SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED

PROPOSED SYLLABUS FOR

T.E. (MECHANICAL ENGINEERING)

w.e.f. 2010-11

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED.

Teaching & Examination scheme for

Third Year Mechanical Engineering

w.e.f 2010-11

Part -I

Sr. No.	Subject	Teaching Scheme			Examination Scheme				
		L	**P**	**Total**	**Th**	**Test**	**TW**	**Pr**	**Total**
1	Engineering Metallurgy	04	02	06	80	20	25	25	150
2	Computer Oriented Numerical Methods	04	02	06	80	20	25	25	150
3	Automatic Control Systems	04	02	06	80	20	25	25	150
4	Heat Transfer	04	02	06	80	20	25	25	150
5	Machine Design- I	04	02	06	80	20	25	25	150
6	Technical Paper Presentation	--	02	02	--	--	25	25	50
	Total	**20**	**12**	**32**	**400**	**100**	**150**	**150**	**800**

Note: Industrial visit / tour is compulsory, student should visit the Industries like Foundry, Rolling Mills, Forging Industries, Automobile Industries.

Part -II

Sr. No.	Subject	Teaching Scheme			Examination Scheme				
		L	**P**	**Total**	**Th**	**Test**	**TW**	**Pr**	**Total**
7	Tool Engineering	04	02	06	80	20	25	25	150
8	Steam & Gas Turbine	04	02	06	80	20	25	25	150
9	CAD/CAM/CIM	04	02	06	80	20	25	25	150
10	Machine Design-II	04	02	06	80	20	25	25	150
11	Industrial Management & Quality Engineering	04	--	04	80	20	--	--	100
12	Dynamics of Machines	02	02	04	40	10	25	25	100
	Total	**22**	**10**	**32**	**440**	**110**	**125**	**125**	**800**

L- Lectures, P-Practical, Th-Theory, TW-Term-work, Pr-Practical exam

Note: Minimum two unit tests shall be conducted for each subject and average of best 2 shall be considered as test marks if more than two tests are conducted.

All the students shall undergo Inplant Training of 4 to 6 weeks in any industry during summer vacations. The students will submit a report and give a presentation on the same in Final year.

T.E. (Mechanical) Part I

ENGINEERING METALLURGY

Teaching Scheme :
Lectures : 4 Hrs/Week
Practical : 2 Hrs/Week

Examination Scheme:
Paper :80Marks(3 Hrs Duration)
Term work : 25 Marks
Practical Exam : 25 Marks

Unit - I: METALS & ALLOY SYSTEMS : 5Hrs

a) Metals, metallic bonds, crystal structure (BCC, FCC, HCP & BCT only), imperfection in crystals.
b) Alloy formation by crystallization, nucleation, solidification and growth, cooling curves, Effect of alloying elements on properties of steel.
c) Solid solutions and intermediate phases.
d) Phases and phase role.
e) Construction of equilibrium diagrams from cooling curves, Eutectic, Eutectoid, Peritectic transformations, dendritic structure and coring.
f) Dislocation & its types, Detailed study of Iron Carbon diagram.

Unit - II: : 8 Hrs

Metal extraction – Pig iron production, manufacture of steel by Basic oxygen steel making, Electric Arc steel making.
Cast Iron – Types, Properties, Microstructure & Uses of different Cast Irons. Effect of rate of cooling on Micro structure of Cast Iron.
Steel specification – Indian standard specifications, AISI – SAE and British specifications.
Plain Carbon Steel – Low carbon steel – Cold forming steel, DUAL phase steel.
a) Mild Steel – Conventional mild steel, free cutting steel.
b) Medium Carbon Steel : Rail steel, spring steel.
c) High carbon steel – Structural steel, high strength low alloy steel, Ni-Cr-Mo low alloy steels, ausformed steels, Maraging steels, TRIP steels.

Tool Steels & Its Types with Uses.
Stainless Steel – Types & Uses.
Super Alloys.

Unit – III: HEAT TREATMENT OF STEEL : 7 Hrs

Annealing – Stress Relieving, Full annealing, ISO thermal annealing, Diffusion annealing, partial annealing, Recrystallization annealing, process annealing, Spherodoising, Homogenising.
Normalising – Normalising V/s Annealing.
Hardening – Factors affecting, hardening methods, defects & Quenching stresses.
Tempering – Structural changes during tempering, effect of alloying elements on tempering, temper brittleness, Temper colors.
TTT – Curves & Effect of carbon on TTT-curves.
Austempering, Martemparing, Sub-zero treatment, Patenting.

Quenching media, effect of carbon content & effect of alloying elements on TTT curves.

Unit - IV: HEAT TREATMENT : **8 Hrs**

Chemical Heat Treatment of Steel

Carburising – Pack, Liquid and gas carburizing, vaccum carburizing. Post carburizing Heat Treatment, cyaniding V/s carbonitriding-cyaniding, carbonitording, Nitriding, plasma nitriding, salt bath nitriding, Nitro-carburising, boronizing, chromizing and Toyota diffusion process.

Surface Hardening

Flame hardening, Induction, Electron beam, Laser hardening, Case depth measurement in steel – Hardness method, Chemical method and macrostructure method and microscopic method.

Unit - V: NON-FERROUS METALS : **5 Hrs**

Copper & its alloys, **Aluminium** & its alloys, **Magnesium** & its alloys, **Titanium** & its alloys & **Bearing metals**.

