of Learning, Individual Decision Making, classical conditioning, operant conditioning, social learning theory, continuous and intermittent reinforcement.
07 Hours

UNIT - 4
PERCEPTION: Definition, Factors influencing perception, attribution theory, selective perception, projection, stereotyping, Halo effect**.**
07 Hours

PART - B

UNIT - 5
MOTIVATION: Maslow's Hierarchy of Needs theory, Mc-Gregor's theory X and Y, Hertzberg's motivation Hygiene theory, David Mc-Clelland's three needs theory, Victor Vroom's expectancy theory of motivation**.**
06 Hours

UNIT - 6
THE GROUPS: Definition and classification of groups, Factors affecting group formation, stages of group development, Norms, Hawthorne studies, group processes, group tasks, group decision making**.**
06 Hours

UNIT - 7
CONFLICT & STRESS MANAGEMENT: Definition of conflict, functional and dysfunctional conflict, stages of conflict process**.** Sources of stress, fatigue and its impact on productivity. Job satisfaction, job rotation, enrichment, job enlargement and reengineering work process**.**
08 Hours

UNIT - 8
PRINCIPLES OF COMMUNICATION: Useful definitions, communication principles, communication system, role of communication in management, barriers in communication, how to overcome the barriers, rule of effective communication**.**
06 Hours

TEXT BOOKS:

1. **Organizational Behaviour,** Stephen P Robbins, 9th Edition, Pearson Education Publications, ISBN-81-7808-561-5 2002

2. **Organizational Behaviour,** Fred Luthans, 9th Edition, Mc Graw Hill International Edition, ISBN-0-07-120412-12002

REFERENCE BOOKS:

1. **Organizational Behaviour,** Hellriegel, Srocum and Woodman, Thompson Learning, 9th Edition, Prentice Hall India, 2001

2. **Organizational Behaviour,** Aswathappa - Himalaya Publishers. 2001

3. **Organizational Behaviour,** VSP Rao and others, Konark Publishers.2002

4. **Organizational Behaviour,** (Human behaviour at work) 9th Edition, John Newstron/ Keith Davis. 2002

COMPUTER GRAPHICS

Subject Code	:	**10ME836**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

Scan Conversion and Clipping Representation of points, lines, Line Drawing Algorithms: DDA algorithm, Bresenham's integer line algorithm, Bresenham's circle algorithm, mid point line and circle, Polygon filling algorithms: scan conversion, seed filling, scan line algorithm. Viewing transformation, Clipping –points, lines, text, polygon, Cohen-Sutherland line clipping, Sutherland-Hodgmen algorithm.

07 Hours

UNIT - 2

Two Dimensional Transformations Representation of points, Transformations: Rotation, Reflection, Scaling, Combined Transformations, Translations and Homogeneous Coordinates, A geometric interpretation of homogeneous coordinates, Over all scaling, Points at infinity, rotation about an arbitrary point, Reflection through an arbitrary line.

06 Hours

UNIT - 3

Three Dimensional Transformations and Projections 3D Transformation matrix: general matrix, Translation, scaling, Shearing, Rotation, Reflection, Multiple transformations, Rotation about an axis parallel to coordinate axis, Rotation about an arbitrary axis in space, Reflection through an arbitrary plane, Orthographic, Parallel projection Transformations, one, Perspective projections- one point, two point and three point.

06 Hours

UNIT - 4

Plane and Space Curves Curve representation, Nonparametric curves, parametric curves, parametric representation and generation of line, circle, ellipse, parabola, hyperbola, generation of circle, ellipse, parabola, hyperbola, Cubic spline, normalized cubic splines, Bezier curves: blending function, properties, generation, B-spline curves- Cox-deBoor recursive formula,properties,open uniform basis functions, Non-uniform basis functions, periodic B-spline curve.

07 Hours

PART - B

UNIT - 5

Types and Mathematical Representation of Solids, Solid Models, Solid entities, Solid representation, Solid modeling- set theory, regularized set operations, set membership classification, Half spaces, Half spaces of plane, cylinder, sphere, conical half-space, Boundary representation, Constructive Solid Geometry- basic elements, Building operations.

07 Hours

UNIT - 6

VISUAL REALISM-I: Introduction, hidden line removal- visibility of object views, Visibility techniques: minimax test, containment test, surface test, Silhouttes, Homogeneity test, Sorting, Coherence, Hidden line priority algorithm, Hidden surface removal- Z-buffer algorithm, Warnock's algorithm, Hidden solid removal- ray tracing algorithm.

