Course Code: **TME 701** L T P C
Course Name: **INDUSTRIAL AUTOMATION** **3 0 0 3**

**UNIT 1:**

INTRODUCTION: Production System Facilities, Manufacturing Support systems, Automation in Production systems, Automation principles & Strategies
MANUFACTURING OPERATIONS: Manufacturing Operations, Product/Production Relationship, Production concepts and Mathematical Models & Costs of Manufacturing Operations 8 Hours

**UNIT 2**

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.
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. 9 Hours

**UNIT 3**

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.
QUALITY CONTROL SYSTEMS: Traditional and Modern Quality Control Methods, Taguchi Methods in Quality Engineering. Introduction to SQC Tools. 9 Hours

**UNIT 4**

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 8 Hours

**UNIT 5**

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. 8 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

Course Code: **TME 702** L T P C
Course Name: **COMPUTER AIDED DESIGN & MANUFACTURING(CAD/CAM)** **3 0 0 3**

**UNIT 1**

Fundamentals of CAD: Introduction: Design Process: Application of computers in Design: Creating manufacturing database: benefits of CAD. Computer Hardware; Graphic input devices; display devices; Graphics output devices; Central processing unit (CPU)
CAD software and Database: Software configuration of a graphics system: functions of a graphics package: geometric modeling: Database structure and control; Graphics standard: GKS and IGES. Geometric Transformations: Mathematics preliminaries, matrix representation of 2 and 3 dimensional transformation: Concatenation of transformation matrices. 8Hours

**UNIT 2**

Representation of curves and surfaces: Polygon, meshed and ruled surfaces:Bezier curves; B-spline curves. Geometric Modeling: Wireframe model: solid modeling: representation, volumetric properties, surface modeling. 8 Hours

**UNIT 3**

Group Technology (GT): Part families; part classification ,Group technology machine cells: Advantages of GT.Computer Aided Process Planning: Introduction and benefits of CAPP. Types of CAPP system, Flexible Manufacturing System (FMS) its advantages, components of a FMS system. 8 Hours

**UNIT 4**

Introduction to Automation and need and future of NC systems and CAM. Advantages &disadvantages. Classification. Open and closed loop systems. Historical development and future trends. Difference between ordinary and NC machine tools. Methods for improving Accuracy and Productivity. 8 Hours

**UNIT 5**

NC Part Programming- (a) Manual (word address format) programming. Examples Drilling Robotics- NC machine vs Robots. Types and generations of Robots. Robot applications. Economics, Introduction to Artificial Intelligence for Intelligent manufacturing. 8 Hours

**TEXT BOOKS :**


1. Computer control of Manufacturing systems by Koren
2. Robots by Koren
3. NC Machines by Koren
4. CAD/CAM by Groover.
5. NC Machine Tools by S.J. Martin.
6. CAD/CAM by Groover & Simmers, Prentice Hall of India
7 Automation, Production Systems and computer integrated manufacturing by Groover, Prentice Hall of India
8. CAD/CAM by P N RAO,TMH Pub.


**REFERENCE BOOKS :**


1. NC Machine Tools by S.J. Martin.
2. NC Machines by Koren
3. Automation, Production Systems and Computer Integrated Manufacturing by Mikell , P.Groover

Course Code: **TME 703** L T P C
Course Name: **MODELING & FINITE ELEMENT ANALYSIS** **3 0 0 3**

**UNIT-1**

Introduction: Equilibrium equations in elasticity subjected to body force, traction forces, and stress-strain relations for plane stress and plane strains. General description of Finite Element Method, Application and limitations. Types of elements based on geometry. Node numbering, Half band width. 8 Hours

**UNIT-2**

Basic Procedure: Euler - Lagrange equation for bar, beam (cantilever / simply supported fixed) Principle of virtual work, principle of minimum potential energy, Raleigh's Ritz method. Direct approach for stiffness matrix formulation of bar element. Galerkin's method. 8 Hours

**UNIT-3**

Interpolation Models: Interpolation polynomials- Linear, quadratic and cubic. Simplex complex and multiplex elements. 2D PASCAL's triangle. CST elements-Shape functions and Nodal load vector, Strain displacement matrix and Jacobian for triangular and rectangular element. Solution of 1-D Bars: Solutions of bars and stepped bars for displacements, reactions and stresses by using penalty approach and elimination approach. Guass elimination technique.
8 Hours

**UNIT-4**

Higher Order Elements: Langrange's interpolation, Higher order one dimensional elements- Quadratic and cubic element and their shape functions. Shape function of 2-D quadrilateral element-linear, quadric element Iso-parametric, Sub parametric and Super parametric elements. numerical integration : 1, 2 and 3 gauge point for 1D and 2D cases.
Trusses: Stiffness matrix of Truss element. Numerical problems.
Beams: Hermite shape functions for beam element, Derivation of stiffness matrix. Numerical problems of beams carrying concentrated, UDL and linearly varying loads. 9 Hours

**UNIT-5**

Second order differential equation in one dimension, Axisymmetric problems, weak form and finite element model, Linear elastic spring, Torsion of Circular shaft, Electrical resistor circuit, Flow through pipes, heat transfer, Governing equation, Finite element model, Numerical examples. 8 Hours

**TEXT BOOKS:**

1. The Finite Element Method O.C. Zienkiewicz and R.L. Taylor McGraw Hill
2. An Introduction to Finite Element Method J. N. Reddy McGraw Hill
3. Finite Element Procedure in Engineering Analysis K.J. Bathe McGraw Hill

**REFERNCE BOOKS :**

4. Finite Element Analysis C.S. Krishnamoorthy Tata McGraw Hill
5. Concepts and Application of Finite Element Analysis R.D. Cook, D.S. Malcus and M.E. Plesha John
6. Introduction to Finite Elements in Engineering T.R Chandragupta and A.D. Belegundu Prentice Hall
7. Finite Element and Approximation O.C. Zenkiewicy & Morgan -
8. Numerical Methods E Balagurusamy Tata McGraw Hill

Course Code: **TME 704** L T P C
Course Name: O**PERATIONS RESEARCH & OPTIMIZATION TECHNIQUES** **3 0 0 3**

**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.

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. 8 Hours

**UNIT 2**

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.

8 Hours

**UNIT 3**

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.

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.

10 Hours

**UNIT 4**

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.

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.

9 Hours

**UNIT 5**

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.

6 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**


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

Course Code: **TME 711 (ELECTIVE –I)** L T P C
Course Name: **OPTIMIZATION TECHNIQUES IN ENGINEERING** **3 0 0 3**

**UNIT 1**
UNCONSTRAINED OPTIMIZATION: Optimizing Single-Variable Functions, conditions for Local Minimum and Maximum, Optimizing Multi-Variable Functions. 5 Hours

**UNIT 2**
CONSTRAINED OPTIMIZATION: Optimizing Multivariable Functions with Equality Constraint: Direct Search Method, Lagrange Multipliers Method, Constrained Multivariable Optimization with inequality constrained: Kuhn-Tucker Necessary conditions, Kuhn Tucker Sufficient Conditions. 9 Hours

**UNIT 3**
OPTIMIZATION: Quasi-Newton Methods and line search, least squares optimization, Gauss-Newton, Levenberg- Marquartd, Extensions of LP to Mixed Integer Linear Programming (MILP), Non-Liner Programming, The Newton Algorithm, Non-Linear Least Squares, Sequential Quadratics Programming (SQP), Constrained Optimization, SQP Implementation, Multi-Objective Optimization, Branch and Bound Approaches, Genetic Algorithms and Genetic Programming, Singular Based Optimization, On-Line Real-Time Optimization, Optimization in Econometrics Approaches – Blue. 10 Hours

**UNIT 4**
OPTIMIZATION AND FUNCTIONS OF A COMPLEX VARIABLE AND NUMERICAL ANALYSIS: The Finite Difference Method for Poisson's Equation in two Dimensions and for the Transient Heat Equation, Eulers Method, The Modified Euler Method and the Runga-Kutta Method for Ordinary Differential Equations, Gaussian Quardative Tranzoidal Rule and Simpson's 1/3 and 3/8 Rules, the Newton Raphson in one and two Dimensions, Jacobi's Iteration Method.
9 Hours

**UNIT 5**
OPTIMIZATION IN OPERATION RESEARCH: Dynamic Programming, Transportation – Linear Optimization Simplex and Hitchcock Algorithms, Algorithms, Minimax and Maximum Algorithm, Discrete Simulation, Integer Programming – Cutting Plane Methods, Separable Programming, Stochastic Programming, Goal Programming, Integer Linear Programming, Pure and Mixed Strategy in theory of Games, Trans shipment Problems, Heuristic Methods.
9 Hours

**TEXT BOOKS :** .
1. Winston W L: Operations Research: Applications and Algorithms
2. Rao S.S., Optimization: Theory and Applications.
3. Walsh G R: M methods of Optimization.

**REFERENCE BOOKS :**
4. Williams H.P.: Model Building in Mathematics Programming.
5. Williams H.P.: Model Solving in Mathematics Programming
7. R.G. Parker and R.L. Rarding Discrete Optimization.

Course Code: **TME 712 (ELECTIVE –I)** L T P C
Course Name: **RELIABILITY ENGINEERING** **3 0 0 3**

**UNIT 1**
INTRODUCTION: Definition of reliability, types of failures, definition and factors influencing system effectiveness, various parameters of system effectiveness. 8 Hours

**UNIT 2.**
RELIABILITY MATHEMATICS: Definition of probability, laws of probability, conditional probability, Bay's theorem; various distributions; data collection, recovery of data, data analysis Procedures, empirical reliability calculations. 9 Hours

**UNIT 3**
RELIABILITY: Types of system- series, parallel, series parallel, stand by and complex; development of logic diagram, methods of reliability evaluation; cut set and tieset methods, matrix methods event trees and fault trees methods, reliability evaluation using probability distributions, Markov method, frequency and duration method. 9 Hours

**UNIT 4**
RELIABILITY IMPROVEMENTS: Methods of reliability improvement, component redundancy, system redundancy, types of redundancies-series, parallel, series - parallel, stand by and hybrid, effect of maintenance. 8 Hours

**UNIT 5**
RELIABILITY TESTING: Life testing, requirements, methods, test planning, data reporting system, data reduction and analysis, reliability test standards. 8 Hours

**TEXT BOOKS :**

1. R.Billintan & R.N. Allan,"Reliability Evaluation of Engineering and Systems", Plenum Press.
2. K.C. Kapoor & L.R. Lamberson,"Reliability in Engineering and Design", John Wiely and Sons.

**REFERNCE BOOKS :**

3. S.K. Sinha & B.K. Kale,"Life Testing and Reliability Estimation", Wiely Eastern Ltd.
4. M.L. Shooman, "Probabilistic Reliability, An Engineering Approach", McGraw Hill.
5. G.H.Sandler,"System Reliability Engineering", Prentice Hall.

Course Code: **TME 713 (ELECTIVE –I)** L T P C
Course Name: **NON-CONVENTIONAL ENERGY RESOURCES & UTILIZATION** **3 0 0 3**

**UNIT 1**

ENERGY RESOURCES AND THEIR UTILIZATION : Indian and global energy sources, Energy exploited, Energy planning, Energy parameters (energy intensity, energy-GDP elasticity), Introduction to various sources of energy, Solar thermal, Water power, Wind energy, Biomass, Ocean thermal, Tidal and wave energy, Geothermal energy, Hydrogen energy systems.

SOLAR RADIATIONS: Extra terrestrial radiation, Spectral distribution, Solar constant, Solar radiations on earth, Measurement of solar radiations, Solar radiation geometry, Flux on a plane surface, Latitude, Declination angle, Solar radation data for India. 7 Hours

**UNIT 2**

SOLAR ENERGY: Solar thermal power and it's conversion, Solar collectors, Flat plate, Performance analysis of flat plate collector, Solar concentrating collectors, Types of concentrating collectors, Thermodynamic limits to concentration, Cylindrical collectors, Thermal analysis of solar collectors, Tracking CPC and solar swing . Solar thermal energy storage, Different systems, Solar pond. Applications, Water heating, Space heating & cooling, Solar distillation, solar pumping, solar cooking, Greenhouses, Solar power plants.

SOLAR PHOTOVOLTAIC SYSTEM: Photovoltaic effect, Efficiency of solar cells, Semiconductor materials for solar cells, Solar photovoltaic system, Standards of solar photovoltaic system, Applications of PV system, PV hybrid system. 7 Hours

**UNIT 3**

BIO GAS: Photosynthesis, Bio gas production Aerobic and anaerobic bio-conversion process, Raw materials, Properties of bio gas, Producer gas, Transportation of bio gas, bio gas plant technology & status, Community biogas plants, Problems involved in bio gas production, Bio gas applications, Biomass conversion techniques, Biomass gasification, Energy recovery from urban waste, Power generation from liquid waste, Biomass cogeneration, Energy plantation, Fuel properties, Biomass resource development in India.

WIND ENERGY: Properties of wind, Availability of wind energy in India, wind velocity, Wind machine fundamentals, Types of wind machines and their characteristics, Horizontal and Vertical axis wind mills, Elementary design principles, Coefficient of performance of a wind mill rotor,Selection of a wind mill, Wind energy farms, Economic issues, Recent development.

9 Hours

**UNIT 4**

ELECTROCHEMICAL EFFECTS AND FUEL CELLS: Principle of operation of an acidic fuel cell, Reusable cells, Ideal fuel cells, Other types of fuel cells, Comparison between acidic and alkaline hydrogen-oxygen fuel cells Efficiency and EMF of fuel cells, Operating characteristics of fuel cells, Advantages of fuel cell power plants, Future potential of fuel cells .

TIDAL POWER: Tides and waves as sources of energy, Fundamentals of tidal power, Use of tidal energy Limitations of tidal energy conversion systems.

HYDROGEN ENERGY: Properties of hydrogen in respect of it's use as source of renewable energy, Sources of hydrogen, Production of hydrogen, Storage and transportation, Problems with hydrogen as fuel, Development of hydrogen cartridge, Economics of hydrogen fuel and its use. 10 Hours

**UNIT 5**

THERMOELECTRIC SYSTEMS: Kelvin relations, power generation, Properties of thermoelectric materials, Fusion Plasma generators.

GEOTHERMAL ENERGY: Structure of earth’s interior, Geothermal sites, earthquakes & volcanoes, Geothermal resources, Hot springs, Steam ejection, Principal of working, Types of

geothermal station with schematic representation, Site selection for geothermal power plants. Advanced concepts, Problems associated with geothermal conversion.
OCEAN ENERGY; Principle of ocean thermal energy conversion, Wave energy conversion machines, Power plants based on ocean energy, Problems associated with ocean thermal energy conversion systems. Impact of renewable energy generation on environment, Kyoto Protocol, Cost of electricity production from different energy sources, Energy options for Indian economy. 9 Hours

**TEXT BOOKS**:

1. Bansal Keemann, Meliss," Renewable energy sources and conversion technology", Tata Mc
   Graw Hill.
2. Kothari D.P., “Renewable energy resources and emerging technologies”, Prentice Hall of India Pvt. Ltd.

**REFERENCE:**

3. Rai G.D, "Non-Conventional energy Sources", Khanna Publishers.
4. Ashok V. Desai, "Nonconventional Energy", New Age International Publishers Ltd.

Course Code: **PME-711** L T P C
Course Name: **AUTOMATION & FMS LAB** **0 0 3 2**

## 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

(Programming & 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.

Course Code: **PME 712** L T P C
Course Name: **PROJECT PHASE I** **0 0 3 2**

STUDENTS ARE ADVISED TO INITIATE THE PROJECT WORK , ON ANY TOPIC RELATED TO MECHANICAL ENGINEERING OR RELAVENT FIELD. TOPICS CAN BE DISCUSSED WITH THE GUIDES AND IN LAST MONTH OF THE SEMESTER, THEY ARE REQUIRED TO SUBMIT A SYNOPSIS TO THE RESPECTIVE GUIDES, WITH A POWER POINT PRESENTATION OF THEIR WORK PLAN.

Course Code: **PME 713** L T P C
Course Name: **SEMINAR ON INDUSTRIAL TRAINING** **0 0 3 2**

STUDENTS ARE REQUIRED TO SUBMIT A POWER POINT PRESENTATION ON THEIR INDUSTRIAL TRAINING, MENTIONING THE MACHINES USED, TECHNOLOGY LEARNT & PROCESS ADOPTED BY THE CONCERNED INDUSTRY FOR A PARTICULAR PRODUCT MANUFACTURING.

Course Code: **TME 801** L T P C
Course Name: **AUTOMOBILE ENGINEERING** **3 0 0 3**

**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. 6 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

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

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

FUEL SUPPLY SYSTEM: Diesel & Petrol vehicle system such as Fuel Injection Pump, Injector & Fuel Pump, Carburettor etc. MPFI. 10 Hours

**UNIT 3**

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. 10 Hours

**UNIT 4**

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.

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 11 Hours

**UNIT - 5**

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. 5 Hours

**TEXT BOOKS :**

1. Automotive Engineering- Hietner
2. Automobile Engineering - Kripal Singh.

**REFERNEC BOOKS** :

3. Automobile Engineering - Narang.
4. Automobile Engineering - Newton and Steeds.

Course Code: **TME 802** L T P C
Course Name: **POWER PLANT ENGINEERING** **3 0 0 3**

**UNIT 1**

INTRODUCTION: Power and energy, sources of energy, review of thermodynamic cycles related to power plants, fuels and combustion, calculations. Variable Load problem Industrial production and power generation compared, ideal and realized load curves, terms and factors. Effect of variable load on power plant operation, methods of meeting the variable load problem. Power plant economics and selection Effect of plant type on costs, rates, fixed elements, energy elements, customer elements and investor's profit; depreciation and replacement, theory of rates. Economics of plant selection, other considerations in plant selection. 9 Hours

**UNIT 2**

STEAM POWER PLANT: Power plant boilers including critical and super critical boilers. Fluidized bed
boilers, boilers mountings and accessories. General layout of steam power plant. Different systems such as fuel handling system, pulverizes and coal burners, combustion system, draft, ash handling system, feed water treatment and condenser and cooling system, turbine auxiliary systems such as governing, feed heating, boiler-heating , flange heating and gland leakage. Operation and maintenance of steam power plant, heat balance and efficiency. 9 Hours

**UNIT-3**

DIESEL POWER PLANT: General layout, performance of diesel engine, fuel system, lubrication system, air intake and admission system, supercharging system, exhaust system, diesel plant operation and efficiency, heat balance. Gas turbine power plant: Elements of gas turbine power plants, Gas turbine fuels, cogeneration, auxiliary systems such as fuel, controls and lubrication, operation and maintenance, combined cycle power plants. 8 Hours

**UNIT-4**

NUCLEAR POWER PLANT: Principles of nuclear energy, basic components of nuclear reactions, nuclear power station.
Hydro electric station: Principles of working, applications, site selection, classification and arrangements, hydroelectric plants, run off size of plant and choice of units, operation and maintenance, hydro systems, interconnected systems. 8 Hours

**UNIT-5**

NUCLEAR FUELS IN FISSION AND FUSION REACTORS, Types of nuclear reactors, Fissile and fertile materials, Neutron chain reaction in fission reactors, Neutron flux, Concept of criticality for bare homogeneous reactors, Coolants, moderators, Control and structural materials. Heat generations and steady state temperature distribution in fuel elements, Heat removal. 7 Hours

**TEXT BOOKS:**

1. Nuclear Reactor Engineering By S. Glastone and A . Sesonske.
2. Basic Nuclear Engineering, by K.S. Ram.
3. Introduction to Nuclear Engineering, by J.R lamarsh.
4. Power Plant Enginereing, F.T. Morse, Affiliated East-WstePress Pvt. Ltd, New Delhi/Madras.
5. Power Plant Engineering, Mahesh Verma, Metropolitan Book Company Pvt. Ltd. New Delhi.
6. Power Plant Engineering by P.K. Nag, Tata McGraw Hill.

**REFERENCE BOOKS:**

1. Steam & Gas Turbines & Power Plant Engineering by R.Yadav, Central Pub.House.
2. Power Plant Technology, El-Vakil, McGraw Hill.

Course Code: **TME 811 (ELECTIVE II)** L T P C
Course Name: **VALUE ENGINEERING** **3 0 0 3**

**UNIT 1**
AN OVERVIEW: Definition, value engineering recommendations, programmes, advantages. Approach of function: Evaluation of function, determining function, classifying function, evaluation of costs, evaluation of worth, determining worth, evaluation of value. 8 Hours

**UNIT 2**
VE JOB PLAN: Introduction, orientation, information phase, speculation phase, analysis phase. Selection of Evaluation of VE Projects; Projects selection, Methods selection, value standards, application of VE methodology. 8 Hours

**UNIT 3**
VERSATILITY OF VE: VE operation in maintenance and repair activities, value engineering in non hardware projects. 8 Hours

**UNIT 4**
Initiating A VE Programme Introduction, training plan, career development for VE specialities. Fast Diagramming Cost models, life cycle costs. 9 Hours

**UNIT 5**
VE LEVEL OF EFFORT: VE team, Co-ordinator, designer, different services, definitions, construction management contracts, value engineering case studies. 8 Hours

**TEXT BOOKS :**
1. Tufty Herald, G., "Compendium on Value Engineering" The Indo American Society, First Edition, 1983.
2. Miles, L.D., "Techniques of Value Engineering and Analysis:, McGraw Hill second Edition, 1972.

**REFERNCE BOOKS :**
1. Khanna, O.P., Industrial Engineering and Management", Dhanpat Rai & Sons, 1993.

Course Code: **TME 812(ELECTIVE II)** L T P C
Course Name: **ADVANCED WELDING TECHNOLOGY** **3 0 0 3**

**UNIT 1**

INTRODUCTION : Importance and application of welding, classification of welding process. Selection of welding process.

BRIEF REVIEW OF CONVENTIONAL WELDING PROCESS : Gas welding, Arc welding, MIG, TIG welding. Resistance welding. Electroslag welding, Friction welding etc. Welding of MS.CI, Al, Stainless steel & Maurer/Schaefflar Diagram. Soldering & Brazing. 9 Hours

**UNIT 2**

ADVANCED WELDING TECHNIQUES- Principle and working and application of advanced welding techniques such as Plasma Arc welding, Laser beam welding, Electron beam welding, Ultrasonic welding etc. 8 Hours

**UNIT 3**

ADVANCED WELDING TECHNIQUES (CONTINUED) : Principle and working and application of advanced welding techniques such as explosive welding/ cladding, Underwater welding, Spray-welding / Metalizing, Hard facing. 8 Hours

**UNIT 4**

WELD DESIGN : Welding machines/equipments and its characteristics and arc-stability, Weld defects and distortion and its remedies, Inspection/testing of welds, Weld Design, Welding of pipe-lines and pressure vessels. Life predication. 8 Hours

**UNIT 5**

THERMAL AND METALLURGICAL CONSIDERATION: Thermal considerations for welding, temperature distribution, Analytical/Empirical analysis/formulae, heating & cooling curves. Metallurgical consideration of weld, HAZ and Parent metal, micro & macro structure. Solidification of weld and properties. 9 Hours

**TEXT BOOKS :**

1. “Welding technology “ by Little

**REFENCE BOOKS :**

1. Welding Hand Book

Course Code: **TME 813 (ELECTIVE II)** L T P C
Course Name: **MECHANICAL VIBRATIONS** **3 0 0 3**

**UNIT 1**

Introduction Periodic motion, harmonic motion, superposition of simple harmonic motions, beats, Fourier analysis

Single Degree Freedom System Free vibration, Natural frequency, Equivalent systems, Energy method for determining natural frequency, response to an initial disturbance, Torsional vibrations, Damped vibrations, Vibrations of systems with viscous damping, Logarithmic decrement 9 Hours

**UNIT 2**

Single Degree Freedom: Forced Vibration: Forced vibration, Harmonic excitation with viscous damping, steady state vibrations, Forced vibrations with rotating and reciprocating unbalance, Support excitation, Vibration isolation, Transmissibility, Vibration measuring instruments, Displacement, velocity and acceleration measuring instruments 8 Hours

**UNIT 3**

Two Degree Freedom systems: Introduction, Principal modes, Double pendulum, Torsional system with damping, coupled system, un damped dynamic vibration absorbers, Centrifugal pendulum absorbers, Dry friction damper 6 Hours

**UNIT 4**

Multi Degree Freedom system: Exact Analysis: Undamped free and forced vibrations of multi-degree freedom systems, influence number, Reciprocal theorem, Torsional vibration of multi-degree rotor system, Vibration of gear system, Principal coordinates, Continuous systems-Longitudinal vibrations of bars, Torsional vibrations of circular shafts 10 Hours

**UNIT 5**

Multi Degree Freedom system: Numerical Analysis: Rayleigh's, Dunkerely's, Holzer's and Stodola methods, Rayleigh-Ritz method

CRITICAL SPEED OF SHAFTS Shaft with one disc with and without damping, Multi-disc shafts, Secondary critical speed. 8 Hours

**TEXT BOOKS :**

1. Mechanical Vibrations – P. Srinivasan, TMH

2. Mechanical Vibrations – G. K. Groover, Jain Brothers, Roorkee

**REFERENCE BOOKS :**

3. Mechanical Vibrations – W. T. Thomson

4. Mechanical Vibrations – Tse, Morse & Hinkle

5. Mechanical Vibrations – V. Rama Murthy, Narosa Publications

Course Code: **TME 814 (ELECTIVE II)** L T P C
Course Name: **MAINTENANCE & SAFETY MANAGEMENT** **3 0 0 3**

.

**UNIT 1**

INTRODUCTION : Operating life cycle, reliability, Failure data analysis, failure rate curve, hazard models. maintainability, availability, reliability 5 Hours

**UNIT 2**

MAINTENANCE STRATEGIES: Break down maintenance, planned maintenance, strategies, preventive maintenance, design out maintenance, planned lubrication, total productive maintenance, zero break down, preventive inspection of equipment used in emergency. 8 Hours

**UNIT 3**

REPLACEMENT PLANNING &MAINTAIN OR REPLACE DECISION: Replacement of items that deteriorate with time identical equipment, replacement of items that fail without deterioration individual, group replacement, replacement in anticipation of failure. Break down maintenance planning 9 Hours

**UNIT 4**

SAFETY IN ENGINEERING INDUSTRY: definitions - classification of engineering industry - different process in engineering industry. Safety in welding, cutting, finishing, Safety in heat treatments - safety in handling and storage,. disposal of effluents - health precautions, elimination and prevention of long time exposure to the hazardous fumes, source of fumes, ventilation and fume protection. Care and maintenance of common elements used in material handling equipments like rope chains slings, hooks , clamps general safety consideration in material handling - manual and mechanical handling . Handling assessments - handling techniques – lifting, carrying, pulling, pushing, palletizing and stocking. Occupational diseases due to physical and chemical agents. 12 Hours

**UNIT 5**

MAINTENANCE MANAGEMENT, production maintenance system, objectives and functions, forms, policy, planning, organization, economics of maintenance, manpower planning, materials planning, spare parts planning and control, evaluation of maintenance management. 8 Hours

**TEXT BOOKS**

1. Management of systems – R.N. Nauhria & R. Prakash

**REFERENCE BOOKS**

1. Industrial Safety Handbook : William Handley
2. Introduction to Safety Engineering : David S Gloss & Miriam GayleWardle
3. Industrial Safety : Roland P Blake
4. Health and Safety in Welding and allied process :N C Balchin,Jaico publishers

Course Code: **TME 821 (ELECTIVE III)** L T P C
Course Name: **MECHANICAL SYSTEM DESIGN** **3 0 0 3**

**UNIT 1**

ENGINEERING PROCESS AND SYSTEM APPROACH: Basic concepts of systems, Attributes characterizing a system, system types, Application of system concepts in Engineering, Advantages of system approach, Problems concerning systems, Concurrent engineering, A case study-Viscous lubrication system in wire drawing

PROBLEM FORMULATION: Nature of engineering problems, Need statement, hierarchical nature of systems, hierarchical nature of problem environment, problem scope and constraint, A case study: heating duct insulation system, high speed belt drive system 10 Hours

**UNIT 2**

SYSTEM THEORIES : System Analysis, Black box approach, state theory approach, component integration approach, Decision process approach, A case study- automobile instrumentation panel system.

SYSTEM MODELLING: Need of modeling, Model types and purpose, linear systems, mathematical modeling, concepts, A case study compound bar system 8 Hours

**UNIT 3**

GRAPH MODELLING AND ANALYSIS :Graph Modelling and analysis process, path problem, Network flow problem, A case study: Material handling system

OPTIMIZATION CONCEPTS: Optimization processes, Selection of goals and objectives-criteria, methods of optimization, analytical, combinational, subjective. A case study: aluminium extrusion system. 8 Hours

**UNIT 4**

SYSTEM EVALUATION: Feasibility assessment, planning horizon, time value of money, Financial analysis, A case study: Manufacture of maize starch system

CALCULUS METHOD FOR OPTIMIZATION: Model with one decision variable, model with two decision variables, model with equality constraints, model with inequality constraints, A case study: Optimization of an insulation system. 8 Hours

**UNIT 5**

DECISION ANALYSIS: Elements of a decision problem, decision making, under certainty, uncertainty risk and conflict probability, density function, Expected monetary value, Utility value, Baye's theorem, A case study: Installation of machinery
6 Hours

SYSTEM SIMULATION: Simulation concepts, simulation models, computer application in simulation, spread sheet simulation, Simulation process, problem definition, input model construction and solution, limitation of simulation approach, A case study: Inventory control in production plant. 7 Hours

**TEXT BOOKS :**

1. Design and Planning of Engineering systems-DD Reredith, KV Wong, RW Woodhead, and RR Worthman, Prentice Hall Inc., Eaglewood Cliffs, New Jerse
2. Design Engineering-JR Dixon, TMH, New Delhi

**REFERNCE BOOKS :**

3. An Introduction to Engineering Design Method-V Gupta and PN Murthy, TMH, New Delhi
4. Engineering Design-Robert Matousck, Blackie and son ltd. Glasgow
5. Optimization Techniques-SS Rao
6. System Analysis and Project Management-Devid I Cleland, William R King, McGraw Hill.

Course Code: **TME 822 (ELECTIVE III)** L T P C
Course Name: **EXPERIMENTAL STRESS ANALYSIS** **3 0 0 3**

**UNIT 1**

ELEMENTARY ELASTICITY: STRESS: Introduction, Stress Equations of Equilibrium, Laws of Stress Transformations, principal Stresses, Two-Dimensional State of Stress, Stresses Relative to Principal Coordinate System, Special States of Stress.

STRAIN: Introduction, Displacement and Strain, Strain Transformation Equation, Principal Strains, Compatibility, Volume Dilation, Stress Strain Relations, Strain Transformation Equations and Stress Strain Relations for Two-Dimensional State of Stress. 9 Hours

**UNIT 2**

STRAIN MEASUREMENTS: Introduction, Properties of Strain Gage Systems, Types of Strain Gages, Grid- Method of Strain Analysis.

BRITTLE COATING METHOD: Coating Stresses, Failure Theories, Brittle Coating Crack Patterns, Resin and Ceramic Based Brittle Coating, Test Procedure, Analysis of Brittle Coating Data. 9 Hours

**UNIT 3**

ELECTRICAL RESISTANCE STRAIN GAGES: Introduction, Strain Sensitivity in Alloys, Strain Gage Adhesives, Gage Sensitivity and Gage Factor.

STRAIN GAGE CIRCUIT: Potentiometer and its Application, Wheat-Stone Bridge, Bridge Sensitivity, Null Balance Bridges.

ANALYSIS OF STRAIN GAGE DATA: Three Element Rectangular Rosette, Delta Rosette, Stress Gage, Plane Shear-Gage. 8 Hours

**UNIT 4**

THEORY OF PHOTO ELASTICITY: Introduction, Temporary Double Refraction, Stress Optic Law, Relative Retardation, Stressed Model in Plane Polaris cope, Effect of Principal Directions, Effect of Principal Stress Difference, Stressed Model in Circular Polaris cope, Light and Dark Field arrangements, Tardy Compensation, Fringe Sharpening and Multiplication by Partial Mirrors. 9 Hours

**UNIT 5**

TWO DIMENSIONAL PHOTO ELASTICITY : Introduction, Iso chromatic Fringe Patterns, Isoclinic Fringe Patterns, Compensation Techniques, Calibration Methods, Separation Methods, Shear Difference Method, Electrical Analogy Method, Oblique Incidence Method, Materials for Two-Dimensional Photo elasticity. 7 Hours

**TEXT BOOKS:**

1. Experiment Stress Analysis by James W. Dally and William F. Riley, International Student Edition, McGraw-Hill Book Company.

**REFERENCE BOOKS :**

2. Experiment Stress Analysis by Dr. Sadhu Singh, Khanna Publishers.

Course Code: **TME 823 (ELECTIVE III)** L T P C
Course Name: **INDUSTRIAL ERGONOMICS** **3 0 0 3**

**UNIT 1**

INTRODUCTION: Importance applications and principles of occupational ergonomics.
PHYSIOLOGICAL PRINCIPLES: Muscular work, Nervous control of movements, Improving working efficiency. Optimal use of muscle strength. /Guidelines for work layout.
SKILLED WORK: Acquiring skill, control of skilled movements. Design of tools and equipments for skilled work. 6 Hours

**UNIT 2**

HEAVY WORK: Energy consumption, Efficiency, Heart rate as a measure of workload.
WORK-STATION DESIGN: Anthropometric data, Reach and clearance dimensions. Percentiles to be accommodated. 6 Hours

**UNIT 3**

WORKING HEIGHTS: Comfortable working postures. Room to grasp or move things, and operate controls. Sedentary work. Its advantages, disadvantages and limitation. Sedentary workplace design. Design of VDT workstations, Design of Key board.
HANDLING LADS: The Human spine, back troubles associated with industrial work, Inter vertebral disc, disc pressure, slip of disc, Bio-mechanical models of lower back. Recommendations for handling loads.
MAN-MACHINE SYSTEM: Display equipment, Controls, Relation between control and display instruments, Mental activity, Fatigue, Occupational stress, Job design in monotonous task. 10 Hours

**UNIT 4**

HUMAN VISUAL SYSTEM: Accommodation, Aperture of the pupil, Adaptation of reline, eye movements Visual capacity, Visual strain, Physiology of reading.
ERGONOMIC PRINCIPLES OF LIGHTING: Light sources, measurement, physiological requirements of artificial lighting, arrangement of light. Light for fine work and for VDT offices. 9 Hours

**UNIT 5**

NOISE AND VIOLATION: Sound perception, Noise load, damage to hearing, physiological and psychological effects of noise. Protection against noise, Vibrations and their effect on performance.
WORKING ENVIRONMENT: Thermo-regulation in human body, comfort indoors, Air quality and its dryness, Air pollution and ventilation. Heat in industry Recommendations for comfort indoors. Daylight, colours and music for pleasant work environment. 10 Hours

**TEXT BOOKS :**

1. Fitting the task to the Man, E. Gandjean, Taylor and Francis.
2. A guide to Ergonomics of Manufacturing, Helander, M., East-West Press.

**REFERENCE BOOKS :**

3. Human Factor in Engineering and Design, Sanders, M.S., and Mc Cormik, E.J., Mc Graw.Hill

Course Code: **PME 801** L T P C
Course Name: **AUTOMOBILE ENGINEERING LAB** **0 0 3 2**

*Experiments: Say minimum 12 experiments out of following.*

1. Performance Analysis of Four stroke S.I. Engine- Determination of indicated and brake thermal efficiency, specific fuel consumption at different loads, Energy Balance.
2. Determination of Indicated H.P. of I.C. Engine by Morse Test.
3. Performance Analysis of Four stroke C.I. Engine- Determination of indicated and brake thermal efficiency, specific fuel consumption at different loads, Energy Balance.
4. Study & experiment on Valve mechanism.
5. Study & experiment on Gear Box.
6. Study & experiment on Differential Gear Mechanism of Rear Axle.
7. Study & experiment on Steering Mechanism.
8. Study & experiment on Automobile Braking System.
9. Study & experiment on Chassis and Suspension System.
10. Study & experiment on Ignition system of I.C. Engine.
11. Study & experiment on Fuel Supply System of S.I. Engines- Carburetor, Fuel Injection Pump and MPFI.
12. Study & experiment on Fuel Supply System of C.I. Engines- Injector & Fuel Pump.
13. Study & experiment on Air Conditioning System of an Automobile.
14. Comparative study of technical specifications of common small cars (such as Maruti Swift,
    Hyundai i20, Cheverlet Aveo, Tata Indica, Ford Fusion etc
15. Comparative study & technical features of common scooters & motorcycles available in India.
16. Visit of an Automobile factory.
17. Visit to a Modern Automobile Workshop.
18. Experiment on Engine Tuning.
19. Experiment on Exhaust Gas Analysis of an I.C. Engine.

Course Code: **PME 802** L T P C
Course Name: **PROJECT PHASE II** **0 0 12 6**

STUDENTS ARE REQUIRED TO SUBMIT THE PROJECT WORK , ON THE TOPIC SELECTED IN PROJECT PHASE I.

THE STUDENTS ARE REQUIRED TO SUBMIT THE PROJECT REPORT & MODEL PREPARED BY THEM. THEY ARE ALSO APPEAR FOR THE FINAL VIVA VOCE FOR THE PROJECT