Unit - VI: POWDER METALLURGY : **7 Hrs**

a) Basic steps of powder metallurgy process, powder manufacturing, characteristics of metal powders, secondary operations in powder metallurgy. Advantages, disadvantages & applications.

b) **Non-metallic Materials :**
   i) Composite materials & its types.
   ii) Plastics & its types
   iii) Ceramics & its types

TERM WORK

Term work shall consist of journal based on following experiments **(at least 8)**:

(i) Study of metallurgical microscope.

(ii) Preparation of specimen for microscopic examination.

(iii) Heat treatment of PCS and determine percentage of hardness.

(iv) Demonstration of N.D.T. (Any two different N.D.T. tests)

(v) Study of microstructure of PCS of various compositions.

(vi) Study of microstructure of various types of C.I.

(vii) Study of microstructure of various types of Non-ferrous metals.

(viii) Jominy end-quench test for hardenability.

(ix) Surface hardening and study of microstructure.

(x) Observation of various industrial heat treatment processes during industrial visit.

PRACTICAL EXAMINATION

It shall consist of practically identifying the given unknown specimen and oral based on the above prescribed syllabus.

REFERENCE BOOKS

(i) Material Science & Metallurgy for Engineers-Dr.V.D.Kotgire.

(ii) Physical Metallurgy-Principles & Practice by-V.Raghavan.

(iii) Introduction to Physical Metallurgy by-Sidney H. Avner.

(iv) Physical Metallurgy by-Virendra Singh.

(v) Heat Treatment Principles & Techniques by-T.V.Rajan, C.P.Sharma.

(Vi) Engineering Metallurgy by – R.A.Higgins Part I

T.E. (Mechanical) Part I

COMPUTER ORIENTED NUMERICAL METHODS

Teaching Scheme :
Lectures : 4 Hrs/Week
Practical : 2 Hrs/Week

Examination Scheme:
Paper :80Marks(3 Hrs Duration)
Term work : 25 Marks
Practical Exam : 25 Marks

UNIT – I : (06 Hrs)

REVIEW OF C- PROGRAMMING :

C-fundamentals, data types, expressions, I/o statements, Decision making, Loops, Function, Array

UNIT – II : (08 Hrs)

MODELING, APPROXIMATION AND ERRORS :

Simp0le mathematical model, accuracy and precision, error definitions, types of errors
Roots of equation :
Bracketing methods : Graphical methods, Bisection method, False position method
Open methods : Newton – Raphson method, Secant method, multiple roots

UNIT – III : (06 Hrs)

SYSTEM OF LINEAR ALGEBRAIC EQUATIONS :

Gauss elimination method, pitfalls of elimination, techniques for improving solutions, Gauss-Jordan method, Gauss-Seidel method, Matrix inverse, LU decomposition method

UNIT-IV : (06 Hrs)

CURVE FITTING :

Least squares regression, Linear regression, polynomial regression, multiple linear regression, Interpolation : Newton's divided difference, interpolating polynomials

LAGRANGE'S INTERPOLATION POLYNOMIALS & SPLINE :

Linear, quadratic and cubic interpolation

UNIT – V: (08 Hrs)

NUMERICAL DIFFERENTIATION AND INTEGRATION :

Newton Cotes integration formula, Trapezoidal rule, Simpson's rule and integration with unequal segments, Integration of equations, Romberg integration, Numerical differentiation

UNIT – VI : (06 Hrs)

DIFFERENTIAL EQUATIONS :

One step method, Euler's method, Modification and improvement of Euler's method, Runge-Kutta method, System of Equations, Partial differential equations, Laplace's equations.

Termwork :
The students should
Atleast 10 programs (using C) based on above syllabus.

Practical examination : Practical examination will be of 3 hours including oral examination based on syllabus.

TEXT BOOKS :

1. Steven C Chapra; Numerical Methods for Engineers, 5th Edition, McGrawHill Book
2. S.S.Sastry; Introductory Methods of Numerical Analysis, 4th Edition, PHI Publication
3. John H. Mathew; Numerical methods for mathematics, science and engineering, 2nd Edition, PHI Publication

REFERENCE BOOK :

1. I.P.Kandasamy, K,Thilagavathy, K.Gunavathi; Numerical Methods, S.CHAND Publication

T.E. (Mechanical) Part I

AUTOMATIC CONTROL SYSTEMS

Teaching Scheme :
Lectures : 4 Hrs/Week
Practical : 2 Hrs/Week

Examination Scheme:
Paper :80Marks(3 Hrs Duration)
Term work : 25 Marks
Practical Exam : 25 Marks

UNIT- 1

Basic Concepts : Various Elements of Control System, Open Loop & Closed Loop Control System with examples, Generalized Feed Back Control System, Concept of Transfer Function. **02 Hrs**

UNIT- 2

Block Diagrams & Signal Flow Graph : Rules for Block Diagram Reduction, Signal Flow Graph & Mason's Gain Formula, Elimination of Disturbances effect. Linearization of Non-Linear Functions, Linearization by Operating Charts & Simple Numerical. **05 Hrs**

UNIT- 3

Derivation of System Equations : Systems – Mechanical, Electrical, Thermal Fluid Pressure Relationships (1^{st} & 2^{nd} Order Systems) and their Block Diagrams & Transfer Functions. Analogy between Mechanical & Electrical elements using Ground Chair Representation. **05 Hrs**