06 Hours

UNIT - 7
VISUAL REALISM-II: Shading, shading models- diffuse reflection, specular reflection, ambient light, Shading surfaces- constant shading, gourmand shading, Phong shading, Shading enhancements, Shading Solids- Ray tracing for CSG, z- buffer algorithm for B-rep and CSG, octree encoded objects, Colouring- RGB, CMY, HSV, HSL colour models.

07 Hours

UNIT - 8
COMPUTER ANIMATION: Introduction, Conventional animation-key frame, Inbetweening, Line testing, Painting, Filming, Computer animation- entertainment and engineering animation, Animation system hardware, software architecture, Animation types- frame buffer, colour table, zoom-pan-scroll, cross bar, real time play back, Animation techniques- key frame, skelton. Path of motion and p-curves.

06 Hours

TEXT BOOKS:

1 **CAD/CAM-Theory and Practice,** Ibraham Zeid, McGraw Hill, 2006

2 **Mathematical Elements for Computer Graphics**, Rogoer's Adams, McGraw Hill. 1990

REFERENCE BOOKS:

1. **Computer Graphics**, Xiang z, Plastock, R. A., Schaums outlines, McGraw Hill. 2007.

2. **Computer Graphics, principles and practice,** .Foley, Van- Damn, Finner and Hughes, Addison Wesley. 2000

3. **Computer Graphics,** Sinha A. N., Udai A. D., Tata McGraw Hill, 2008.

4. **Computer Graphics,** C Version- Doneld Heran, M. Pauline Baker, 2nd Edition, Pearson.

RAPID PROTOTYPING

Subject Code	:	**10ME837**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Need for the compression in product development, history of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems.
STEREO LITHOGRAPHY SYSTEMS: Principle, Process parameter, Process details, Data preparation, data files and machine details, Application.

07 Hours

UNIT - 2

SELECTIVE LASER SINTERING: Type of machine, Principle of operation, process parameters, Data preparation for SLS, Applications.
FUSION DEPOSITION MODELLING: Principle, Process parameter, Path generation, Applications.

07 Hours

UNIT - 3

SOLID GROUND CURING: Principle of operation, Machine details, Applications. Laminated Object Manufacturing: Principle of operation, LOM materials. Process details, application.

06 Hours

UNIT - 4

CONCEPTS MODELERS: Principle, Thermal jet printer, Sander's model market, 3-D printer. Genisys Xs printer HP system 5, object Quadra systems.

06 Hours

PART - B

UNIT - 5

RAPID TOOLING: Indirect Rapid tooling, Silicone rubber tooling, Aluminum filled epoxy tooling, Spray metal tooling, Cast kirksite, 3Q keltool, etc. Direct Rapid Tooling Direct. AIM.

06 Hours

UNIT - 6

RAPID TOOLING: Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft Tooling vs. hard tooling.

06 Hours

UNIT - 7

SOFTWARE FOR RP: STL files, Overview of Solid view, magics, imics, magic communicator, etc. Internet based software, Collaboration tools.

06 Hours

UNIT - 8

RAPID MANUFACTURING PROCESS OPTIMIZATION: factors influencing accuracy. Data preparation errors, Part building errors, Error in finishing, influence of build orientation.

08 Hours

TEXT BOOKS:

1. **Stereo Lithography and other RP & M Technologies,** Paul F. Jacobs: SME, NY 1996.
2. **Rapid Manufacturing,** Flham D.T & Dinjoy S.S Verlog London 2001.

REFERENCE BOOKS:

1. **Rapid Prototyping,** Terry Wohlers Wohler's Report 2000" Wohler's Association 2000.
2. **Rapid Prototyping Materials,** Gurumurthi, IISc Bangalore.
3. **Rapid Automated,** Lament wood. Indus press New York

FOUNDRY TECHNOLOGY

Subject Code	:	**10ME838**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

FOUNDRY METALLURGY: Oxidation of liquid metals, gas dissolution in liquid metals, methods of degassing, fluidity, factors affecting fluidity, fluidity tests, hot tearing, shrinkage of liquid metals.

06 Hours

UNIT - 2

CASTING DESIGN: Introduction to casting design, redesign considerations, design for minimum casting stresses, design for directional solidification, design for metal flow, safety factors, design for low pattern cost and model making as an aid in design.

