MECHANICAL ENGINEERING

CURRICULUM STRUCTURE OF

T.Y. B. Tech.

Effective from 2013-14

MECHANICAL ENGINEERING

CURRICULUM STRUCTURE OF T. Y. Undergraduate Programme
Effective from 2013-14

Summary – Credits and Contact Hours

Total Credits for B Tech (Mechanical Engineering)									
Program	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Sem VII	Sem VIII	Total
B. Tech. (Mech. Engg.)	21	21	24	24	22	24	24	20	180
Teaching Hrs	24	23	29	28	24	28	32	30	218

V-Semester (T.Y. – Mech Sem I) W.E.F. 2013 - 14

Sr. No	Course Code	Subject Title	Category of Course	Contact hours L	T	P	Credits
1	ME 301	Department Elective –I	DEC	3	0	0	3
2	ME 302	Numerical Methods and Computer Programming	PCC	3	1	0	4
3	ME 303	Heat Transfer	PCC	4	0	0	4
4	ME 304	Theory of Machine - II	PCC	4	0	0	4
5	ME 305	Machine Design-I	PCC	3	0	0	3
6	ME 306	Heat Transfer Lab	LC	0	0	2	1
7	ME 307	Theory of Machine - II Lab	LC	0	0	2	1
8	ME 308	Machine Design-I Lab	LC	0	0	2	1
9		Liberal Learning Course	LLC	0	0	0	1
		Total		24 Hrs			22

Departmental Elective – I

Sr. No	Course code for Theory	Subject Title
1	ME 301 -1	Non Conventional Energy Sources
2	ME 301 -2	Steam Engineering
3	ME 301 -3	Operation Research
4	ME 301 -4	Advanced Manufacturing Technology
5	ME 301 -5	Precision Engineering and SPM Tools
6	ME 301 -6	Entrepreneurship Development and Communication Skills
7	ME 301 -7	Finite Element Method
8	ME 301 -8	Automobile Engineering

VI-Semester (T.Y. – Mech Sem II) W.E.F. 2013 - 14

Sr. No	Course Code	Subject Title	Category of Course	Contact hours L	T	P	Credits
1		Open Elective –I	OEC	3	0	0	3
2	ME 309	Machine Design-II	PCC	3	0	0	3
3	ME 310	Energy Conversion	PCC	3	0	0	3
4	ME 311	Fluid Mechanics and Fluid Power	PCC	4	0	0	4
5	ME 312	IC Engines	PCC	3	0	0	3
6	ME 313	Machine Design-II Lab	LC	0	0	2	1
7	ME 314	Energy Conversion Lab	LC	0	0	2	1
8	ME 315	Fluid Mechanics and Fluid Power Lab	LC	0	0	2	1
9	ME 316	IC Engines Lab	LC	0	0	2	1
10		Constitution of India	MLC	2	0	0	2
11		Humanities Course	HSSC	2	0	0	2
		Total		28 Hrs			24

List of Open Electives-I

- Unconventional Machining Processes
- Robotics
- Power Plant Engineering

ME301-1 - NON-CONVENTIONAL ENERGY SOURCES

Teaching Scheme
Lectures – 3 hrs / week

Examination Scheme
Test-20 mark, Mid-Sem-30 marks
End Sem. Exam– 50 marks

Unit 1 [8 hrs]

Solar Energy

Present status of energy scenario. Renewable and non-renewable energy sources. Availability, limitations, application of solar energy.

Solar Radiation

Structure of the sun, energy radiated by the sun, angular relationship of earth, and sun position, measurement of solar radiation. Derivations and Numerical Problems

Unit 2 [7 hrs]

Flat Plate Collectors

Types and constructional details of flat plate collector, energy-balance for a flat plate collector, simple equation and performance curves, selection of flat plate collector.

Solar Concentrator

Limitations of flat plate collectors, various types of concentrators, their advantage, simple, thermal energy-balance equations, heliostats, selection of various materials for concentrators and reflecting surfaces.

Unit 3 [8 hrs]

Solar Heating Systems

Solar water and space heating systems, passive solar heating systems, solar heating economics, solar air-heating systems, typical solar ponds.

Solar Distillation Systems

Various solar stills and selection, constructional details, Solar Energy Storage Systems.

Solar Electric Power

Solar photovoltaic system, materials used and their performance, types of solar thermal power plant, working substance used, and temperature required various systems used.

Unit 4 [7 hrs]

Wind Energy

Availability of wind, various types of windmills and their constructional details and performance study, Power generated by windmills. Offshore Windmills. Derivations and Numerical Problems.

Unit 5 [8 hrs]

Geothermal Energy Sources

Geothermal Energy Sources and application of geothermal energy, various types of geothermal power plants.

Tidal Energy

Tidal energy available in India, suitable locations, study of various tidal energy power plants, and characteristics of turbines required.

Introduction to Wave Energy, Phenomenon of wave generation.

Unit 6: **[7 hrs]**

Bio gas

Chemistry of biogas generation variables affecting simple gas plants, types of digestoers their working and construction, application of biogas, use of bio-gas, case study of "pura" village bio gas electricity generation".

Fuel Cells

Introduction, Types and Applications

Text Books:

1. Sukhatme S.P., " Solar Energy", Tata McGraw Hill Publishing Company Limited, New Delhi, 1994
2. Rai G.D., " An Introduction to Power Plant Technology", Khanna Publishers, Third Edition, Delhi, 1996
3. Bansal N K and others " Non-Conventional Energy Sources".
4. S. Rao and Dr. B. B. Parulekar, Energy Technology, Khanna Publishers, New Delhi.

Reference Books:

1. Krieth and Krieder, "principles of solar engineering", Tata McGraw Hill Publishing Company Limited, New Delhi, 1994
2. Wakil M.M., " Power Plant Technology", McGraw Hill International Book Company, 1984.
3. Pai B.K., and Ramprasad M.S., " Power generation through renewable sources of energy".
4. Garg H.P. and Prakash J., " Solar Fundamental and Application" Tata McGraw Hill Publishing Company Limited, New Delhi, 1997

ME301-2 STEAM ENGINEERING

Teaching Scheme

Lectures – 3 hrs / week

Examination Scheme

Test-20 mark, Mid-Sem-30 marks

End Sem. Exam– 50 marks

Objectives

- To make students aware of concepts of Steam Engineering.
- To know the fundamentals of performance assessment of Boiler; Waste heat recovery and its effect on performance of boiler

Pre requisites for the course: Fundamentals of Thermodynamics, Heat Transfer, Fluid Mechanics, Metallurgy and Fuels and Combustion

Unit 1 **[7 hrs]**

Boilers

Types, Mountings and Accessories, Combustion in boilers, Feed Water and its quality, Blow down; IBR, Boiler standards resent status of energy scenario.

Unit 2 **[8 hrs]**

Piping & Insulation

Water Line, Steam line design and insulation; Insulation-types and application, Economic thickness of insulation, Heat savings and application criteria, Refractory-types, selection and application of refractory, Heat loss.

Unit 3 **[8 hrs]**

Steam Systems

Properties of steam, Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system, Steam Engineering Practices; Steam Based Equipments / Systems; Identifying opportunities for energy savings.

Unit 4 **[7 hrs]**

Boiler Performance Assessment

Performance Test codes and procedure, Boiler Efficiency, Analysis of losses; performance evaluation of accessories; factors affecting boiler performance.

Unit 5 **[8 hrs]**

Energy Conservation and waste minimization

Energy conservation options in Boiler; waste minimization, methodology; economical viability of waste minimization

Unit 6 **[7 hrs]**

Instrumentation & Control

Process instrumentation; control and monitoring

Text Books:

1. T. D. Estop, A. McConkey, Applied Thermodynamics, Parson Publication
2. Domkundwar; A Course in Thermal Engineering; Dhanapat Rai and sons
3. R.K. Rajput, Applied Thermodynamics, S. Chand & Company Limited
4. Yunus A. Cengel and Boles, "Engineering Thermodynamics ",Tata McGraw-Hill Publishing Co. Ltd

Reference Books:

1. Book II - Energy Efficiency in Thermal Utilities; Bureau of Energy Efficiency
2. Book IV - Energy Performance Assessment for Equipment & Utility Systems; Bureau of Energy Efficiency
3. Edited by J. B. Kitto & S C Stultz; Steam: Its Generation and Use; The Babcock and Wilcox Company
4. P. Chatopadhyay; Boiler Operation Engineering: Questions and Answes; Tata McGrawHill Education Pvt Ltd, N Delhi

ME301-3- OPERATIONS RESEARCH

Teaching Scheme
Lectures – 3 hrs / week

Examination Scheme
Test20 marks, Mid-Sem-30 marks
End Sem. Exam– 50 marks

Unit 1 **[8 hrs]**

Introduction to Operations Research, phases involved, applications of operations research.

Linear programming problem

Formulation, graphical method, Simplex method, artificial variable techniques, duality in LPP, Introduction to sensitivity analysis.

Unit 2 **[7 hrs]**

Allocation models

Transportation models with and without degeneracy, TP for maximisation, Assignment model.

Unit 3 **[8 hrs]**

Network Techniques

CPM & PERT, float calculation, time calculation, crashing, levelling and updating.

Unit 4 **[7 hrs]**

Games Theory

2 X 2 Game – Algebraic, arithmetic method, m X 2 Game and 2 X n Game- Graphical , algebraic and LPP method, 3 X 3 Game, method of matrices, iterative method.

Unit 5 **[7 hrs]**

Waiting Line Theory

MM1/FCFS/∞/∞. Applications of waiting line theory.
Sequencing Model- 2 machines n jobs, 3 machines n jobs and m machines n jobs.

Unit 6 **[8 hrs]**

Inventory Control Models

Basic terminology, inventory associated costs, economic order quantity, E.O.Q. with price breaks.

Text Books:

1. Operations Research, S. D. Sharma,
2. Operations Research, Hira Gupta, S. Chand & Co. Ltd., New Delhi.
3. Operations Research, Kanti Swarup,Man Mohan and P. K.Gupta, Sultan Chand & Sons,New Delhi.

Reference Books:

1. Operations Research-An Introduction, H. Taha, Maxwell Macmillan,New York.
2. Principles Operations Research, Wrangler,Prantice-Hall of India,New Delhi.

ME 301-4 - ADVANCED MANUFACTURING TECHNIQUES

Teaching Scheme
Lectures – 3 hrs / week

Examination Scheme
Test-20 marks, Mid-Sem-30 marks
End Sem. Exam– 50 marks

Unit 1 [8 hrs]

Plastic Material and Processes

Different thermosetting and thermoplastic compounds, compression moulding, transfer moulding, injection moulding, film and sheet forming, thermoforming and their applications.

Unit 2 [8 hrs]

Rapid prototyping

Product development cycle and importance of prototyping, types of prototypes-principles and advantages, different types of generative manufacturing process viz. streolithography, FDM and SLS.

Unit 3 [7 hrs]

Non-conventional machining processes

Principles, process parameters and applications of Laser material processing, EDM, WEDM and ECG.

Unit 4 [7 hrs]

Special processes

Principles, silent features, advantages and applications of abrasive floor machining, magnetic abrasive machining, honing, lapping and super-finishing. Study of micro-electro manufacturing system (MEMS).

Unit 5 [8 hrs]

Powder Metallurgy

Process, different methods of producing powders, different techniques to form the shape viz: - Pressing, Extruding, Sintering and Hot pressing, Advantages , disadvantages.

Unit 6 [7 hrs]

Surface Coating

Principles, elements, process, advantages and surface preparation, physical vapour deposition, chemical vapour deposition, Electro less coating.

Text Books:

1. B.H. Amsteal, Philip F. Ostwald & Myron L. Begeman, "Manufacturing Processes", John Wiley & Sons, eighth edition.
2. HMT Hand Book-Production Technology

Reference Books:

1. G.F. Benidict, "Advanced Manufacturing Processes", Marcel Deker Publisher.
2. Willer, "Manufacturing Analysis", "Non-Traditional Machining Processes", SME Publications

3. Machining Data Hand Book
4. Metals Hand Book
5. P. K. Mishra**,** Non-Conventional Machining Processes", Narosa Publication

ME301-5- PRECISION ENGINEERING AND SPM TOOLS

Teaching Scheme
Lectures - 3 hrs/week

Examination Scheme
Tests-20 marks, Mid-Sem.– 30 marks
End Sem. Exam– 50 marks

Unit 1 [8 hrs]

Principles of Precision Engineering

Introduction to Precision Engineering and Evaluation of High Precision; **Design Theory:** The Axiom of Minimum Information, The Principle of Functional Independence, The Principle of Total Design, The Principle of Zero Play, Abbe's Principle, The Principle of Compliance, The Principle of Minimization of Heat Deformation, The Principle of Smooth Motion, The Principle of Kinematics Design, The Principle of Error Correction, The Filter Effect Principle, The Reduction Principle

Unit 2 [7 hrs]

Machining Theory

The Principle of the Upper Limit for Machining Precision, The Principle of Element Technology, The Principle of Machining Units, The Copying Principle, The Principle of Evolution, The Anisotropic Principle, The Work Material Principle, The Principle of Distortionless Support, The Principle of Multistage Machining, The Principle of In-place Machining

Unit 3 [8 hrs]

Micro-manufacturing

Definitions, Sources Of Error, Basic Concepts Of Machining, Machine Tool Variables- accuracy, stiffness, spindle vibration, flatness, straightness, and smoothness of motion, 1-2 DOF systems, Feedback Variables, Cutting Tool Variables, Workpiece Variables, Environment Effects and Thermal Errors;

Unit 4 [7 hrs]

Introduction to Machining Analysis

Geometry of Cutting Edge, Energy Models, Comparison with Microscale Machining., size scales, scaling analysis, technology change, Lithographic Processes- Optical and X-ray;

Diamond Micromachining

Introduction, Diamond as a Tool Material, Compatible Materials, Diamond Performance, Diamond Machining, Micromechanical Applications, Diamond Machining as a Micromechanical Process Research Method.

Unit 5 [8 hrs]

Micromilling

Micromilling Tools, Process Results and Micromilling Applications- micromechanically milled X-ray masks, micromilled mask materials, Mask Absorption Quantification, Exposure Quantification

Introduction to Microdrilling

Microdrilling and Macrodrilling Techniques **and LASER MICROMACHINING** (laser Optics, Laser Ablation, Heat Affected Zone and Laser Polymerization).

Unit 6 **[7 hrs]**

Machine Tool Design

Machine Tool Structure, Drives and Control (CNC, Microprocessor and PLC), Sensor based Manufacturing (Agile manufacturing), Special Purpose Machine Tool Systems, Flexible Systems.

Text Books:

1. Hiromu Nakazawa, Principles of Precision Engineering, Oxford Univeristy Press,
2. Handbook of Machine Tools,M Weck(Vol.1-3)

ME 301-6- ENTREPRENEURSHIP DEVELOPMENT & COMMUNICATION SKILLS

Teaching Scheme

Lectures -3 hr/Week

Examination Scheme

Test-20 marks, Mid-Sem-30 marks
End Sem. Exam– 50 mark

Objectives

- Provide an exposure to potential learners to become job creators rather than job seekers
- It will consist of theoretical and practical aspects of becoming an Entrepreneur. The program will include lectures, interactive sessions with real life entrepreneurs, and visits to enterprises, Guest lectures/workshops by Banking, Production Marketing and other related professionals.

Unit 1 **[7 hrs]**

Entrepreneurship

- What is entrepreneurship?
- Importance and Relevance of Entrepreneurship
- Charms of being an entrepreneur
- Factors influencing entrepreneurship

Information on Support system

- Industrial terminology
- Planning a small scale enterprise
- Information on Sources of Support
- Financial agencies
- Other important agencies

Unit 2 **[7 hrs]**

Business Opportunity Identification

- Classification of business
- Environment scanning: Need Assessment
- Environment scanning: Resource Assessment
- Environment scanning: Sources of Supply: Analysis
- Environment scanning: Policy/economy Assessment
- Project Ideas
- Criteria for selection of Business Opportunity
- Project Feasibility
- Final Selection of business Opportunity

Market Assessment

- Market Assessment and Relevance: Need
- Market Assessment and Techniques: Tools
- Market Survey
- Sources of Market Information
- Preparation and use of Market Survey report in selecting the Product

Unit 3 [7 hrs]

Entrepreneurial Motivation

- Exploring Self
- Self Assessment
- Entrepreneurial competencies
- Goal Setting
- Systematic planning
- Team Building
- You too can do it
- **Technical report writing** – concepts, contents of a report , writing one or two reports
- An assignment on report writing.

Unit 4 [6 hrs]

Business Plan Preparation and Project Finance

- Market Feasibility
- Technical Feasibility
- Financial Feasibility
- Strategic Planning
- Implementation Schedule
- Loan Application and Disbursement Formalities

Unit 5 [6 hrs]

Small Business Management

- Planning for Success
- Crises management
- Problem Solving and Decision making
- Communication Skills
- Time management
- Quality management
- Value orientation in small business

Unit 6 **[7 hrs]**

- Recruitment
- Marketing management
- Financial management
- Costing and Pricing
- Statutory Requirements
- Labour related requirements
- Industry specific requirements
- Writing Executive Summary of a business proposal

Reference Books

- Small scale industries and entrepreneurial development, C.S.V. Murthy, TMH India publication.
- Course material developed by Entrepreneurship Development Institute Aheamadabad. Volume 1 to 10.

ME301-7- FINITE ELEMENT METHOD

Teaching Scheme
Lectures – 3 hrs / week

Examination Scheme
Test-20 marks, Mid-Sem.– 30 marks
End Sem. Exam– 50 marks

Objectives

The objective of the course is to teach the fundamentals of finite element method of solids, structures, and fluids with emphasize on the underlying theory, assumption, and modelling issues as well as providing hands on experience using finite element software to model, analyse and design systems of relevance to mechanical and aerospace engineers. This includes the theoretical foundations and appropriate use of finite element methods. Comprehend quantitative and analytical methods, Understand and perform engineering analysis of machine systems, Apply mathematics, and science and engineering to design, communicate ideas graphically and in writing

Unit 1 **[8 hrs]**

a. Fundamentals of FEM

Introduction, Historical background, Steps in FEM, Applications, Advantages and Disadvantages, Commercial FEM Softwares, Competing Technologies, Future Trends

b. Theoretical Approaches of FEM

Weighted residual, Variation Formulation, Ritz, and Galerkin methods. Sources of errors in FEM, FEM convergence requirement.

Unit 2 **[8 hrs]**

a. Discritization Of The Problem

Introduction, Geometrical approximations, Simplification through symmetry, Basic element shapes and behaviour, Choice of element type, Size and number of elements, Element shape and distortion, Location of nodes, Node and element numbering

b. Interpolation Functions And Simplex Elements

Introduction, simplex, complex and multiplex elements, linear interpolation polynomials for simplex elements, Natural co-ordinates, vector quantities, an axi-symmetric element

Unit 3 **[8 hrs]**

a. Assemblies And Solution Of The Finite Element Equations

Introduction, co- ordinate transformations, assembly of element equations, incorporation of the boundary conditions, solution of the equations, elimination method, penalty method

b. FEM Applied to Solid Mechanics Problems

Introduction, Classification of solid mechanic problems, Basics of elasticity, Formulation Of The Elements Characteristic Matrices And Vectors For Elasticity Problems, Derivation of stiffness properties for 1-D, 2-D elements and 3-D elements, Mesh generation and modelling concerns.

Unit 4 **[7 hrs]**

a. FEM for Trusses

Introduction, FEM equations, plane trusses, 3-dimensional trusses, Introduction to non-linear static elasticity problems – Material non-linearity, Geometric non-linearity.

b. FEM for Beams and Frames

Introduction, element formulation, load vector, boundary conditions, Shear force and bending moment, Beams on elastic support, plane and 3-d frames.

Unit 5 **[7 hrs]**

FEM for Heat Transfer Problems

Field problems, weighted residual approach for FEM, 1D and 2Dheat transfer problem

Unit 6 **[7 hrs]**

Further Applications Of The Finite Element Method

Introduction to non-linear problems, Buckling problems, Dynamic problems – Modal analysis.

Text Book:

1. Chandrapatala, Belgundu, "Introduction to Finite Elements in Engineering", PHI.
2. J. N. Reddy, "An Introduction to Finite Element Method", 2/e, McGraw Hill International Editions, ISBN 0-07-112799-2

Reference Books:

1. G.R. Liu, "The finite element methods ";Rakmo Press Pvt Ltd, New Delhi-20
2. R. D. Cook, D. S. Malku; "Concepts & Applications of Finite Element Analysis"; John Wiley & sons Publications 3/e 1989

3. "Finite Element Analysis- Theory and Practice"; Longman Scientific &Technical
4. A. J. Baker; "Finite Element Method 1-2-3"; McGraw Hill International Editions, ISBN 0-07-909975-0
5. O. C, Zienkiewicz; "The Finite Element Method – Basic Concepts and Linear Applications"; McGraw Hill International Editions; ISBN 0-07-084175-6

ME 301-8 – AUTOMOBILE ENGINEERING

Teaching Scheme
Lectures – 3 hrs / week

Examination Scheme
Test-20 marks,Mid-Sem.– 30 marks
End Sem. Exam– 50 marks

Unit 1 [6 hrs]

Introduction

Vehicle specifications, classifications, chassis layout, frame, main components of automobile and articulated vehicles. Engine cylinder arrangements, Design considerations, materials and their properties. Power requirements , motion resistance and power loss; tractive efforts and vehicle performance curves.

Unit 2 [8 hrs]

Steering and Suspension Systems

Steering system, principle of steering, centre point steering, steering linkages, steering geometry and wheel alignment, power steering.

Suspension system, need, types, independent suspension, coil and leaf springs, suspension systems for multi, axle vehicles, trouble shooting and remedies.

Unit 3 [6 hrs]

Transmission System

Clutches: need, types. Need of gearbox, types of gear transmission, shift mechanisms, over running clutch, fluid coupling, and torque converters. Transmission universal joint, constant velocity joint, propeller shaft, Hotchkiss drive, torque tube drive, front and rear axles types, stub axles, need of differential and types, four wheel drive.

Unit 4 [8 hrs]

Brakes, Wheels and Tyres

Brakes, need, types, Mechanical, hydraulic and pneumatic brakes, disc and drum types, their relative merits, details of components, brake adjustments and defects, power brakes. Wheels and Tyres: Types, tyre construction, specification, tyre wear and cause, wheel balancing.

Unit 5 [8 hrs]

Electrical Systems

Electrical systems – construction, operation and maintenance of lead acid batteries – battery charging system – principle and operation of cutout and regulators – starter motor– Bendix drive – solenoid drive – magneto coil and solid stage ignition systems – ignition-timing – lighting and electrical accessories – automobile air conditioning – panel board instruments.

Unit 6 **[8 hrs]**

Vehicle Testing and Maintenance

Need of vehicle testing, vehicle tests standards, different vehicle tests. Maintenance – trouble shooting and service procedure – over hauling –engine tune up, tools and equipment for repair and overhaul – organization and management of service station – testing equipments. Pollution due to vehicle emissions and exhaust emissions control systems and regulations. Selection of power unit and engine performance characteristics troubleshooting and rectification, engine tuning and servicing**.**

Text Books:

1. Automobile Engineering by Dr. Kirpal Singh (Vol. I & II) Standard Publishers
2. Automobile Engineering by G.B.S. Narang.
3. Automotive Technology by H.M. Sethi.
4. Automobile Engineering by Banga & Singh
5. Joseph Heitner'Automotive Mechanics', 2nd Ed., Affiliated Eastern Law house, 1967.
6. Dolan. J.A., 'Motor Vehicle Technology and Practical Work', ELBS, 1978

Reference Books:

1. Motor Vehicles, Newton & Steed
2. Motor Manuals (Vol I to VII), A.W. Judge.
3. Automobile Mechanics, W.H. Crouse. McGraw Hill ublishing Co

ME 302 - NUMERCIAL METHODS AND COMPUTER PROGRAMMING

Teaching Scheme
Lectures – 3 hrs / week

Examination Scheme
Test-20 marks,Mid-Sem-30 marks
End Sem. Exam– 50 marks

NUMERICAL METHODS I **[15 hrs]**

Bracketing and Open Methods. Rate of Convergence. Numerical Solution of Linear and Non-linear Simultaneous Equations: Gauss- Elimination, Gauss- Seidal, Gauss- Jordan, Relaxation Technique, Eigen values, Matrix- Inversion, Tridiagonal systems.

Numerical Integration using Newton- Cotes formulae, Gauss-Quadrature,Romberg Integration, Double Integration.

NUMERICAL METHODS II **[15 hrs]**

Approximation by Forward, Backward, Central and Divided Difference Formulae, Richardson Extrapolation Technique, Higher- order derivatives.

Least Square Technique, Linear, Exponential and Multiple Regressions.Interpolation by Newton's Formulae, Lagrange's, Spline Interpolation, Hermite and Stirling Formulae.

Ordinary Differential Equations
Taylor's Series, Picards Method, Euler's, Modified Euler's, Runge- Kutta (Second and Fourth Order), Predictor- Corrector, Simultaneous and Second Order differential Methods.

Text:
- Chapra, Cannale, " Numerical Methods for Engineers", McGraw-Hill Int.
- Shastry, "Introductory Methods of Numerical Analysis", Prentice Hall of India Delhi.

Reference:
- Rajaraman, "Computer Oriented Numerical Methods", Prentice Hall of India Delhi.
- T Veerarajan, T Rama Chandran, "Theory and Problems in Numerical Method" Tata McGraw-Hill
- William H. Press, Saul A. Tenkolsky, William T, Vellering, Brain P. Flannery "Numerical Recipes in C", Cambridge University Press.

ME 303 - HEAT TRANSFER

Teaching Scheme
Lectures: 4 hr/Week

Examination Scheme
Tests -20 marks, Mid Sem-30 marks
End Sem. Exam– 50 marks

Unit 1 **[7 hrs]**

Introduction
Modes/laws of heat transfer, Thermal Conductivity, Electrical Analogy in conduction, derivation of Generalized heat conduction equation in Cartesian coordinates. Its reduction to Fourier, Laplace and Poission's equation. thermal diffusivity. Generalized heat conduction equation in cylindrical and spherical co-ordinates (no derivation).

Unit 2 **[7 hrs]**

One dimensional steady state heat conduction
Heat conduction through a plane wall, cylindrical wall and sphere. Heat conduction through a composite slab, cylinder and sphere, effect of variable thermal conductivity, critical radius of insulation, Economic insulation, and thermal contact resistance. One dimensional steady state heat conduction with heat generation for plane wall, cylinder and sphere.

Unit 3 **[8 hrs]**

Extended Surfaces
Types and Applications of Fins. Heat transfer through Extended surfaces, derivation of equations for temperature distribution and heat transfer through fins of constant cross-section area. Effectiveness and efficiency of a fin. Errors in the measurement of temperature in a thermo-well.

Unsteady state heat conduction
System with negligible internal resistance, Biot and Fourier numbers. Lumped heat capacity method.

Unit 4 **[8 hrs]**

Convection

Local and average convective coefficient. Hydrodynamic and thermal boundary layer. Laminar and turbulent flow over a flat plate and in a pipe. Friction factor, laminar and turbulent flow over a flat plate. Drag and drag co-efficient.

Free and Forced Convection

Dimensional analysis in free and forced convection. Physical significance of the dimensionless numbers related to free and forced convection. Empirical correlations for heat transfer in laminar and turbulent flow over a flat plate and in a circular pipe. Empirical correlations for free convection heat transfer over horizontal, vertical plate cylinder.

Introduction to Condensation and Boiling

Modes of pool boiling, critical heat flux, burnout point, forced boiling. Film and drop wise condensation.

Unit 5 [8 hrs]

Radiation

Fundamental concepts, Black body radiation-Planck's distribution law, Wien's displacement law and the Stefan-Boltzmann law. Surface emission, radiative properties of a surface. The grey, black and real surface. Radiation shape factor, use of shape factor charts, Kirchoff's law, Lambert's cosine law.

Heat exchange between non-black bodies, heat exchange between two infinitely parallel planes and cylinders. Radiation shields, heat exchange by radiation, between two finite black surfaces. Gas radiation (elementary treatment only). Solar radiation, irradiation, radiation potential, electrical network method of solving radiation problems.

Unit 6 [7 hrs]

Heat Exchangers

Heat exchangers classification, overall heat transfer coefficient, heat exchanger analysis-use of log mean temperature difference (LMTD) for parallel and counter flow heat exchangers. LMTD correction factor, fouling factor. The effectiveness-NTU method for parallel and counter flow heat exchangers. Design considerations of heat exchanger, compact heat exchangers.

Text Books:

1. J.P. Holman: Heat Transfer; McGraw Hill Book Company, New York.
2. Gupta and Prakash: Engineering Heat Transfer, New Chand and Bros., Roorkee (U.P.) India.
3. R.C. Sachdeva: Fundamentals of Engineering Heat and Mass Transfer, Wiley Eastern Ltd., India.

Reference Books

1. Incropera and Dewitt: Fundamentals of Heat and Mass Transfer, John Wiley and Sons, New York.
2. Frank Kreith: Principles of Heat Transfer, Harper and Row Publishers, New York.
3. Donald Q. Kern: Process Heat Transfer, Tata McGraw Hill Publishing Company Ltd., New Delhi.