UNIT- 4

Control Actions : Basic types of control actions, Discontinuous Mode Control Actions, ON-OFF Control Action, Floating Control Actions, Continuous Mode Control Actions (P, I, D, P+I, P+D, P+I+D), Operational Amplifier (Op-Amps) and design of PID Controller using Op-Amps. **05 Hrs**

UNIT- 5

Pneumatic Systems : Pneumatic Flapper Nozzle Valve, Pneumatic Diaphragm Valve, Pneumatic Relay, Pneumatic Actuating Valve, Pneumatic Flow / Position Control System, Pneumatic Amplifiers, Pneumatic PID Controller.
Hydraulic Systems : Hydraulic Servo Motor, Different types of hydraulic valves Hydraulic PID Controllers. **06 Hrs**

UNIT- 6

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

05 Hrs

UNIT – 7

Frequency Response Analysis: Stability analysis, Relative stability concepts, Bode attenuation diagrams, Gain margin and phase margin, Stability analysis using Bode plots, Simplified Bode Diagrams. Polar plots, Nyquist stability criterion, M&N circles.

06 Hrs

UNIT - 8

Root Locus Plots: Definition of root loci, General rules for constructing root loci, Analysis using root locus plots. **06 Hrs**

TERM WORK : It shall consists of any eight Experiments/ exercises on,

1. Experiment on open loop& close loop control system.
2. Experiment on ON-OFF temperature control.
3. Study of PID controller action.
4. Study of control system components.
5. Study of different types of pneumatic valves.
6. Study of different types of Hydraulic valves.
7. Building a pneumatic circuit using different pneumatic valves.
8. Building a hydraulic circuit for speed control of diesel engine/turbine.
9. Study of different types of stepper motor.
10. Experiment on speed control of DC motor
11. Experiment on position control of DC motor

PRACTICAL EXAMINATION :

It shall consists of oral based on above syllabus & term work.

TEXT BOOKS :

1. **Modern Control Engineering,** Katsuhiko Ogatta, Pearson Education,2004.
2. **Control Systems Principles and Design,** M.Gopal, TMH,2000.
3. **Automatic Control Engineering,** Francis H. Raven
4. **Process Control Instrumentation Technology,** Curtis D. Johnson
5. **Automatic Control System,** Benjamin C. Kuo (PHi)
6. **Modern Control Systems**, Richard.C.Dorf and Robert.H.Bishop, Addison Wesley,1999
7. **System dynamics & control**, Eronini-Umez, Thomson Asia pte Ltd. singapore, 2002.
8. **Feedback Control System**, Schaum's series. 2001.

T.E. (Mechanical) Part I

HEAT TRANSFER

Teaching Scheme :
Lectures : 4 Hrs/Week
Practical : 2 Hrs/Week

Examination Scheme:
Paper :80Marks(3 Hrs Duration)
Term work : 25 Marks
Practical Exam : 25 Marks

Course Objective:

The subject Heat Transfer is related to know the basic phenomena of heat transfer in the form of conduction, convention & radiation. The subject also deals with the study of heat transferring devices like heat exchangers. Being mechanical engineer the student must know the process of heat transfer in various heat transferring devices like boilers, turbines, heat exchangers, heaters etc.

UNIT-I INTRODUCTION: (06 HRS)

The importance of heat transfer in various fields, different models of heat transfer. Fourier's law, Newton's Law, Stefan Boltzman's law. Thermal conductance and resistance, thermal conductivity, variation of thermal conductivity with different factors. Different types of insulating materials, their properties, uses with examples. General three-dimensional heat conduction equation in Cartesian co-ordinates. Cylindrical co-ordinates. Spherical co-ordinates simple Numerical solution.

UNIT-II CONDUCTION: (06 HRS)

Thermal diffusivity, steady state one-dimensional heat conduction and temperature distribution in the following : plane wall, composite wall, hollow cylinder, sphere and composite cylinder. Critical radius of insulation and its importance. Introduction to unsteady state heat conduction through a plane wall , cylinder, sphere having no internal resistance. Numerical solution of steady and unsteady state one dimensional heat transfer.

UNIT-II HEAT TRANSFER FROM EXTENDED SURFACES: (06 HRS)

Types of fins, necessity of fins, heat transfer from a fin of uniform cross section, different end conditions to solve fin problems. Efficiency and effectiveness of fins, determination of thermometric error by theory of fins. Both end of fin connected to source temperature.

UNIT-IV RADIATION: (08 HRS)

Mechanism of heat transfer by radiation, basic laws of radiation; Planks law, Kirchoffs law, Stefan Boltzman law, Weins displacement law and lambert's cosine law, intensity of radiation, radiosity, radiation hat exchange between two black bodies. Electrical network analogy for radiation, heat exchange between two and three gray bodies, shape factor for simple geometries, properties of shape factor, radiation shields, heat transfer with radiation shields, error in thermocouple reading in radioation heat, theory.

UNIT-V CONVECTION: (07 HRS)

Mechanism of heat transfer by convection, natural and forced convection, hydrodynamic and thermal boundary layers, heat transfer coefficient for convection, effect of various parameter such as physical properties of the fluid system geometry, fluid flow, etc. on heat transfer coefficient Nu = f (Re , Pr). Imperical relation for convection heat transfer, physical significance of dimensionless numbers such as Nusselts' number, Grashoof's number, Prandtl's number, Reynolds' number and Stanton's number. Introduction to filmwise and dropwise condensation.

UNIT- VI HEAT EXCHANGERS: (07 HRS)

Definition, Classification, types, application, effect of fouling factor, determination of overall heat transfer coefficient, determination of L.M.T.D for different heat exchangers , special case of condenser evaporators and heat exchangers where heat capacities of both fluids are same. Effectiveness of heat exchangers, number of transfer units (NTU).

TERM WORK / PRACTICAL:

The term work shall consist of record of experiment (any eight) out of the listed below :

1 Measurement of thermal conductivity of metal.
2 Measurement of thermal conductivity of insulating powder.
3 Determination of heat transfer coefficient (forced) between surface and fluid.
4 Study of effect on heat transfer by using different fins form given surface.
5 Experiment on heat exchangers for different flow arrangements and for same or different fluids (can be two experiments)
6 Measurement of emissivity.
7 Determination of Stefan Boltzman constant Boiling heat transfer determination of critical heat flux and observe the phenomenon. Demonstration and Study of different types of insulating materials. Observation of phenomenon of dropwise and filmwise condensation.
8 Boiling heat transfer, determination of critical heat flux and observe the phenomenon.
9 Demonstration and study of different types of insulating materials.
10 Observation of phenomenon of dropwise and flim wise condensation.

PRACTICAL EXAMINATION :

It shall consist of practical and an oral based on above syllabus and term work.

RECOMMENDED BOOKS :

Heat transfer by J.P. Holman 7th Edition. McGraw Hill International (Edition 1992).
Engineering heat Transfer by C.P. Gupta and R. Prakash Nemchand and Bros. Roorkee
A course in Heat and Mass Transfer S. Dhanpat RAi and Sons Delhi.
A text book on Heat Transfer - Dr. S.P. Sukhatme orient Longman, Mumbai (1993)
Principle of Heat Transfer by Frank Kreith, Mari S. Both Harper and Row Publishers.

T.E –MECHANICAL PART-I

MACHINE DESIGN-I

Teaching Scheme :
Lectures : 4 Hrs/Week
Practical : 2 Hrs/Week

Examination Scheme:
Paper :80Marks(3 Hrs Duration)
Term work : 25 Marks
Practical Exam : 25 Marks

Subject Objective:

The subject Machine design is related to know the basic idea about the component design for automobiles. The students must know about the customers need in the form aesthetic, ergonomic, economic, product.

Henry Dreyfuss say " If the point of contact between the product and people becomes a point of friction, then the industrial designer has failed. On the other hand if the people are made safer, more efficient, more comfortable or just plain happier, by contact with the product, then the designer has succeeded.

UNIT-1 **(04hrs)**

INTRODUCTION:

A) **FUNDAMENTAL PRINCIPLES**: Definition, Meaning Of Design, Mechanical Engineering design, Design procedure, Phases of design, Static equilibrium, Center of gravity, Moment of inertia, Principle of superposition, Factor of safety, Selection of factor of safety.

B) **GENERAL CONSIDERATION:** Materials selection, Aesthetic and Ergonomic consideration, Value analysis, BIS System for steel designation, Copper alloys, Aluminum alloys, Plastics, Natural and Synthetic rubbers, regression, population combinations, Concurrent Engineering, Weighted point method, creep.

UNIT-2 **(12hrs)**

A) **DESIGN AGAINST STATIC LOAD:** Static Load, Stress, Strain, Stress Strain Relationship, Modes of failure, Failure of ductile materials, Failure of brittle materials, Stress due to bending moment, Stress due to torsional moment, Eccentric axial loading, Design of machine parts subjected to combined direct and bending stress.

B) **DESIGN OF COTTER AND KNUCKLE JOINT**: Introduction, Cotter joint, Applications of the cotter joint, Types of cotter joint and their design, Introduction of knuckle joint, Applications of knuckle joint, Design procedure of knuckle joint.

C) DESIGN AGAINST FLUCTUATING LOAD: Definition, Stress concentration, Causes of stress concentration, Stress concentration factor, Reduction of stress concentration, Fluctuating stress, Fatigue failure endurance limit, S-N curve, Low cycle and High cycle fatigue.

Endurance Limit: Approximate estimation, Reversed stresses- Design for finite and infinite life, Cumulative damage in fatigue, Soderberg and Goodman lines, Modified Goodman diagrams, Gerber equation, Fatigue design under combined stresses.

UNIT-3 **(04hrs)**

DESIGN OF POWER SCREWS: Definition of power screw, Application, Forms of threads, Force analysis of square and trapezoidal threads, Self locking screw, Efficiency of square threaded screw, Efficiency of self locking screw, Collar friction torque, Overall efficiency, Design of screw nut, Differential and compound screws, Recirculating ball screw.

UNIT-4 **(06hrs)**

DESIGN OF JOINTS:

A) **THREADED JOINTS**: Introduction, Definition, Basic types of screw fastening, Cap screws, Set screws, Eccentrically loaded bolted joints in shear, bolted joint under fluctuating load, Bolted joints with combined stresses.

B) **RIVETED JOINTS**: Introduction, Definition, Types, Methods of riveting, Types of rivet heads, Types of riveted joints, Strength of joint, eccentric loaded riveted joint.

C) **WELDED JOINTS**: Introduction, Definition, Types, Stresses in Butt fillet joints, Strength of welded joints, Eccentrically loaded joints, subjected to bending moment and fluctuating forces.

UNIT-5 **(08hrs)**

DESIGN OF SHAFTS, KEYS AND COUPLINGS:

A) Shafts: Introduction, Shaft design on strength, Shaft design on torsional rigidity, ASME code for shaft design, Castigliano's theorem, Area moment method, Graphical integration method.

B) Keys: Definition, Types of keys and their design, Splines and their design.

C) Couplings: Definition, Muff coupling, Design of Muff coupling, Rigid flange coupling, Design procedure for rigid flange coupling, Bushed pin flexible coupling, Design for flexible coupling, design for lateral rigidity.

UNIT-6 **(06hrs)**

DESIGN OF SPRINGS:

Definition, Function, Application, Types, Terminology of helical spring, Stress and deflection equation, Series and parallel connections, Spring materials, Styles of ends, Static load design against fluctuating load, Optimum design of helical spring, Helical torsion spring, Multi leaf springs, Design of multi leaf spring, Nipping of leaf springs, Shot peening.

TERM WORK:

Two full imperial size sheets with the design problems as given below.

1. At least one problem of the following
   Cotter joint, (Differential joints), Knuckle joint.
2. At least one problem (Details and Assembly) out of Screw jack, Couplings, Toggle jack etc.
3. Assignment on each unit

PRACTICAL/ORAL EXAMINATION:

It shall consist of Practical / Oral based on the above syllabus and Term work.

REFERENCE BOOKS:

1. Design of Machine elements –By V.B. Bhandari, Tata Mc Graw Hill Co.
2. Mechanical Engineering Design –By J.E. Shigley,Tata Mc Graw Hill Co.
3. Machine Design –By Pandey and Shah, Chalotar publishing house.
4. Design of machine elements –By M.F. Spotts, Prentice hall of India Ltd.

T.E. (Mechanical) Part I

Technical Paper Presentation

Teaching Scheme :
Practical : 2 Hrs/Week

Examination Scheme:
Term work : 25 Marks
Practical Exam : 25 Marks

Technical Paper Presentation is a seminar which is expected to be on a state – of – the – art technical topic, related to Mechanical Engineering discipline but outside syllabus. The seminar report and its presentation is to be based on material, mainly collected and analysed from the latest papers in technical journals. The report is expected to be of about 15 A4 size pages, including figures and plates, in addition to certificate, synopsis and reference pages. The presentation is expected to be in front of the audience which must include at least two internal examiners one of them being a guide. The marks distribution is equally divided between the report and presentation.

T.E. (Mechanical) Part II

TOOL ENGINEERING

Teaching Scheme :
Lectures : 4 Hrs/Week
Practical : 2 Hrs/Week

Examination Scheme:
Paper :80Marks(3 Hrs Duration)
Term work : 25 Marks
Practical Exam : 25 Marks

Objective of Subject :

To introduce students to the design practices of toolings (Jigs & Fixtures) and die design for presswork

Unit - I: Theory of Metal Cutting : (04 Hrs)

Tool Geometry, Tool Signature, Chip Formation & Types of Chips, Types of Cutting, Tool Wear, Surface Finish, Cutting Fluids, Machinability & Machinability Index, Forces in Cutting Merchant's Circle.

Unit - II: Introduction to jigs & fixtures : (04 Hrs)

Necessity, basic concepts of jigs & fixture for different manufacturing processes. **Location & clamping system :** Principles, types, applications, locating pins , pads, diamond pins, adjustable supports, Vee & post locators, Clamping system principles, types, screw clamp, strap, lever, hing type, cam operated, toggle clamps, centralizer & equalizer clamp, multiple clamping, quick acting clamp, pneumatically operated clamps.

Unit - III: Design Of Jigs : (06 Hrs)

Principles of jig design, types of jigs : plate, template, box, channel, sandwich, latch, tumble, turn over jig etc; types of bushes, selection of bushes & liners, construction of jigs & fixture bodies by using standard parts.

Unit - IV: Design Of Fixtures : (06 Hrs)

Principles of fixture design, types of fixture-gang, straddle, vertical slot, sting milling fixture etc. selection of suitable type, design of milling fixtures, use of setting block, tennons, T bolt etc. Design of turning fixture for lathe.

Indexing System : Necessity, different indexing system for jigs & fixtures.

Unit - V: Introduction to Press Tools : (04 Hrs)

Dies, punches, types of presses, types of dies, simple, compound, combination & progressive dies, press tools for operations like blanking, piercing, drawing, shaving, trimming etc.

Unit - VI: Design of Die Set for Cutting Operations : **(04 Hrs)**

Theory of metal cutting, cutting force & blank holding force estimation, punch & die clearance, scrap strip layout, design of punches, design of dies, pilots strippers, stock stops, finger stops, auto stops centre of pressure, selection of die set.

Unit - VII: Design of Drawing Die : **(06 Hrs)**

Blank size determination, no. of draws, stage wise achievement of drawn component, stage wise components drawing, drawing radii & clearance, drawing force, defects in drawing.

Unit - VIII: Miscellaneous Dies : **(06 Hrs)**

Miscellaneous dies like-cut off dies, trimming, shaving, bulging, rubber, lancing, slitting, horn type, side cam dies, bending , forming curling dies etc. (theoretical treatment only).

TERM WORK

Term work shall consist of following :

(i) Study of various elements of Jigs & Fixtures.

(ii) Design & drawing of two drilling / reaming Jigs (details of drawing on one full size sheet showing tolerance & materials specification).

(iii) Design & drawing of two milling fixtures (details of drawing on one full size sheet showing tolerance & materials specification).

(iv) Design & drawing of one progressive die.

(v) Design & drawing of one drawing die.

REFERENCE BOOKS

(i) Tool Design, Donaldson (TMH).

(ii) Tool Design, Pollock, Reston Publication Co. Inc.

(iii) An Introduction to Jigs & Tool Design, M.H.A.Kempster, (ELBS).

(iv) A Text Book of Production Engineering, P.C.Sharma, S.Chand.

(v) Hand Book of Die Design, Suchy (McGraw Hill).

(vi) Die Design Fundamentals, J.R.Paquin, R.E.Crowley, Industrial Press Inc.

(vii) Jigs & Fixtures, P.H.Joshi, TMH.

(viii) Techniques of Press Working of Metals by Eary & Reed.

(ix) CMTI Machine Tool Design Hand Book (TMH).

(x) Design Data Hand Book – P.S.G.College of Tech. Coimbtore.

T.E. (Mechanical) Part II

STEAM AND GAS TURBINES

Teaching Scheme :
Lectures : 4 Hrs/Week
Practical : 2 Hrs/Week

Examination Scheme:
Paper :80Marks(3 Hrs Duration)
Term work : 25 Marks
Practical Exam : 25 Marks

Objective:-

1) To make aware the student about the details of power generation in thermal power plants.
2) To develop analytical competency in solving the problem of energy conversion in thermal power plants.
3) To develop the analytical skill regarding performance of different elements used in power plants.

Unit I:

STEAM GENERATORS: Introduction, classification of boilers , Types of boilers (Babcock and Wilcox , Benson, Lamont Loeffler, volex boilers), mountings and Accessories. **(4 Hrs)**

PERFORMANCE OF STEAM GENERATOR: Thermodynamic properties of steam, steam table and molliar chart. Evaporation rate, equivalent evaporation, factor of evaporation, boiler efficiency , Heat losses in boiler plant, boiler trial and heat balances. **(4 Hrs)**

Unit II:

TYPES OF STEAM TURBINES : Principle of operation of steam turbines, comparison of steam engines and turbines, classification of steam turbines, simple impulse turbine, compounding of impulse turbine, pressure compounded impulse turbine, reaction turbines, combination turbines, difference between impulse and reaction turbines turbine. **(4Hrs)**

RANKINE AND BINARY VAPOUR CYCLES : Simple Rankine cycle, working principle, thermodynamic analysis, effect of operating conditions on efficiency, principles of increasing the thermal efficiency, deviation of actual cycle from theoretical cycle, Binary vapor cycle. **(4 Hrs)**

Unit III: **(6 Hrs)**

NOZZLES AND DIFFUSERS : Introduction, Types of nozzles, Types of diffusers, equation of continuity, sonic velocity and mach number, SFEE in nozzles, gas nozzles, momentum equation for the flow through steam nozzles, entropy changes with friction, nozzle efficiency, effect of friction on the velocity of steam leaving the nozzle, shape of nozzle , for uniform pressure drop , mass for discharge though nozzles, throat pressure for maximum discharge, existence of critical pressure in nozzle flow or choked flow. Maximum discharge of saturated steam, maximum discharge of steam initially superheated, general relationship between area, velocity and supersaturated flow, in nozzles, effect of variation in back pressure, parameters affecting the performance of nozzles.

Unit IV: **(5 Hrs)**

REGENERATIVE FEED HEATING CYCLE : Introduction, most ideal regenerative feed heating cycle, regenerative feed heating cycles and their representation on T–s and H –s diagram, representation of actual process on T -s and H –s diagram in regenerative cycle, other types of feed heating arrangement, optimum feed water temperature and saving in heat rate, advantage

and disadvantage of regenerative feed heating cycles over simple Rankine cycle. Feed heaters, direct contact heaters, surface heaters, deareators

Unit V: **(6 Hrs)**

RFHEATING,REHEATING – REGENERATIVE AND REGENERATING WATER – EXTRACTION CYCLES : Flow wet steam in nozzles, velocity diagram for dry steam and water particles, corrosions to condition curve for wetness, erosion and corrosion of blades, reheating of steam, practical reheating and non reheating cycles, advantages of reheating, disadvantage, regenerative water extraction cycles, practical feed heating arrangements, advantages and disadvantages of turbine drives, boiler feed pump.

Unit VI: **(8 Hrs)**

GAS TURBINES : Simple open cycle gas turbine, air standard Joule cycle, actual Brayton cycle. Cycle air rate, cycle work ration, means of improving the efficiency and specific output of simple cycle.

Open cycle gas turbine with regeneration, open gas turbine cycle with reheat., open gas turbine cycle with inter cooling , open gas turbine cycle with reheat and regeneration, effect of regeneration, inter cooling and reheating on efficiency, water injection.

Closed cycle gas turbine, advantages and disadvantages of closed cycle gas turbine over the open cycle.

Basic gas turbine components, compressors, centrifugal and axial flow compressors, surging, pre-whirl, choking flow, stalling, combustion chambers and factors affecting combustion chamber performance, turbine blade cooling, application of gas turbines

TERM WORK:-

Students should submit at least 8 assignments based on the above syllabus.

PRACTICAL EXAMINATION :-

It shall consist of oral based on above syllabus and term work.

Text Books:

Steam and Gas Turbines - R. Yadav.

Thermal engineering – Dr. C.P. Kothandaraman
S. Domkundwar

Reference Books:

Steam Turbines - Theory and Practice – W.J. Kearton.

Gas Turbine theory – N. Cohen, F.C. Rogers.

Steam Turbines – Church

Theory and Design of Steam and Gas Turbines – J.F Lee.

T.E(Mechanical) Part II

CAD/CAM/CIM

Teaching Scheme :
Lectures : 4 Hrs/Week
Practical : 2 Hrs/Week

Examination Scheme:
Paper :80Marks(3 Hrs Duration)
Term work : 25 Marks
Practical Exam : 25 Marks

Unit-I:

Transformations- 6Hrs

Introduction, 2D and 3D transformations,Formulation, Translation, Rotation, Scaling, Reflection, Homogenous Representation, Concatenated Transformation, their use in automation of orthographic projections.

Solid modelling- 7 Hrs

Wire frame modelling, solid modelling, surface modelling, feature based modelling(FBM), hybrid modelling, their merits and demerits. Need of solid modelling, study of different representation schemes in solid modelling, - primitive instancing, generalized sweeps, boundary representation, constructional solid geometry, special occupancy enumeration.

Unit-II

Introduction to NC/CNC- 7 Hrs

NC/CNC applications, benefits, basic components, classification of NC/CNC machine tools, reference points, component dimensioning in NC/CNC. NC motion control modes, types of interpolation, axis designation in NC/CNC. File formats, issues in file transfer and integration, tooling on CNC-introduction. Punched tape, manual data input, types of tape coding formats, EIA and ISO codes, use of subroutines and canned cycles, tape readers, NC words, NC procedure.

Unit-III

Part Programming- 8 Hrs

NC part programming, APT, macro statements

Unit-IV

CIM 9 Hrs

Introduction to CIM, basic building blocks of CIM, Product data management for CIM, Integration of the production management and business functions for CIM ,tool handling systems, material handling systems, distributed NC, material handling and storage systems, robots, AGV systems, AS/RS etc. Development for total material handling system. Inspection and communication in CIM.

Automatic inspection systems, use of CMM, communication systems, links in the networks, computer control systems from product design to manufacturing. Group technology – Introduction to GT, part families, parts classification and coding, production flow analysis, machine cell design, benefits of GT.

FMS 3 Hrs

Scope of FMS, types, elements, benefits of FMS, flexible cell,FMS system design, development and utilization.

TERM WORK

It shall consists of any eight assignments/ exercises on,

1. Assignment on 3D transformations.
2. CAD for any one simple machine element and/or system such as shafts, beams, gears, springs, cams, screw jack, crane hook etc/ case study.
3. Study of any one generalised/customised CAD software, like AUTOCAD, IDEAS, PRO-E, UNIGRAPHICS, CATIA etc.
4. NC part programming
5. APT programming
6. FMS
7. CIM
8. AGV's
9. AS/RS
10. CMM

PRACTICAL EXAMINATION:

It shall consists of an oral based on above syllabus and term work.

REFERENCES

- Groover M. P. & Zimmer E. W.-CAD/CAM – Pearson Education
- P.N. Rao -CAD/CAM, Principles & Applications-Tata McGraw Hill
- T.K. Kundra- Numerical Control& Computer aided Manufacturing –TMH
- P. Radhakrishnan - CAD/CAM/CIM –New Age International Ltd.Publishers New Delhi
- Mathematical elements of computer graphics- Rogers, Adams- Tata McGraw Hill
- Automation, Production systems and CAM- Groover M. P. – Prentice Hall India
- CNC machines-B.S. Pabla, M. Adithan- Willey Eastern Ltd

T.E. (Mechanical) Part II

MACHINE DESIGN - II

Teaching Scheme :
Lectures : 4 Hrs/Week
Practical : 2 Hrs/Week

Examination Scheme:
Paper :80Marks(3 Hrs Duration)
Term work : 25 Marks
Practical Exam : 25 Marks

Unit I: **(4Hrs)**

Design of Flexible Mechanical Elements:

Materials and construction of flat and V belts, Geometric relationships for length of belt, Power rating of belts, Maximum power condition, Selection of flat and V belts from Manufacturer's catalogue, Belt tensioning methods, Relative advantages and limitations of flat and V belts.

Chain drives , roller chains, polygonal effect.

Unit II: **(8Hrs)**

Friction Clutches and Brakes:

Friction Clutches :

Classification and selection of friction clutches, Torque transmitting capacities and design of single-plate, multi-plate, Cone and Centrifugal clutches, Types of friction materials, their advantages, limitations and selection criteria.

Brakes :

Energy absorbed by brake, Design considerations in Pivoted block brake with short and long shoe, Internal expanding shoe brake ,Band brake and Disk brake, Thermal considerations in brake design.

Unit III: **(8Hrs)**

Gear Drives :

Classification of gears, Selection of types of gears, Gear trains

Spur Gears:

Basic tooth dimensions, Types of gear tooth failure, Desirable properties and selection of gear material, Constructional details of gear wheel, Force analysis, Beam strength (Lewis) equation, Velocity factor, Service factor, Load concentration factor, Effective load on gear, Wear strength (Buckingham's) equation, Estimation of module based on beam and wear strength, Estimation of dynamic tooth load by velocity factor and Buckingham's equation, Methods of gear lubrication, Introduction to addendum modification and its advantages**.**

Unit IV: **(8Hrs)**

Helical, Worm and Bevel Gear:

Helical Gears: Kinematics, tooth proportions, force analysis, strength analysis**.**

Bevel Gears: Straight tooth bevel gear kinematics, force analysis, strength analysis.

Worm Gearing: Kinematics, tooth proportions, force analysis, strength analysis.

Introduction to AGMA gear design procedure.

Unit V:

Rolling contact bearings: **(6Hrs)**

Types of rolling contact Bearings, Static and dynamic load carrying capacities, Stribeck's equation, Equivalent bearing load, Load-life relationship, Selection of bearing life, Selection of rolling contact bearings from manufacturer's catalogue, Taper roller bearing, Design for cyclic loads and speed, Bearing with probability of survival other than 90%, Lubrication and mounting

of bearings, Preloading of rolling contact bearings, Types of failure in rolling contact bearings – causes and remedies.

Unit VI:

Lubrication and journal bearings: (6Hrs)

Types of lubrication, viscosity, Petroff's law, stable lubrication, thick film lubrication, Hydrodynamic theory, design considerations, bearing performance, pressure feed bearings, heat balance, bearing design, bearing types, bearing materials, boundary lubricated bearings.

Reference Books

1. Shigley J.E. and Mischke C.R. – "Mechanical Engineering Design" McGrow Hill Pub. Co. Ltd.
2. Bhandari V.B. – "Design of machine elements" – Tata McGrow Hill Public Co. Ltd.
3. Hall-"Theory and problems of Machine Design"- SI Edition,Schaum's outline series.
4. Kulkarni S.G. – Machine Design- TMH Outline Series
5. "Design Data" – P.S.G. College of Technology, Coimbatore.
6. Spott's M.F. and Shoup T.E. – "Design of Machine elements" – Prentice Hall International.
7. Black P.H. and O. Eugene Adams – "Machine Design" – McGrow Hill Book Co. Ltd.
8. Andrew D DIMAROGONAS -"Machine Design: A CAD Approach", John Wiley Sons, Inc, 2001.

Term Work:

1. Two imperial size sheet consisting of assembly and detailed component drawing with all specifications on any one design problem from the following
   Design of single plate/ multi plate/ centrifugal/ cone clutch assembly.
   Design of flat or V- belt drive
   Design of single stage or two stage gear box using spur/helical/bevel/worm gears.
2. Assignment on any of the four topics from the six units mentioned above consisting of theory and design numerical.
3. One computer program written in C or C++ for design of any one machine elements out of above syllabus.

Practical examination:

It shall consist of oral based on above syllabus and term work.

T.E. (Mechanical) Part II

Industrial Managent And Quality Engineering

Teaching Scheme : Lectures : 4 Hrs/Week

Examination Scheme: Paper :80Marks(3 Hrs Duration)

Course Objective:

1. Making the students well acquitted with basic aspect of managerial and organizational Skills.
2. Making the students well acquainted with basic concept to quality and it's corelational criteria's to implement the concept of quality.

UNIT-I INTRODUCTION TO INDUSTRIAL MANAGEMENT : (O7 HRS)

Definition and Concept of management. Evolution of management thoughts by Gilberth , Fesset, Mayo , Fayol : F.W. Taylor's scientific management Principles and functions of management. Difference relationship between management. Administration and organization.

UNIT-II ORGNIZATION : (O7 HRS)

Definition, Concept and Principles of organization, Elements and types of organization, Organization. Chart, Design of organization structure , Organizational behavior, Industrial ownership wise Proprietorship, Partnership, J.S.O. , Public limited companies and Govt. undertakings.

UNIT-III DEPARMENTS : (05 HRS)

Various departments like Material, marketing, production, finance and personal in Industry with their brief functions and objectives. Leadership styles ; Decision making.

UNIT-IV INTRODUCTION TO QUALITY ENGINEERING : (06 HRS)

Meaning of engineering. Definition; concept and significance of quality. Gurvin's five definations and Eight Dimensions of quality . Introduction to management quality philosophies like W.E. Deming Joseph Juran ; Philip crosby ; K.Ishikawa. Defination of total quality management.

UNIT-V QUALITY COST : (06 HRS)

Classification of different quality costs. Model of optimum quality cost. Analysis of quality cost. Cost of poor quality, guidelines to establish and cut down quality cost.

UNIT- VI DATA ANALYSIS : (09 HRS)

Scope of data analysis Basic probability concept like histogram , box and whisker plot. Probability distribution- Normal, Exponentiation. Poisson and Binomial and it's applicability. Hypothesis Testing and drawing conclusion. Simple numericals based on above.

REFERENCES BOOKS :

1. Industrial Engiand Management. : O.P. Khanna
2. Management Today Principales and Practice by Gene Burton MaThakur : McGraw Hill (1996)
3. Industrial organization and Management : Bangg Sharma
4. Quality planning and analysis : J. M.Juran, Frank M. Gryna, TMH.
5. Statistical Quality control : E.L. