MEC-801 MACHINE DESIGN

Unit I Design of Belt, Rope and Chain Drives: Methods of power transmission, selection and design of flat belt and pulley; Selection of V-belts and sleave design; Design of chain drives, roller chain and its selection; Rope drives, design of rope drives, hoist ropes.

Unit II Spur and Helical Gears: Force analysis of gear tooth, modes of failure, beam strength, Lewis equation, form factor, formative gear and virtual number of teeth; Gear materials; Surface strength and wear of teeth; strength against wear; Design of straight tooth spur and Helical Gears.

Bevel Gears: Application of bevel, formative gear and virtual number of teeth; Force analysis; Lewis equation for bevel gears; Strength against wear; Design of bevel gear.

Unit III Design of I.C. Engine Components: General design considerations in I C engines; design of cylinder; design of piston and piston-rings; design of connecting rod; design of crankshaft.

Unit IV Design of Miscellaneous Components: design of Flanged coupling; Rigid coupling, Design of Pressure vessels subjects to internal pressure, external pressure, design of penetration, design of flanges, cone cylinder junctions ,Materials, Fabrication.

Unit V Optimization: Basic concept of optimization, classification of optimization, optimization techniques, engineering applications of optimization. Classical optimization techniques: unconstrained optimization single-variable optimization, multivariable optimization, solution by direct search method, solution by Lagrange-multipliers method.

Note: PSG Design data book and/ or Mahadevan and Reddy's Mechanical design data book are to be provided/ permitted in exam hall (duly verified by authority).

References Books:

1. Shigley J.E.; Machine Design; TMH
2. BhandariVB; Design of Machine Elments; TMH
3.Sharma CS and Purohit K; Design of Machine Elements; PHI Learning.
4.Hall and Somani; Machine Design; Schaum Series; TMH
5.Wentzell TH; Machine Design; Cegage Learning
6.Sharma & Agrawal; Machine Design; Katson

List of Experiment :

1. To design and sketch of flat belt and pulley
2. To design a connecting rod
3. To design center crankshaft
4. To design of a flanged coupling
5. To design helical gear

MEC-802 REFRIGERATION & AIR CONDITIONING

Unit-I Introduction: Principles and methods of refrigeration, freezing; mixture cooling by gas reversible expansion, throttling, evaporation, Joule Thomson effect and reverse Carnot cycle; unit of refrigeration, coefficient of performance, vortex tube & thermoelectric refrigeration, adiabatic demagnetization; air refrigeration cycles- Joule's cycle Boot-strap cycle, reduced ambient cycle and regenerative cooling cycles.

Unit-II Vapour compression system: Vapor compression cycle, p-h and t-s diagrams, deviations from theoretical cycle, sub-cooling and super heating, effects of condenser and evaporator pressure on cop; multi-pressure system: removal of flash gas, multiple expansion & compression with flash inter cooling; low temperature refrigeration: production of low temperatures, cascade system, dry ice, production of dry ice, air liquefaction system,.

Unit-III (a) Vapour absorption system: Theoretical and practical systems such as aqua- ammonia, electrolux & other systems; (b) Steam jet refrigeration: Principles and working, simple cycle of operation, description and working of simple system, (c) refrigerants: nomenclature & classification, desirable properties, common refrigeration, comparative study, leak detection methods, environment friendly refrigerants and refrigerant mixtures, brine and its properties

Unit-IV Psychrometric: Calculation of psychrometric properties of air by table and charts; psychrometric processes: sensible heating and cooling, evaporative cooling, cooling and dehumidification, heating and humidification, mixing of air stream, sensible heat factor; principle of air conditioning, requirements of comfort air conditioning, ventilation standards, infiltrated air load, fresh air load human comfort, effective temperature & chart, heat production & regulation of human body,

Unit-V Air conditioning loads: calculation of summer & winter air conditioning load, bypass factor of coil, calculation of supply air rate & its condition, room sensible heat factor, grand sensible heat factor, effective sensible heat factor, dehumidified air quantity. Problems on cooling load calculation. Air distribution and ventilation systems

References Books:

1. Arora CP; Refrigeration and Air Conditioning; TMH
2. Sapali SN; Refrigeration and Air Conditioning; PHI
3. Ananthanarayan; Basic Refrigeration and Air conditioning; TMH
4. Manohar Prasad; Refrigeration and Air Conditioning; New Age Pub
5. Ameen; Refrigeration and Air Conditioning; PHI

List of Experiments:-

1. General Study of vapor compression refrigeration system.
2. General Study of Ice Plant
3. General Study and working of cold st
4. General Study One tone Thermax refrigeration unit.
5. General Study of Water cooler
6. General Study of Psychrometers (Absorption type)
7. General Study of window Air Conditioner.
8. General Study and working of Vapor compression Air conditioning Test rig.
9. Experimentation on Cold Storage of Calculate COP & Heat Loss.
10. Experimentation on Vapor compression Air Conditioning test rig.

MEC-803 (A) COMPUTER AIDED MANUFACTURING

Unit I Introduction C. N.C. System : Definition, applications, Historical background Role of Computers in Manufacturing. Computer Numerical control in CAM: Definition, basic components of CAM system, Procedure, Co-ordinate system, motion control systems, Advantages of CNC system;

Unit II Introduction of CNC Machine tools, Application of CNC systems, Economics of CNC machining centers, Part Programming : CNC part programming : manual part programming,

Unit III Introduction computer aided part programming Robot Technology: Introduction, Industrial Robots, Robot physical Configuration, Basic Robot motions, Technical features, such as work volume, precision of movement speed o movement, weight carrying capacity, type of drive systems, Programming of the robot, Introduction to robot languages, End erectors, work cell control and interlocks, Robotic sensors, Robot applications & economics, Intelligent robots, interfacing of a vision system with a Robot,

Unit IV Introduction Definition and broad characteristics of Flexible Manufacturing Cells, , Group technology Systems FMS hardware CNC machines tools, robots, AGVs, ASRs, Inspection and Cleaning stations - Control aspects of FMS-DNC of machine tools, cutting tools, Types of Flexibility in FMS, Flexible and Dynamic Manufacturing Systems, Computer Aided Inspection:

Unit V Introduction Principles and interfacing, software metrology. Applications of Lasers in precision measurements - Laser interferometer, speckle measurements, laser scanners. Coordinate Measuring Machine - Types of CMM - Probes used - Applications - Non contact CMM using Electro optical sensors for dimensional metrology - Non contact sensors for surface finish measurements. Image processing and its application in inspection.

ReferencesBooks:-

1. Automation, Production Systems and Computer Integrated Manufacturing M.P.Grover,
2. Principal of Computer integrated manufacturing S.KantVajpayee.
3. Numerical control and computer aided manufacturing Kundra, Rao & Tiwari

MEC- 803(B) QUALITY MANAGEMENT & CONTROL

UNIT-I

ITRODUCTION: Basic concepts, definitions and history of quality control. Quality function and concept of quality cycle. Quality policy and objectives. Economics of quality and measurement of the cost of quality. Quality considerations in design. Process control: Machine and process capability analysis .Use of control charts and process engineering techniques for implementing the quality plan. Acceptance Sampling: single, double and multiple sampling, lot quality protection, features and types of acceptance sampling tables.

UNIT-II

MANAGEMENTDURATION AND CONTROL: Importance and options to accelerate project completion; timecost tradeoff; fixed variable and total costs; use of floats and cost optimization; project performance measures; project monitoring info and reports; project control process; Gant chart and control chart cost-schedule S-graph; planned cost of work schedule (PV), budgeted/ earned cost of work (EV) and actual cost of work completed (AC).

UNIT-III

QUALITY ORGANIZATION, CULTURE AND LEADERSHIP: projects within functional organization; dedicated project/ task-force teams; staff, matrix and network organization;; Organization culture; ten characteristics; cultural dimensions supportive to projects; social network and management by wandering around (MBWA);; five stage team development model; shared vision; conflicts; rewards; rejuvenating project teams; project stakeholders; concept of project partnering.

UNIT-IV

STRATEGIC PLANNING AND PROJECT APPRAISAL: Capital allocation key criteria; Porters competitive strategy model; BCG matrix; Strategic Position Action Evaluation (SPACE); time value of money; cash flows; payback period; IRR; cost of capital; NPV; social cost benefit analysis; UNIDO approach; project risks and financing.

UNIT-V

DEFECT DIAGNOSIS AND PREVENTION : Basic causes of failure, curve/control of failure. MTBF. Maintainability, Condition monitoring and dignostic techniques. different traits of a manager and leader; managing project teams, choosing appropriate project organization.

References Books:

1. Prasana Chandra: Projects: planning Implementation control; TMH.
2. Gray Clifford F And Larson EW; Project The managerial Process; TMH
3. Panneerselven and Serthil kumar; Project management, PHI
4. Burke ; Project Management-Planning and control technics; Wiley India
5. Kamaraju R; Essentials of Project Management; PHI Learn

MEC-803(C) SOLAR ENERGY UTILISATION

UNIT-I

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, Photovoltaic, Water power, Wind energy, Biomass, Ocean thermal, Tidal and wave energy, Geothermal energy, Hydrogen energy systems, Fuel cells, Decentralized and dispersed generation.

UNIT-II

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, Surface azimuth angle, Hour angle, Zenith angle, Solar altitude angle expression for angle between incident beam and the normal to a plane surface (no derivation), Local apparent time, Apparent motion of sun, Day length, Solar radiation data for India.

UNIT-III

Solar energy: Radiation, flat plate and concentrating collectors, fluid flow and heat transfer analysis, estimation of solar radiation, Active systems, solar pond, passive space conditioning, power generation, photovoltaic's. Principles and applications of wave energy, tidal energy, biomass energy, OTEC and Geothermal energy. MHD Engineering. Fuel Cells. Wind Energy potentials.

UNIT-IV

Solar Photovoltaic: Principle of photovoltaic conversion of solar energy, types of solar cells and fabrication. Photovoltaic applications: battery charger, domestic lighting, street lighting, water pumping, power generation schemes.

UNIT-V

Other Non- Conventional energy sources: Geothermal energy – Introduction, Types of geothermal resources, Methods of Harnessing. Energy from oceans – wave energy, energy conversion devices, tidal energy- Types of tidal power plants, ocean thermal energy – Introduction, open & closed systems.

References Books:

1. Solar Energy – S.P.Sukhatme, Tata mcgraw hill co.
2. Power Plant Engineering – P.K.Nag, Tata mcgraw hill publishing co.
3. Kothari, Singal & Rajan; Renewable Energy Sources and Emerging Technologies, PHI Learn
4. Solar Energy Fundamentals Design, Modelling and Applications by G.N. Tiwari, Nwrosh.
5. Bansal Keemann, Meliss," Renewable energy sources and conversion technology", Tata Mc Graw

MEC-804 (A) – TOOLS DESIGN AND MACHINE TOOLS

Unit I Basic Features and Kinematics of Machine Tools: Features of basic machine tools; construction and operation, types of machine tools, machine tools motions, transmission-rotation in to rotation, rotation in to translation, kinematic-structures of machine tools: elementary, complex and compound structure, kinematic-features of gear shapers and gear hobbing machine.

Unit II Regulation of Speed: Design of gear boxes- need for variation of speed, selection of speed range, laws of stepped regulation, standardization of speeds, speed diagram, analysis of productivity loss, kinematic advantage of GP, structural diagrams, ray diagram and speed chart. Gear Drives: Belt and cone pulley, slip gear type, north gear drive, draw key gear drive, clutch type, mechanical step less drives, electrical drives; hydraulic drive.

Unit III Design of Metal working Tools: Design of press working tools, shearing, piercing, blanking, dies, compound die design principles for forging dies, bending, forming drawing dies, tooling for forging - design principles for forging dies, drop forging, upset forging, design principles and practice for rolling, roll press design.

Unit IV Design of Jigs and Fixtures: Principles of location, locating method and devices, principles of clamping, clamping devices, drilling jigs, types, drill bushes, fixture and economics, types of fixture, milling, grinding, broaching, assembly fixtures indexing jig and fixtures, indexing devices.

Unit V Design of Gauges and Inspection Features: Design of gauges for tolerance for dimensions and form inspection; dies and mould design for Ppastics & rubber parts: compression molding, transfer molding, blow molding.

References Books:

1. Mehta N.K.; Machine Tool Design and Numerical Control; TMH
2. Sen G.C, Bhattacharya A; Principles of Machine Tools; New Central Book Agency.
3. Donaldson; Tool Design T.M.H.
4. Jain KC and Chitale AK; Text Book Of Production Engineering; PHI Learning
5. Juneja, Sekhon and Seth; Fundamentals of Metal Cutting and Machine Tools; New Age.
6. Krar SF, Gill AR, Smid P; Technology of Machine Tools;TMH

MEC-804(B) WIND ENERGY TECHNOLOGY

Unit-I Historical perspective, latest developments, state of art of wind energy technology, turbine rating, cost of energy, wind power plant economics, installation and operation costs, decommissioning, national scenario and worldwide developments, present status and future trends.

Unit -II Nature of atmospheric winds; wind resource characteristics and assessment; anemometry; wind statistics; speed frequency distribution, effect of height, wind rose, Weibull distribution, atmospheric turbulence, gust wind speed, effect of topography. Aerodynamics of air of oil; lift; drag; stall; effect of Reynold's number; actuator disc; momentum theory and Betz coefficient; design of wind turbine blade;

Unit -III design characteristics, multiple stream tube theory, vortex wake structure; tip losses; rotational sampling, wind turbine design programs, aerodynamic loads, tower shadow, wind shear, blade coning, gyroscopic, transient Aerodynamic damping and stability, teetering motion, stiff and soft towers.

Unit- IV Power train dynamics, design standards. Innovative designs and recent advances in wind energy conversion systems. Pitch control, yaw control, aerodynamic braking, teeter mechanism. Wind turbine dynamics with DC and AC generators: induction and synchronous generators, permanent magnet generator,

Unit -V Wind farm electrical design, Planning of wind farms, special application for developing countries, maintenance and operation, wind farm management, site selection. Environmental assessment; noise emission, visual impact, avian mortality, telecommunication interference etc. Instrumentation, data loggers, remote monitoring and control. Remote sensing applications like SODAR, LIDAR, SAR etc.

Reference Books :

1. Ahmed Siraj (2016). WIND ENERGY: Theory and Practice, 3/e PHI, Eastern Economy Edition ISBN 978-81-203-5163-9 New Delhi.

2. Thomas Ackermann (2012). Wind Power in Power Systems, 2/e Wiley Publications, ISBN 978-0-470-97416-2 Germany

MEC-804(C) TOTAL QUALITY MANAGEMENT

Unit-I Introduction to TQM, Importance of TQM in manufacturing and service industry, Basic approach of TQM, Concept of Quality Circle, Tools and system for quality management Just in time(JIT) production system, quality production through JIT and Kanban,

Unit-II Focus on total customer satisfaction Development of process Failure Mode & Effect Analysis (FMEA), Falt Tree analysis (FTA) Implementation and need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 Quality system Strategic Quality Planning Case studies of TQM STATISTICAL QUALITY CONTROL (SQC)

Unit-III STATISTICAL QUALITY CONTROL (SQC) Introduction to Quality Control, Fundamentals of statistical concepts and techniques in quality control and improvement, graphical methods and data representation. Statistical process control using control charts, Control charts for variables and attributes, Process capability analysis. Acceptance sampling plans for attributes and variables,

Unit-IV Operating characteristic curves, A & L system for Lot by Lot acceptance sampling, Sampling plans, MILSTD411, Dodge -Romig sampling plans, LTPD, AOQL. Chain sampling, Continuous sampling, Skip lot,

Unit-V Economic design of sampling plans. Life testing, Life cycle curve and probability distributions in modelling reliability, system reliability. Experimental Design and Taguchi Methods, Factorial designs, Signal to noise ratio, Taguchi definition of Quality

References Books:-

1. Statistical quality control Doulas C. Montgomery,
2. Statistical quality control by Grant Leaven worth
3. Quality planning and analysis J.Juran
4. Dale H Bersterfilled Total Quality Management Pearson Education Asia
5. James R Evan and William M Lindsya The management and Control of Quality
6 Oaland J.S. tqm Text with Cases Butterworth Heinemann Ltd Oxfod

MEC -805 (A) INDUSTRIAL ORGANISATION & MANAGEMENT

Unit-I Industrial Evolution in India: Downfall of early industries, evolution of modern industry, effects of partition, industrial policy and progress after independence. Forms of Industrial Organization: Single Proprietorship, Partnership, Joint Stock companies., Cooperatives and State Enterprises.

Unit-II Growth of Industry and Management: Meaning of industrial management, functions and tools of management, growth of management concepts. Principles of Management: Management, different functions of management: Planning, organizing, coordination and control., Structure of an industrial organization.,

Unit-III Functions of different departments. Relationship between individual departments. Human and Industrial Relations, Human relations and performance in organization. Understand self and others for effective behavior, Behaviour modification techniques, Industrial relations and disputes, Relations with subordinates, peers and superiors, Characteristics of group behaviour and trade unionism.

Unit-IV Professional Ethics: Concept of ethics, Concept of professionalism, Need for professional ethics. Code of professional ethics, Typical problems of professional engineers, Professional bodies and their role.. Motivation: Factors determining motivation, Characteristics of motivation, Methods for improving motivation, Incentives, pay, promotion, rewards, Job satisfaction and job enrichment.

Unit-V Leadership: Need for leadership, Functions of a leader, Factors for accomplishing effective leadership, Manager as a leader. Human Resource Development: Introduction, Staff development and career development, Training strategies and methods. Accidents and Safety: Classification of accidents; according to nature of injuries i.e. fatal, temporary; according to event and according to place

. **References Books:-**

1.Industrial Organization Pepall L., Richards D., and Norman G.
2. The Theory of Industrial Organization. Tirole, J.
3. Industrial Engineering and Management TR Banga.
4. Industrial Engineering and Management OP Khanna,
5. Industrial Management VK Sharma, OP Harkut.

MEC-805(B) COMPOSITE MATERIALS

Unit-I Introduction, definition and classification of composite materials, Types of reinforcements, Types of Matrix, Interface, Wettability, Polymer and Metal matrix composites: Types, lamina, laminate, orthotropy, anisotropy in composites, Processing of Composites:

Unit-II Primary and Secondary Manufacturing- Lay-up, Autoclave Molding, Filament Winding, Pultrusion, Compression Molding, RTM and RIM, Interface and Applications. Introduction of ceramic matrix composites, Nano-composites. Micromechanics of composites, Density of composites,

Unit-III Predication of elastic constants, strength and stiffness, Load transfer in fiber and particulate reinforced composites, Macromechanics of composites, Elastic constants of an isotropic material and a lamina,

Unit-IV Analysis of laminated composites, Constitutive classical laminate theory, Stress and strain in laminate composites, Tensile and compressive strength of unidirectional fiber composites,

Unit-V Introduction to fracture mechanics, failure mechanics and crack propagation in composites, Design consideration for composite materials, Performance of composite under fatigue and impact loading.

References Books :-

1. Composite Materials: Science and Engineering Krishnan K. Chawla
2. Mechanics of Composite Materials Autar K. Kaw
3. Composite Materials S. C. Sharma.
4. Composite Manufacturing: Materials, Product & Process Engineering, Sanjay K. Mazumdar

MEC-805(C) COMPUTATIONAL FLUID DYNAMICS

Unit-I Introduction: Mathematical Background: Classification of differential equations, representative differential equations for heat transfer and fluid flow; Boundary and initial condition; Integral forms. Survey of Numerical Methods Used in Heat Transfer and Fluid Mechanics

Unit-II Finite Difference Methods Basic concepts, Direct approximation approach, Taylor series, Control Volume approach, Truncation error, Discretization and round off errors; convergence, numerical stability, Solution of simultaneous equations, Transient diffusion. Finite Element Methods: Steps for FEM solution, Fundamentals, Assembly, Steady Diffusion, Transient Diffusion Finite Volume Methods: Problem formulation for one-dimensional convection diffusion equations.

Unit- III Simulation of Transport Process Conduction Heat Transfer: Steady and unsteady state one & two dimensional problems. Explicit, Implicit and Crank-Nicolson scheme, ADI and ADE methods. Convection Heat Transfer: Boundary Layer Flows, Similarity solutions, Derived Variables, Patankar/Spalding Methods for two-dimensional flows.

Unit- IV Elliptic Solutions: Control Volume formulation. Energy and other scalar equations, Momentum equations, Segregated Solution method; SIMPLE & SIMPLER schemes, Stream Function – Vorticity

Unit-V Transport method. Turbulence: Examples of turbulent flows, Stress relations, Reynolds stresses, turbulence model computations, Analogy between Heat Transfer and Momentum, Linearization of source terms.

References Books:-

1.Computational Fluid Dynamics" by Anderson J D
2.Numerical Computation of Internal and External Flows" by Hirsch C
3. Computational Fluid Dynamics and Heat Transfer" by Tenehill J C and Pletcher R H
4. An Introduction to Computational Fluid Dynamics: The Finite Volume Method" by H Versteeg
5. Computational Fluid Dynamics" by Tapan Sen Gupta

MEC – 806 Industrial Training Project - II

Objectives of the course Industrial Training Project - II

To provide students with a comprehensive experience for applying the knowledge gained so far by studying various courses. To develop an inquiring aptitude and build confidence among students by working on solutions of small industrial problems. To give students an opportunity to do something creative and to assimilate real life work situation in institution. To adapt students for latest development and to handle independently new situations. To develop good expressions power and presentation abilities in students.

The focus of the Major Project is on preparing a working system or some design or understanding of a complex system using system analysis tools and submit it the same in the form of a write up i.e. detail project report. The student should select some real life problems for their project and maintain proper documentation of different stages of project such as need analysis market analysis, concept evaluation, requirement specification, objectives, work plan, analysis, design, implementation and test plan. Each student is required to prepare a project report and present the same at the final examination with a demonstration of the working system (if any)

Working schedule The faculty and student should work according to following schedule:

Each student undertakes substantial and individual project in an approved area of the subject and supervised by a member of staff. The student must submit outline and action plan for the project execution (time schedule) and the same be approved by the concerned faculty.

Action plan for Major Project work and its evaluation scheme #(Suggestive)

Task/Process	Week	Evaluation	Marks For Term Work#
Orientation of students by HOD/Project Guide	1st	-	-
Literature survey and resource collection	2nd	-	-
Selection and finalization of topic before a committee*	3rd	Seminar-I	10
Detailing and preparation of Project (Modeling, Analysis and Design of Project Work	4th to 5th	-	10
Development stage			
Testing, improvements, quality control of Project	6th to 10th 11th	-	25
Acceptance testing	12th	-	10

Report Writing	13th to 15th	-	15
Presentation before a committee (including user manual, if any)	16th	- Seminar-II	30

* Committee comprises of HOD, all project supervisions including external guide from industry (if any)

The above marking scheme is suggestive, it can be changed to alternative scheme depending on the type of project, but the alternative scheme should be prepared in advance while finalizing the topic of project before a committee and explained to the concerned student as well.

NOTE: At every stage of action plan, students must submit a write up to the concerned guide.

MEC – 807 General Proficiency

Objective of GD and seminar- is to improve the MASSCOMMUNICATION and CONVINCING / under standing skills of students and it is to give student anopportunityto exercise their rights to expressthemselves.

Evaluation will be done by assigned faculty base don group discussion and power point presentation.