ME 304 - THEORY OF MACHINES – II

Teaching Scheme
Lectures – 4 Hrs / week

Examination Scheme
Test -20 Marks, Mid Sem-30 marks
End Sem. Exam-50 marks

Unit 1 **[7 hrs]**

Belt & Chain Drives

Introduction, Type of belts, Tension ratio in belts, Initial tension, Open & cross belt drive, Length of belt, Power transmitted by belt, chain drives. Advantages & Disadvantages of chain drive.

Unit 2 **[7 hrs]**

Cams and followers

Types of cams and followers, type of follower motion: SHM, uniform velocity, uniform acceleration and retardation, Cycloidal displacement, velocity and acceleration diagrams. Cams with specified contours.

Unit 3 **[7 hrs]**

Clutches, Brakes and Dynamometer

Introduction, Types of clutch, uniform wear and Uniform pressure for the clutch, Types of brakes, the braking of a vehicle, Dynamometer and its type.

Unit 4 **[8 hrs]**

Gyroscope

Introduction, Angular acceleration, Gyroscopic couple, Effect of gyroscopic couple on aeroplane, Naval ship, Stability of vehicles.

Unit 5 **[8 hrs]**

Balancing

Static and dynamic balance, balancing of revolving several masses on several planes, Balancing of reciprocating masses in single and multi cylinder engines, balancing Machines.

Unit 6 **[8 hrs]**

Mechanical Vibrations

Fundamentals, undamped and damped free vibrations of single degree freedom system, Forced vibration of single degree of freedom system, Critical speed of shafts.

Text Books:

1. Bevan Thomas "The Theory of Machines" CBS Publishers and Distributors
2. Ratan S. S. "Theory of Machines", Tata McGraw Hills
3. Dr. Bansal R. K. "Theory of Machines" Laxmi Publications Pvt. Ltd. New Delhi
4. Rao J.S. & Dukkipati R.V. , "Mechanisms and Machine Theory" New Age International Pvt. Ltd.

Reference Books:

1. Ulicker Jr. J.J., Penock G.R. & Shigley J.E. "Theory of Machines and Mechanisms" Tata McGraw Hills
2. Ghosh Amitabha & Mallik Asok Kumar, "Theory of Mechanisms and Machines" east-West Press Pvt. Ltd. New Delhi
3. Ramamurthy, "Mechanics of Machines" , Narosa Publishing House
4. Kimbrell J.T., "Kinematics Analysis and Synthesis" McGraw – Hill International Editons.

ME 305 - MACHINE DESIGN – I

Teaching Scheme
Lectures - 3 Hrs/Week

Examination Scheme
Tests-20marks, Mid-Sem. -30Marks
End Sem. Exam. -50 marks

Objectives

- To make student understand the general principles of designing mechanical components subjected to static loading with mechanical strength as design creterion
- To make students conversant with fundamental aspect of design.
- To make students conversant with different types of stresses induced in a component due to different types of static loading conditions.
- Having developed the above concept, make them competent in designing various components screw fasteners, shaft and coupling, spring, welded joints etc.
- To develop competency in designing a system involving the various component, as a design project in practical.

(Note – This course presents principles of design of mechanical components subjected to static loading with mechanical strength of the component as design criterion. Emphasis will be given on making an idealized physical model of given component with necessary corrections for geometry and loading, identifying the type of loading, geometry and its critical sections subjected to stresses, material of construction and their mechanical properties, calculation of stresses and comparison with critical strength and selecting suitable dimensions, related standards, and so on. Variety of practical situations will be considered and the generalization of the method of designing a mechanical component for mechanical strength, subjected to static loading will be emphasized. In this light, designing of components mentioned below will be studied in detail, in particular)

Unit 1 **[6 hrs]**

Fundamental aspect of design

The meaning of design, Engineering design, Phases of design, design consideration, stress and strain consideration, factor of safety, standardization , preferred series, material selection – weighted point method.

Unit 2 **[8 hrs]**

Design against static load

Commonly used engineering materials and their important mechanical properties – Cast Iron, Mild Steel, Non-ferrous materials like Copper and Brass, Stress-strain relationship, stresses due to bending and torsional load, design of cotter/knuckle, Turn-buckle joints, eccentric loading and theories of failure.

Unit 3 **[6 hrs]**

Design of screw and fasteners

Design of bolted and threaded joints, design of power screws, introduction to re-circulating ballscrew.

Unit 4 **[6 hrs]**

Design of shafts, keys and coupling

Shafts subjected to bending and torsion, types of keys and their design, design of rigid and flexible couplings

Unit 5 **[6 hrs]**

Design of mechanical springs

Design against static and fluctuating load, helical torsion spring, design of multi leaf spring, Nipping.

Unit 6 **[6 hrs]**

Design of welded joints

Types of welded joints, eccentrically loaded joints, welded joints subjected to bending moment.

Text Books

1. Shigley J.E. and Mischke C.R. – "Mechanical Engineering Design" McGraw Hill Publ.Co. Ltd.
2. Bhandari V.B. – "Design of Machine Elements" – Tata McGraw Hill Publ. Co. Ltd.

Reference Books

1. Spotts M.F. and Shoup T.E. – " Design of Machine Elements" – Prentice Hall International.
2. Black P.H. and O. Eugene Adams – " Machine Design" - McGraw Hill Book Co. Ltd.
3. William C. Orthwein – " Machine Component Design" – West- publishing Co. and Jaico Publ. House.
4. "Design Data" – P.S.G. College of Technology, Coimbatore.
5. Juvinal R.C. – " Fundamentals of Machine Components Design" – John Wiley and Sons.
6. Hall A.S.; Holowenko A.R. and Laughlin H.G. – " Theory and Problems of Machine Design" – Schaum's outline series.

ME306 - HEAT TRANSFER – LABORATORY

Teaching Scheme
Practical - 2 hrs/week

Examination Scheme
Term work - 50 marks
Practical/Oral- 50 marks

List Of experiments

Students have to perform following experiments: (Any Eight)

1. Determination of thermal conductivity of insulating powder.
2. Determination of thermal conductivity of a given metal rod.
3. Determination of thermal conductivity of a given liquid.
4. Determination of thermal conductivity of composite slab.
5. Determination of heat Transfer Coefficient in Natural Convection from Cylinder.
6. Determination of heat Transfer Coefficient in Forced Convection from Cylinder.
7. Determination of Critical Heat Flux
8. Study of Performance of parallel and counter flow heat exchanger
9. Determination of emissivity of given surface
10. Determination of Stefan Boltzmann Constant.

ME 307 - THEORY OF MACHINES – II LABORATORY

Teaching Scheme
Practical – 2 hrs/week

Examination Scheme
Term work – 50 marks
Practical/Oral- 50 marks

List Of experiments

The students should perform the following experiments.

1. To determine the belt slip.
2. To study frictional properties of clutch/brake lining and to determine experimentally torque carrying capacity and slip of the clutch or brake.
3. To determine the coefficient of friction and wear of a given material.
4. Study of mechanical/transmission type dynamometer.
5. Verification of Gyroscopic principle and determination of gyroscopic couple
6. Study of principle of static and dynamic balance machines.
7. Determination of natural frequency of transverse vibrations of a bar.
8. Determination of damping coefficient of torsional vibrations.
9. Determination of node point of two rotor system.
10. Determination of critical speed of shaft of single rotor.

Assignments:

The students should submit the following assignments as Term Work.
To draw cam profile for various types of follower motion

ME 308 - MACHINE DESIGN - I (DESIGN & DRAWING)

Teaching Scheme
Practical – 2 hrs/week

Examination Scheme
Term work - 50 marks
Practical/Oral- 50 marks

1. Term work shall consist of 'TWO' design projects. Each design project shall consist of two imperial size sheets – one involving assembly drawing with a part list and overall dimensions and the other sheet involving drawings of individual components. Manufacturing tolerances should be specified so as to make it working drawing. A design report giving all necessary calculations of the design of components and assembly should be submitted in a separate file.
   Design project should be in the form of " Design of Mechanical System" comprising of Machine elements studied and topics covered in the syllabus. Design data book shall be used wherever necessary to achieve selection of standardized components.
2. Three assignment of problems based on the syllabus.

The ORAL shall be based on Term Work.

LIBERAL LEARNING COURSE

OPEN ELECTIVE -I

ME 309 - MACHINE DESIGN – II

Teaching Scheme
Lectures - 3 hrs/Week

Examination Scheme
Tests -20marks, Mid - Sem. (30marks)
End Sem. Exam. -50marks

Objectives

- *Introduction to conventional and optimum design, aesthetic and ergonomic consideration in design*
- *To develop competency in designing various types of bearing and gears.*
- *To develop competency in designing a system involving the various components mentioned above, as a design project in practical.*

Unit 1 **[7 hrs]**

Design against fluctuating load

Stress concentration, fatigue failure, endurance limit, notch sensitivity, Goodman and Soderberg diagrams, and modified Goodman diagram, fatigue design under combined stresses.

Unit 2 **[7 hrs]**

Sliding contact bearing
Modes of lubrication, hydrostatic step bearing, and Reynolds's equation, bearing design, selection of parameters, and construction details of bearings.

Unit 3 **[7 hrs]**

Rolling contact bearing
Types, static and dynamic load carrying capacity, load-life relationship, selection of bearing from manufactures catalogue, comparison of sliding and rolling bearing.

Unit 4 **[8 hrs]**

Design of spur and helical gears
Design of spur gear: Force analysis, gear tooth failures, number of teeth, face width, beam strength of gear tooth, effective load on gear tooth, gear design for maximum power transmission.
Design of helical gear: Virtual number of teeth, tooth proportions, force analysis, beam strength of helical gears, effective load on gear tooth, wear strength of helical gears.

Unit 5 **[7 hrs]**

Design of Bevel gears
Force analysis, beam strength of bevel gears, Wear strength of bevel gears, and effective load on gear tooth.

Unit 6 **[7 hrs]**

Design of worm gears
Worm gear geometry and nomenclature, Force and efficiency analysis, Bending and surface fatigue strength, Worm gear thermal considerations, Methods of lubrications.

Text Books:

1. Bhandari V.B. – " Design of Machine Elements" – Tata McGraw Hill Publ. Co. Ltd.
2. Shigley J.E. and Mischke C.R. – "Mechanical Engineering Design" McGraw Hill Publ. Co. Ltd.

Reference books:

1. Spotts M.F. and Shoup T.E. – " Design of Machine Elements" – Prentice Hall
2. International.
3. Black P.H. and O. Eugene Adams – " Machine Design" – McGraw Hill Book Co.Ltd.
4. William C. Orthwein – " Machine Component Design" – West- publishing Co. and Jaico Publ. House.
5. "Design Data" – P.S.G. College of Technology, Coimbatore.
6. Juvinal R.C. – " Fundamentals of Machine Components Design" – John Wiley and Sons.
7. Hall A.S.; Holowenko A.R. and Laughlin H.G. – " Theory and Problems of Machine
8. Design" – Schaum's outline series.

ME 310 - ENERGY CONVERSION

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme
Tests-20 marks, Mid-Sem.– 30 marks
End Sem. Exam– 50 marks

Objectives*:*

- *To apply fundamentals of engineering thermodynamics to steam nozzles, steam turbines, condensers and gas turbines*
- *To study economics of power generation*

Unit 1 **[8 hrs]**

Steam nozzles

Compressible fluid flow, Static and Stagnation properties, Isentropic flow, Flow of fluid through nozzles, Continuity equation, Variation of velocity, area and specific volume, Mass of discharge, Maximum discharge, Critical pressure ratio, Choking, Effect of friction, Nozzle efficiency, Back pressure effect, Super saturated flow.

Unit 2 **[8 hrs]**

Steam turbines

Types of turbines, Compounding, Velocity diagrams, Performance analysis, Reheat factor, Stage efficiency, Governing, and Losses in turbines.

Unit 3 **[5 hrs]**

Condensers and Cooling Towers

Necessity of condenser, Types, Performance, Cooling towers, Types; Performance.

Unit 4 **[7 hrs]**

Gas turbines

Classification of gas turbines, Analysis, Regeneration, Inter-cooling, Reheating, Applications, Types of jet engines, Construction and working; propulsive efficiency

Unit 5 **[7 hrs]**

Economics of Power Generation

Loads- terms and definitions, Load duration curves, Factors, Performance of power plants at variable load, Energy rate, Cost analysis.

Unit 6 **[7 hrs]**

Solar Energy Conversion

Solar Energy, Thermal Conversion, Photovoltaic Conversion; Flat Plate and Concentrating Collectors, Thermal Energy Storage, Solar Ponds

Text Books:

1. T. D. Eastop and A. McConkey, "Applied Thermodynamics", Addison Wesley Longman
2. R. Yadav, "Steam & Gas Turbines & Power Plant Engineering", Central Publishing House, Allahabad, 2004
3. S. P. Sukhatme; Solar Energy: Principles of Thermal Collection and Storage; Tata McGraw-Hill Publishing Company Ltd

Reference Books:

1. M. M. ElWakil, "Power Plant Technology", McGraw Hill
2. H. A. Sorensen, "Energy Conversion"
3. A.W. Culp, "Energy Conversion", McGraw hill
4. P.K. Nag, "Power Plant Engineering", Tata McGraw Hill, 2nd edition

ME 311 - FLUID MACHINERY & FLUID POWER

Teaching Scheme
Lectures – 4 hrs / week

Examination Scheme
Tests-20 marks, Mid Sem-30 marks
End Sem. Exam– 50 marks

Objectives

- To understand the momentum principles and its applications to various fluid machinery
- To understand the hydraulic and Pneumatic systems and develop the skills for its design & analysis.

Unit 1 **[8 hrs]**

Momentum principle and its application

Impulse- momentum principle, Calculation of force exerted on fixed plate, moving flat plates &curved vanes, Calculation force exerted on series of moving vanes, velocity diagrams & their analysis.

Unit 2 **[8 hrs]**

Turbines

Classification, Various heads & efficiencies, Main components and constructional features of Pelton Wheel, Kaplan and Francis turbines, Velocity diagrams & analysis of Pelton, Francis turbines, Cavitation in water turbines, Governing mechanism, safety devices, Performance characteristics.

Unit 3 **[7 hrs]**

Pumps and Compressors

Classification, Constructional details, working and selection of various types of (Reciprocating and Rotary) pumps and Compressors, Characteristics curves, Specific speeds, Introduction to Jet pumps and Submersible pumps. Construction and Working of two-stage reciprocating compressor.

Unit 4 **[7 hrs]**

Fundamentals of Fluid power

Applications, advantages and dis-advantages of Hydraulic and Pneumatic systems. Various fluids used and their properties. Constructional details and Working of FRL unit. Drying of compressed air. Filters used in Hydraulic system.

Unit 5 **[7 hrs]**

Control Valve & Actuators

Various types of Pressure, Direction & Flow control valves. Impulse valve, speed regulators, time delay valve, shuttle valve, twin pressure valve, solenoid operated valve. Constructional details and Working of various types of Actuators. Seals and Packing.

Unit 6 **[8 hrs]**

Hydraulic and Pneumatic Circuits

Various symbols used. Basic Hydraulic and Pneumatic Circuits. Impulse operation, speed control, Actuation of pneumatic motor, sequencing of motion, use of roller operated valves, time delay circuit, Examples of Circuit design. Industrial Automation. Servo Mechanism.

Text Books:

1. Modi & Seth ,Fluid Mechanics & Fluid Machinery,Standard Book House 2002.
2. S.R. Majumdar, Pneumatic Systems Principles and Maintenance, Tata McGraw-Hill, N.Delhi, 2000.
3. S.R. Majumdar, Oil Hydraulic Systems and Maintenance, Tata McGraw-Hill, N.Delhi, 2001.
4. H.L. Stewart, Hydraulics and Pneumatics Power for Production, Industrial Press Inc. N.Y. USA, 2001.
5. Andrew Parr, Butterworth and Heinemann, Hydraulics and Pneumatics, Oxford, UK, 1987.
6. Espisito,Fluid Power with Application, Prentice Hall International,1998
7. J.J.Pipenger ,Industrial Hydraulics, McGraw Hill, N.York, 1981.

Reference Books:

1. Industrial Hydraulics Manual-Vickers Sperry Rand Corporation, Technical Training Centre, N.York, 1988.
2. Oil Hydraulics-P.Lal, International Literature, N.York, 1978.
3. ISO-1219:1988 Fluid Systems and Components.
4. Yeaple Franklin, Hydraulics and Pneumatics Power and Control, McGraw Hill Book. Co. N.York, 1966.
5. R.K.Rajput,A Text book of Fluid Mechanics and Hydraulic Machines, S.Chand Co.Ltd.,2002

ME 312 - I. C. ENGINES

Teaching Scheme

Lectures - 3 hrs/week

Examination Scheme

Test-20 marks, Mid-Sem.– 30 marks
End Sem. Exam– 50 marks

Objectives

- To understand basic cycles of working
- To study various systems of I.C. Engines
- To test and analyze the performance of I.C. Engines
- To study the combustion phenomenon in I.C. Engines
- To understand the effect and control of emissions

Unit 1 **[8 hrs]**

Thermodynamic cycles

Concept, Types, Fuel air cycles and their significance, Comparison with air standard cycles, Actual cycles, Time and heat loss factors, Exhaust blow down.

Unit 2 **[7 hrs]**

Fuel Supply System

System Components, Carburettor, Fuel injection in S.I. and C.I. engines, Introduction to supercharging and turbo charging.

Unit 3 **[8 hrs]**

Fuels and Combustion

Basic families of hydrocarbon fuels, Refining process, Qualities & properties of fuels, Rating of fuels, Alternate liquid and gaseous fuels, Combustion phenomenon in S.I and C.I. Engines, Pre-combustion, Knock, Detonation, Combustion chambers.

Unit 4 **[8 hrs]**

Testing and Performance

Determination of IP, BP, FP, Mean effective pressure, Fuel consumption, Air Consumption, Engine efficiencies, Performance characteristics, Energy balance.

Unit 5 **[7 hrs]**

Emissions and Controls

Air pollution due to I.C. Engines, Emissions, Euro norms, Emission control methods, Catalytic converters.

Unit 6 **[7 hrs]**

Other Systems

Starting, Ignition, Governing, Lubrication, Cooling and Exhaust systems

Text Books:

1. V. Ganesan, "Internal Combustion Engines", Tata McGraw Hill, Second Edition.
2. Mathur & Sharma, "A Course in Internal Combustion Engines ", R. P. Dhanapat Rai Pub. 1997
3. Heywood, "I.C. Engines Fundamentals", McGraw Hill

Reference Books:

1. Edward E. Obert, "Internal Combustion Engines and Air Pollution", Internal Educational Pub, 1973
2. Kirpal Singh, "Automobile Engineering Vol. I & II", Standard Publishers
3. Crouse W.H., "Automotive Mechanics", McGraw Hill

ME313 - MACHINE DESIGN - II (DESIGN & DRAWING)

Teaching Scheme

Practical: **2**-hrs/week

Examination Scheme

Term work - 50 marks

Practical/Oral- 50 marks

Term Work shall consist of 'TWO' design projects. Each design project should consist of two imperial size sheets – one involving assembly drawing with a part list and overall dimensions and the other sheet involving drawings of individual components. Manufacturing tolerances, surface finish symbols and geometric tolerances should be specified so as to make it working drawing. A design report giving all necessary calculations of the design of components and assembly should be submitted in a separate file. Design project should be in the form of Design of mechanical systems comprising of machine elements studied in the syllabus. Design data book shall be used extensively for the selection of components.
Three assignments of problems based on the syllabus.

The ORAL shall be based on Term Work.

ME314 - ENERGY CONVERSION LABORATORY

Teaching Scheme
Practical: 2-hrs/week

Examination Scheme
Term work - 50 marks
Practical/Oral- 50 marks

List of experiments

1. Study of nozzles,
2. Trial on Thermo-compressor.
2. Trial on steam turbine.
3. Study of condensers.
4. Study of jet engines.
5. Trial on Evaporative type Cooling Tower.
7. Visit to Solar Energy Conversion Plant.
8. Visit to Thermal Power Plant.

ME 315 - FLUID MACHINERY & FLUID POWER LABORATORY

Teaching Scheme
Practical: 2-hrs/week

Examination Scheme
Term work - 50 marks
Practical/Oral - 50 marks

List Of experiments

The journal consisting of at least eight experiments among the following should be submitted. Two experiments out of first three and the tenth experiment is compulsory.

1. Study and trial on Pelton Turbine for performance testing.
2. Study and trial on Francis Turbine for performance testing.
3. Study and trial on Kaplan Turbine for performance testing.
4. Study & trial on centrifugal pump for performance testing.
5. Study & trial on gear pump for performance testing.
6. Study and trial on two-stage air compressor.
7. Study of direction control valves and its use in hydraulic or pneumatic circuits.
8. Study of pressure control valves and its use in hydraulic or pneumatic circuits.
9. Study of flow control valves and its use in hydraulic or pneumatic circuits.
10. Design and analysis of hydraulic or pneumatic circuit using product catalogue of companies.

ME 316 - I. C. ENGINES LABORATORY

Teaching Scheme
Practical: 2-hrs/week

Examination Scheme
Term work - 50 marks
Practical/Oral - 50 marks

List of experiments (Any Eight):

1. Study of Modern Carburettor, Fuel Injector Pump & Nozzle.
2. Study of Ignition and Governing System.
3. Trial on Diesel engine- Variable load test and energy balance.
4. Trial on Petrol engine- Variable speed test and energy balance.
5. Morse Test.
6. Measurements of Exhaust Emissions of Petrol engine.
7. Measurements of Exhaust Emissions of Diesel engine.
8. Study of Combustion Chambers.
9. Visit to Automobile Industry (Compulsory).

ME 317 - UNCONVENTIONAL MACHINING PROCESSES

Teaching Scheme:
Lectures: 3 hrs/week

Examination Scheme:
Tests -20 marks Mid-Sem.– 30 marks
End Sem. Exam– 50 marks

Objectives:

- To learn about various unconventional machining processes, the various process parameters and their influence on performance and their applications

Unit 1 **[5 hrs]**

Introduction

Unconventional machining Process – Need – classification – Brief overview

Unit 2 **[10 hrs]**

Mechanical Energy Based Processes

Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining - Ultrasonic Machining. (AJM, WJM, AWJM and USM). Working Principles – equipment used – Process parameters – MRR-Variation in techniques used – Applications.

Unit 3 **[8 hrs]**

Electrical Energy Based Processes

Electric Discharge Machining (EDM)- working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications.

Unit 4 **[12 hrs]**

Chemical Energy Based Processes

Chemical machining techniques of applying maskants-Process Parameters – Surface finish and MRR-Applications. Principles of ECM-equipments-Surface Roughness and MRR Electrical circuit-Process Parameters-ECG - Applications.

Unit 5 **[10 hrs]**

Thermal Energy Based Processes

Laser Beam machining and drilling (LBM), plasma arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications

Unit 6 **[6 hrs]**

Electro-Chemical Energy Based Processes

Electro-Chemical machining (ECM)-Etchants maskant- techniques of applying maskants-Process Parameters – Surface finish and MRR-Applications. Principles of ECM-equipments-Surface Roughness and MRR Electrical circuit-Process Parameters- ECH - Applications.

Text Books:

1. Vijay.K. Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd., New Delhi, 2007

Reference Books:

1. Benedict. G.F. "Nontraditional Manufacturing Processes" Marcel Dekker Inc., New York (1987).
2. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw-Hill, New Delhi (2007).
3. Mc Geough, "Advanced Methods of Machining" Chapman and Hall, London (1998).
4. Paul De Garmo, J.T.Black, and Ronald.A.Kohser, "Material and Processes in Manufacturing" Prentice Hall of India Pvt. Ltd., New Delhi ,8th Edition,2001.

ME 318 - MODERN CONTROL SYSTEMS

Teaching Scheme:
Lectures: 3 hrs/week

Examination Scheme:
Tests -20 marks Mid-Sem.– 30 marks
End Sem. Exam– 50 marks

Objectives:

- Understand basic control concepts.
- Understand simple mathematical modeling.
- Study & analysis of system in time & frequency domain.

Unit 1 **[6 hrs]**

Introduction, system concept, open & closed loop systems, Mathematical model of physical system, Transfer Function, Review Of Various Types Of Transducers. Block Diagrams And Its Algebra, Block Diagrams For Speed, Temperature And Liquid Level Control Systems. Signal flow graphs.

Unit 2 **[6 hrs]**

Representation Of Control Components, Mechanical Components, Electrical Components, Analogies, Thermal System, Fluid System.

Unit 3 **[6 hrs]**

Hydraulic Systems:
Hydraulic Pump: Gear Type, Vane Type, Reciprocating Piston, Type, Hydraulic Cylinders, ydraulic Direction Control Valve : 2 Way, 3 Way, 4 Way, Valves, Flow Control Valve, Relief Valve, Hydraulic Servomotor, Hydraulic Coping Attachment.
Pneumatic Systems:
Pneumatic Cylinders, Flapper-Nozzle, System, Different Types Of Pneumatic Relays.
Electrical Systems:
D.C. Servomotor: Field Controlled, Armature Controlled, A.C. Servomotor, Positional Servomechanism, Stepper Motor.

Unit 4 **[6 hrs]**

Basic control actions & Pneumatic & Hydraulic controllers. [On/Off, P.I.D., P-I, P-D And Pid Type] Control actions, proptional controllers, obtaining derivative & integral counter actions, effects of integral and derivative control action on system performance.

Unit 5 **[6 hrs]**

Transient And Steady State Response: Introduction to standard test signals, Transient And Steady State Response For First Order System subjected to the Standard Signals. Transient and Steady state response of Second Order System.

Unit 6 **[6 hrs]**

Frequency Response Analysis And Stability Of Control System: -Frequency Response And Its Characteristics, Construction Of Bode Plot and Nyquist Plot, Gain Margin and Phase Margin, Concept Of Stability, Rouths Stability Criterion, Relative Stability.

Text Books:

1. Francis H. Raven: Automatic Control Engineering[Mc Graw Hill]
2. Kastuhiko Ogatta: Modern Control Engineering [Phi]
3. Dr. S.D. Bhide, S. Satyanarayan, N.A. Jalgaonkar: Feedback Control System. Technova Pub. [Pune]
4. John Pippenger :Industrial Hydraulics [Mc Graw Hill]

Reference Books:

5. Kuo: Automatic Control System [John Wiely &Sons,Canada Ltd.]
6. Harry L. Stewart: Pneumatics & Hydraulics [Audel Series]
7. Nagnath and Gopal:Control system Engineering.Tata-McgrawHill Publication.

ME 319 – POWER PLANT ENGINEERING

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme
Tests-20 marks, Mid-Sem.– 30 marks

End Sem. Exam– 50 marks

Objectives:

- To understand the basic working principles of stream, hydel, Diesel, as turbine power plant and boilers
- To understand the various ash and fuel handling equipments, equipments for burning the fuel, mechanical strokers, draught, and condenser types
- To understand the hydel power plant, selection of turbine, governing of turbines
- To understand the concept diesel and gas turbine power plant, reheating regeneration an inter-cooling in gas turbine power plant
- To understand Nuclear, geothermal and other power plant ,also comparison of all power plants
- To understand economics of various power plants.

Unit 1 **[8 hrs]**

Introduction to Power Plants & Boilers

Layout of Steam , Hydel , Diesel , MHD, Nuclear and Gas turbine Power Plants Combined Power cycles – comparison and selection , Load duration Curves, Steam boilers and cycles – High pressure and Super Critical Boilers – Fluidised Bed Boilers.

Unit 2 **[8 hrs]**

Steam Power Plant

Fuel and ash handling ,Combustion Equipment for burning coal, Mechanical Stokers. Pulveriser, Electrostatic Precipitator, Draught- Different Types, Surface condenser types, cooling Towers

Unit 3 **[5 hrs]**

Hydel Power Plants

Hydel Power plant- Essential elements, Selection of turbines, governing of Turbines- Micro hydel developments

Unit 4 **[7 hrs]**

Diesel and Gas Turbine Power Plant

Types of diesel plants, components , Selection of Engine type, applications-Gas turbine power plant- Fuels- Gas turbine material – open and closed cycles- reheating – Regeneration and inter-cooling – combines cycle

Unit 5 **[7 hrs]**

Other Power Plants

Nuclear Energy-Fission, Fusion Reaction, Types of Reactors, Pressurized water reactor,Boiling water reactor, Waste disposal and safety. Geo thermal- OTEC- tidel- Pumped storage –Solar central receiver system

Unit 6 **[7 hrs]**

Economics of Power Plants

Cost of electric Energy- Fixed and operating costs-Energy rates- Types tariffs- Economics of load sharing, comparison of various power plants.

Text Books:

1. Arora S.C and Domkundwar S, "A Course in Power Plant Engineering", Dhanpat Rai, 2001
2. Nag P.K ,"Power Plant Engineering". Third edition Tata McGraw- Hill ,2007

Reference Books:

1. EI-Wakil M.M ,Power "Plant Technology," Tata McGraw-Hill 1984
2. K.K.Ramalingam , " Power Plant Engineering ", Scitech Publications, 2002
3. G.R,Nagpal , "Power Plant Engineering", Khanna Publishers 1998
4. G.D.Rai, "Introduction to Power Plant Technology" Khanna Publishers,1995

CONSTITUTIONS OF INDIA

HUMANITIES COURSE