06 Hours

UNIT - 3

SOLIDIFICATION OF CASTINGS: Crystallization and development of cast structure - nucleation, growth and dendritic growth. Structure of castings - significance and practical control of cast structure, grain shape and orientation, grain size, refinement and modification of cast structure. Concept of progressive and directional solidification, solidification time and derivation of Chvorinov's equation, influence on mold characteristics and cast metal.

07 Hours

UNIT - 4

RISERING AND GATING: Need for risering, general considerations of risering, riser shapes, riser size, and location. Requirements of a riser. Sand, insulating, and exothermic materials used for risers. Riser feeding distance and theory of risering. Internal chills, external chills, use of mould materials of different chill capacities, padding for directional solidification. Open type and blind risers. Riser treatment using exothermic and insulating compounds. Gating system – theoretical consideration of gating, laws of fluid flow, turbulence in gating system, use of ceramic foam filters in gating, need for tapered sprue, gating ratio, simple problems.

07 Hours

PART - B

UNIT - 5

SPECIAL MOULDING TECHNIQUES: Principles, materials used, process details and application of no-bake sand systems, vacuum moulding, flaskless moulding, and high pressure moulding.

CUPOLA MELTING: Developments in cupola melting – hot blast cupola, water cooled cupola, balanced blast cupola, cokeless cupola, cupola charge calculations.

07 Hours

UNIT - 6

FERROUS FOUNDRY: Melting procedures, casting characteristics, production, specification, and properties of some typical steels, grey cast iron, malleable iron, and spheroidal graphite cast iron castings.

07 Hours

UNIT - 7

NON-FERROUS FOUNDRY: Melting procedures, casting characteristics, production, specification, and properties of some typical aluminum, copper, and magnesium based alloy castings.

06 Hours

UNIT - 8
MODERNIZATION AND MECHANIZATION OF FOUNDRY: Need for modernization, and mechanization, moulding and core making, melting, pouring, shake out equipment and fettling, dust and fume control, material handling equipments for sand moulds and cores, molten metal and castings, reclamation of sands. Pollution control – norms, and agencies.

06 Hours

TEXT BOOKS:

1. **Principles of metal casting,** Heine Loper & Rosenthal TMH - 2005

2. **Principle of Foundry Technology**, P. L. Jain, TMH – 2006.

REFERENCE BOOKS:

1. **Castings,** John Campbell, Second edition, Elseivier

2. **Foundry Technology,** P. N. Rao

3. **Manufacturing Process,** I, Dr. K. Radha Krishna 5th Edn. Sapna Book House, Bangalore

ELECTIVE-II (GROUP - E)

MACHINE TOOL DESIGN

Subject Code	:	**10ME841**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

PRINCIPLES OF MACHINE TOOL DESIGN: General requirements of machine tool design - design process machine tool layout general requirements of machine tool design – design process machine tool layout

05 Hours

UNIT - 2

MACHINE TOOL DRIVES AND MECHANISMS: Working and auxiliary motion. Drives- Electric drives, Hydraulic transmission, Kinmatic structure, Regulation of speed and feeds, stepped regulation, standardization of speed and feed, stepless regulation of speeds and feeds.

07 Hours

UNIT - 3

CUTTING FORCE ANALYSIS AND POWER REQUIREMENT: In Turning, Milling, Drilling, Shaping and Broaching operation with simple problems. General requirements of machine tools - Centre lathe, Milling machine.

07 Hours

UNIT - 4

DESIGN OF MACHINE TOOL STRUCTURES: Functions-Requirements-Design criteria Material used – static and dynamic stiffness – Profile and basic design procedure for machine tool structures. Design of beds, columns, housing, bases, tables, cross-rails, arms saddle, carriages.

07 Hours

PART - B

UNIT - 5

DESIGN OF GUIDE WAYS AND POWER SCREWS: Function and types of guide ways – Design and lubrication of slide ways - aerostatic slide ways - antifriction guide ways, combination guide ways - protecting devices, design of power screws.

06 Hours

UNIT - 6

DESIGN OF SPINDLE AND SPINDLE BEARINGS: Functions-Requirements and materials for spindle compliance and machining accuracy. Design of spindles, antifriction bearing, Hydrodynamic and Hydrostatic bearing, Air lubricated bearing.

06 Hours

UNIT - 7

DYNAMICS OF MACHINE TOOLS: Concept of dynamic cutting process, Physical causes of chatter and vibrations, Types of Chatter. Stability chart, chatter vibration in Lathe, Drilling machine, Grinding machine and Milling machine. Different methods for avoiding machine tool chatter and vibration.

07 Hours

UNIT - **8**

CONTROL SYSTEMS IN MACHINE TOOLS: Functions, requirements and classification. Control system for speed and feeds centralized control pre selective control, control system for forming and auxiliary motions –Mechanical control– Ergonomic consideration and compatibility – Automatic control system – Electric Hydraulic and pneumatic systems.

07 Hours

TEXT BOOKS:

1. **Machine Tool Design,** N.K. Mehta Tata McGraw Hill 2001

2. **Principles of Machine Tools,** Sen and Bhattacharaya Oxford IBM Publishing 2000

REFERENCE BOOKS:

1. **Machine Tool Design Volume – II and III,** N. Acharkan MIR Publications 2000

2. **Design of Machine Tools**, S. K. Basu and D. K. Pal 2000

3. **Principles of Machine Tool Design**, Koensberger 1993

INDUSTRIAL ENGINEERING AND ERGONOMICS

Subject Code	:	**10ME842**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

PRODUCTIVITY & WORK STUDY: Definition of productivity, factors affecting productivity, definition, objective & scope of work study, human factors in work study, work study & management, work study & supervisor, work study &worker.

06 Hours

UNIT - 2

METHOD STUDY: Definition, objective & scope, charts to record movements in shop, process charts, flow process charts, Multiple activity charts, two handed process charts, SIMO chart, principles of motion economy.

08 Hours

UNIT - 3

WORK MEASUREMENT: Definition, objectives, techniques of work measurement, work sampling, need of confidence levels, sample size determination, random observation with simple problems

06 Hours

UNIT - 4

TIME STUDY: Definition, time study equipments, selection of jobs, steps in time study, breaking jobs into elements, recording information, rating, standard performance, scales of rating, factors affecting rate of working, allowances, standard time determination.

06 Hours

PART - B

UNIT - 5

INTRODUCTION TO INDUSTRIAL DESIGN: elements of design structure for industrial design in engineering application in modern manufacturing systems.
Ergonomics and Industrial Design: Introduction, general approach to the man-machine relationship, workstation design-working position.

08 Hours

UNIT - 6

VISUAL EFFECTS OF LINE AND FORM: The mechanics of seeing-psychology of seeing general influences of line and form.

06 Hours

UNIT - 7

COLOR MODELS: RGB, CMY, HSV, Color and light, color and objects-color and the eye-color consistency-color terms reactions to color and color continuation-color on engineering equipments.

06 Hours

UNIT - 8

AESTHETIC CONCEPTS: Concept of unity-concept of order with variety-concept of purpose style and environment –Aesthetic expressions. Style –components of style house style, observation style in capital goods, case study.

06 Hours

TEXT BOOKS:

1. **Work study,** ILO, 3rd edition, 2006
2. **Human Factor Engineering**: Sanders & McCormick McGraw Hill Publications.

REFERENCE BOOKS:

1. **Applied Ergonomics Hand Book,** Brain Shakel, Butterworth Scientific, London 1988
2. **Introduction to Ergonomics,** R. C. Bridger, McGraw Hill Publications.
3. **Industrial Design for Engineers,** Mayall W. H. London Hiffee Books Ltd., 1988
4. **Work Study & Ergonomics,** Suresh Dalela & Saurabh, standard publishers & distributors,1999

BIOMASS ENERGY SYSTEMS

Subject Code	:	**10ME843**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1
INTRODUCTION: Biomass energy sources, energy content of various Bio – fuels, Energy plantation, origin of Biomass photo synthesis process, Biomass Characteristics, sustainability of Biomass.

06 Hours

UNIT - 2
BIOMASS CONVERSION METHODS: Agrochemical, Thermochemical, Biochemical (flowchart) & Explanation.

06 Hours

UNIT - 3
PHYSICAL & AGROCHEMICAL CONVERSION: Briquetting, Pelletization, Agrochemical, fuel Extraction, Thermo chemical Conversion: Direct combustion for heat, Domestic cooking & heating.

07 Hours

UNIT - 4
BIOMASS GASIFICATION: Chemical reaction in gasification, Producergas& the constituents, Types of gasifiers. Fixed bed gasifiers, Fluidized bed gasifiers.Liquefaction: Liquefaction through pyrolysis & Methanol synthesis, application of producer gas in I C Engines.

07 Hours

PART - B

UNIT - 5
BIO METHANIZATION: Anaerobic digestion, Basic principles, factors influencing Biogas yield, classification of Biogas digester, floating gasholder & fixed dome type.(Working Principle with diagram), Calculations for sizing the Biogas plant.

06 Hours

UNIT - 6
BIOGAS FOR POWER GENERATION: Ethanol as an automobile fuel, Ethanol production & its use in engines.

06 Hours

UNIT - 7
BIO - DIESEL: Bio Diesel from edible & non-edible oils, Production of Bio diesel from Honge & Jatropha seeds, use of bio diesel in I C engines, Engine power using Bio diesel, Blending of Bio diesel, Performance analysis of diesel engines using bio diesel. Effect of use of bio diesel in I C engines.

07 Hours

UNIT - 8
BIO POWER PLANTS: Bio Power generation routes, Basic Thermodynamic cycles in Bio power generation; Brayton cycle, Sterling cycle, Rankine cycle, Co-generation cycle. Biomass based steam power plant.

07 Hours

TEXT BOOKS:

1. **Bio Gas Technology,** B.T. Nijaguna. New Age International- New Delhi.2001-02
2. **Energy Technology,** S. Rao & B. B. Parulekar – Khanna Publishers, Delhi-1999.
3. **Non Conventional Energy Sources,** G. D. Rai - Khanna Publishers. Delhi.

REFERENCE BOOKS:

1. **Greenhouse Technology for Controlled Environment,** G.N. Tiwari, Alpha Science International Ltd., Pangbourne.England.
2. **Renewable Energy Resources,** John.W.Twidell, Anthony. D. Weir, EC BG-2001.
3. **BioMass, Deglisc. X and P. Magne,** Millennium Enterprise, New Delhi.

AUTOMOTIVE ENGINEERING

Subject Code	:	**10ME844**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

ENGINE COMPONENTS AND COOLING & LUBRICATION SYSTEMS: Spark Ignition (SI) & Compression Ignition (CI) engines, cylinder – arrangements and their relatives merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams, Types of combustion chambers for S.I.Engine and C.I.Engines, Compression ratio, methods of a Swirl generation, choice of materials for different engine components, engine positioning, cooling requirements, methods of cooling, thermostat valves, different lubrication arrangements.

07 Hours

UNIT - 2

FUELS, FUEL SUPPLY SYSTEMS FOR SI AND CI ENGINES: Conventional fuels, alternative fuels, normal and abnormal combustion, cetane and octane numbers, Fuel mixture requirements for SI engines, types of carburetors, C.D.& C.C. carburetors, multi point and single point fuel injection systems, fuel transfer pumps, Fuel filters, fuel injection pumps and injectors.

07 Hours

UNIT - 3

SUPERCHARGERS AND TURBOCHARGERS: Naturally aspirated engines, Forced Induction, Types pf superchargers, Turbocharger construction and operation, Intercooler, Turbocharger lag.

06 Hours

UNIT - 4

IGNITION SYSTEMS: Battery Ignition systems, magneto Ignition system, Transistor assist contacts. Electronic Ignition, Automatic Ignition advance systems.

06 Hours

PART - B

UNIT - 5

POWER TRAINS: General arrangement of clutch, Principle of friction clutches, Torque transmitted, Constructional details, Fluid flywheel, Single plate, multi-plate and centrifugal clutches.

Gear box: Necessity for gear ratios in transmission, synchromesh gear boxes, 3, 4 and 5 speed gear boxes. Free wheeling mechanism, planetary gears systems, over drives, fluid coupling and torque converters, Epicyclic gear box, principle of automatic transmission, calculation of gear ratios, Numerical calculations for torque transmission by clutches.

08 Hours

UNIT - 6

DRIVE TO WHEELS: Propeller shaft and universal joints, Hotchkiss and torque tube drives, differential, rear axle, different arrangements of fixing the wheels to rear axle, steering geometry, camber, king pin inclination, included angle, castor, toe in & toe out, condition for exact steering, steering gears, power steering, general arrangements of links and stub axle, over steer, under steer and neutral steer, numerical problems, types of chassis frames.

06 Hours

UNIT - 7

SUSPENSION, SPRINGS AND BRAKES: Requirements, Torsion bar suspension systems, leaf spring, coil spring, independent suspension for front wheel and rear wheel. Air suspension system.

Types of brakes, mechanical compressed air, vacuum and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, drum brakes, Antilock –Braking systems, purpose and operation of antilock-braking system, ABS Hydraulic Unit, Rear-wheel antilock & Numerical Problems

06 Hours

UNIT - 8

AUTOMOTIVE EMISSION CONTROL SYSTEMS: Automotive emission controls, Controlling crankcase emissions, Controlling evaporative emissions, Cleaning the exhaust gas, Controlling the air-fuel mixture, Controlling the combustion process, Exhaust gas recirculation, Treating the exhaust gas, Air-injection system, Air-aspirator system, Catalytic converter, Emission standards- Euro I, II, III and IV norms, Bharat Stage II, III norms.

6 Hours

TEXT BOOKS:

1. **Automotive mechanics,** William H Crouse & Donald L Anglin, 10th Edition Tata McGraw Hill Publishing Company Ltd., 2007

2. **Automotive Mechanics,** S. Srinivasan, Tata McGraw Hill 2003.

REFERENCE BOOKS:

1. **Automotive mechanics: Principles and Practices**, Joseph Heitner, D Van Nostrand Company, Inc

2. **Fundamentals of Automobile Engineering,** K.K.Ramalingam, Scitech Publications (India) Pvt. Ltd.

3. **Automobile Engineering**, R. B. Gupta, Satya Prakashan, 4th edn. 1984.

4. **Automobile engineering**, Kirpal Singh. Vol I and II 2002.

DATABASE MANAGEMENT SYSTEM

Subject Code	:	**10ME845**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1
DATABASE AND DATABASE USERS: Introduction, characteristics of database approach, intended uses of a DBMS, advantages and implementation of database approach.
06 Hours

UNIT - 2
DATABASE SYSTEMS CONCEPTS AND ARCHITECTURE: Data models, schemes and instances, DBMS architecture and data independence, database languages and interfaces, database system environment, classification of database management systems.
06 Hours

UNIT - 3
DATA MODELING: High level conceptual data models for database design. Entity types, entity sets, attributes and keys, Relationships, relationship types, roles and structural constraints. Weak entity types, ER diagram and design issue.
08 Hours

UNIT - 4
RECORD STORAGE AND PRIMARY FILE ORGANIZATIONS: Secondary storage devices, buffering of the blocks, placing file records on the disk, operations on files, heap files and sorted files, hashing techniques.
06 Hours

PART - B

UNIT - 5
RELATIONAL DATA MODEL AND RELATIONAL ALGEBRA: Brief discussion on code rules, relational model concepts, constraints and schemas. Update operation on relations, basic and additional relational algebra operations, queries in relational algebra.
07 Hours

UNIT - 6
STRUCTURAL QUERY LANGUAGE (SQL): Data definition etc., in SQL2. Basic and complex queries in SQL, Inser, Delete; Update statements, and views in SQKL, embedded SQL.
07 Hours

UNIT - 7
DATABASE DESIGN: Design guidelines for relational schemas, functional dependencies, normalization 1st, 2nd, 3rd, 4th and 5th; normal forms. Database design process, factors influencing physical database design guidelines, and guidelines for relational systems.
07 Hours

UNIT - 8
SYSTEM IMPLEMENTATION: System catalogue for RDBMSs, transaction processing, and system concepts, properties of transaction, brief discussion on concurrency control and recovery techniques, database security and authorization.
05 Hours

TEXT BOOKS:

1. **Fundamentals of Database Systems,** Ramez Elmasri and Shanmkanth B. Navathe, 3rd Edition, Addison Pearson.

2. **Database Management System,** Raghu Ramakrishnan, Tata Mc Graw Hill, 3rd Edn. 2002.

REFERENCE BOOKS:

1. **Database Management and Design,** Gray W.hansen and James V. Hansen, 2nd Edn. Printice Hall India Pvt. Ltd., 2002.

2. **Database Management Systems,** Designing and Building business applications by Gerald V. Post, 3rd Edition, Tata Mc Graw Hill Publishing company Ltd.,- 2005

3. **Project Mangment with PERT and CPM,** Moder Joseph J and Phillips cerel, R., VAN Noserand, Reinhold, 2nd Edn., 1976.

ARTIFICIAL INTELLIGENCE

Subject Code	:	**10ME846**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A
UNIT - 1
ARTIFICIAL INTELLIGENCE: Introduction, definition, underlying assumption, importance f A1, AI and related fields.

06 Hours

UNIT - 2
SPACE REPRESENTATION: Defining a problem. Production systems and its characteristics, Search and Control strategies – Generate and Test, Hill Climbing, Best – first Search, Problem reduction, Constraint Satisfaction, Means – Ends Analysis.

07 Hours

UNIT - 3
KNOWLEDGE REPRESENTATION ISSUES: Representations and Mappings, Types of knowledge – Procedural Vs Declarative, Logic programming. Forward Vs Backward reasoning, Matching.

07 Hours

UNIT - 4
USE OF PREDICATE LOGIC: Representing simple facts, Instance and Isa relationships, Syntax and Semantics for Prepositional logic, FQPL and properties of Wffs, Conversion to Clausal form, Resolution, Natural deduction.

06 Hours

PART - B
UNIT - 5
STATISTICAL AND PROBABILISTIC REASONING: Symbolic reasoning under uncertainty, Probability and Bayes' theorem, Certainity factors and Rule based systems, Bayesian Networks, Shafer Theory, Fuzzy Logic.

07 Hours

UNIT - 6
EXPERT SYSTEMS: Structure and uses, Representing and using domain knowledge, Expert System Shells. Pattern recognition Learning classification patterns, recognizing and understanding speech. Introduction to knowledge Acquisition, Types of Learning.

07 Hours

UNIT - 7
TYPICAL EXPERT SYSTEMS: MYCIN, Variants of MYCIN, PROSPECTOR, DENDRAL, PUFF, ETC.

06 Hours

UNIT - 8
INTRODUCTION TO MACHINE LEARNING: Perceptrons, Checker Playing Examples, Learning Automata, Genetic Algorithms, Intelligent Editors.

06 Hours

TEXT BOOKS:

1. **Artificial Intelligence,** Elaine Rich & Kevin Knight, M/H 1983.
2. **Introduction to AI & ES,** Dan W. Patterson, Prentice Hall of India, 1999.

REFERENCE BOOKS:

1. **Principles of Artificial Intelligence**, Springer Verlag, Berlin, 1981.
2. **Artificial Intelligence in business, Science & Industry**, Wendy B. Ranch
3. **A guide to expert systems,** Waterman, D.A., Addison – Wesley inc. 1986
4. **Building expert systems,** Hayes, Roth, Waterman, D.A. Addison – Wesley, 1983

DESIGN OF EXPERIMENTS

Subject Code	:	**10ME847**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1
INTRODUCTION: Strategy of Experimentation, Typical applications of Experimental design, Basic Principles, Guidelines for Designing Experiments.

05 Hours

UNIT - 2
BASIC STATISTICAL CONCEPTS: Concepts of random variable, probability, density function cumulative distribution function. Sample and population, Measure of Central tendency; Mean median and mode, Measures of Variability, Concept of confidence level. Statistical Distributions: Normal, Log Normal & Weibull distributions. Hypothesis testing, Probability plots, choice of sample size. Illustration through Numerical examples.

07 Hours

UNIT - 3
EXPERIMENTAL DESIGN: Classical Experiments: Factorial Experiments: Terminology: factors, levels, interactions, treatment combination, randomization, Two-level experimental designs for two factors and three factors. Three-level experimental designs for two factors and three factors, Factor effects, Factor interactions, Fractional factorial design, Saturated Designs, Central composite designs. Illustration through Numerical examples.

07 Hours

UNIT - 4
ANALYSIS AND INTERPRETATION METHODS: Measures of variability, Ranking method, Column effect method & Plotting method, Analysis of variance (ANOVA) in Factorial Experiments: YATE's algorithm for ANOVA, Regression analysis, Mathematical models from experimental data. Illustration through Numerical examples.

07 Hours

PART - B

UNIT - 5
QUALITY BY EXPERIMENTAL DESIGN: Quality, Western and Taguchi's quality philosophy, elements of cost, Noise factors causes of variation. Quadratic loss function & variations of quadratic loss function. Robust Design: Steps in Robust Design: Parameter design and Tolerance Design. Reliability Improvement through experiments, Illustration through Numerical examples.

06 Hours

UNIT - 6
EXPERIMENT DESIGN USING TAGUCHI'S ORTHOGONAL ARRAYS: Types of Orthogonal Arrays, selection of standard orthogonal arrays, Linear graphs and Interaction assignment, Dummy level Technique, Compound factor method, Modification of linear graphs. Illustration through Numerical examples.

08 Hours

UNIT - 7
SIGNAL TO NOISE RATIO: Evaluation of sensitivity to noise. Signal to Noise ratios for static problems: Smaller-the-better type, Nominal-the –better-type, Larger-the-better type. Signal to Noise ratios for Dynamic problems. Illustration through Numerical examples.

06 Hours

UNIT - 8
PARAMETER AND TOLERANCE DESIGN: Parameter and tolerance design concepts, Taguchi's inner and outer arrays, parameter design strategy, tolerance design strategy. Illustration through Numerical examples.

06 Hours

TEXT BOOKS:

1. **Design and Analysis of Experiments,** Douglas C. Montgomery, 5th Edition Wiley India Pvt. Ltd. 2007

2. **Quality Engineering using Robust Design,** Madhav S. Phadke, Prentice Hall PTR, Englewood Cliffs, New Jersy 07632, 1989.

REFERENCE BOOK:

1. **Quality by Experimental Design,** Thomas B. Barker, Marcel Dekker, Inc ASQC Quality Press.1985.

2. **Experiments Planning, analysis, and parameter Design optimization,** C.F. Jeff Wu Michael Hamada, John Wiley Editions. 2002.

3. **Reliability Improvement by Experiments,** W.L. Condra, Marcel Dekker, Inc ASQC Quality Press.1985.

4. **Taguchi Techniques for Quality Engineering,** Phillip J. Ross, 2nd Edn. McGraw Hill International Editions, 1996.

DESIGN FOR MANUFACTURING AND ASSEMBLY

Subject Code	:	**10ME848**	IA Marks	: 25
No. of Lecture Hrs./ Week	:	04	Exam Hours	: 03
Total No. of Lecture Hrs.	:	52	Exam Marks	: 100

PART - A

UNIT-1

TOLERANCES, LIMITS & FITS: General Tolerances, Tolerance grades, Limits fundamental deviation, Fits, Tolerance Accumulation cumulative effect of tolerances in assembly. Relationship between attainable tolerance grades and different machining processes.

06 Hours

UNIT-2

GEOMETRIC TOLERANCES: Geometrical characteristics and symbols. Definition and Measurement of circularity, cylindricity, flatness and runout. True position tolerance.

Surface Roughness : Terminology, Terms used for surface roughness, measurement of surface roughness. Surface roughness values obtained from various machining processes.

08 Hours

UNIT-3

CUMULATIVE EFFECT OF TOLERANCES: sure fit law and truncated normal law. Selective assembly and interchangeable part manufacture, Control of axial play by introducing secondary machining processes and by adding laminated shims.

06 Hours

UNIT-4

STASTICAL QUALITY CONTROL: Frequency distribution, standard deviation concept of skewness & Kurtosh variance, Process capability, Indices C_p and C_{pk} control charts.

06 Hours

PART - B

UNIT-5

COMPONENT DESIGN FROM CASTING CONSIDERATIONS: Pattern, Mould, Parting line, cored holes and machined holes, Design for reducting/eliminating sand cores.

06 Hours

UNIT-6

COMPONENT DESIGN FROM MACHINING CONSIDERATION: Design considerations for turning, drilling, tapping, milling and grinding operations, provisions for clamping, Reduction in machining area, simplification by separation and amalgamation, Use of productive machines.

06 Hours

UNIT-7

DESIGN CONSIDERATIONS: Major Design Phases. Design for Manufacturability consideration. Influence of Fabrication properties (Machinability, Castability, Weldability, Polymer processing).

07 Hours

UNIT-8

SELECTION OF MATERIALS IN DESIGN: Properties of Materials used in design. Material selection process – cost per unit property, weighted properties and limits on properties methods.

07 Hours

TEXT BOOKS:

1. **Design for Manufacture,** Harry Peck,Pitman Publications,1983.

2. **Engineering Metrology,** R.K. Jain Khanna Publishers,2000.

REFERENCE BOOKS:

1. **ASM Handbook,vol.20.** Material selection & Design.

2. **Design for Manufacturability Handbook,** Jamesh G. Baralla, Editor, Mcgraw Hill 1998.

3. **Product Design for Manufacture and Assembly,** Geoffery Boothroyed et al 'Mercel Dekker Inc. New York.

4. **Engineering Design: A Materials and Processing Approach,** Geaorge. E. Dieter, Mcgraw Hill, 1991.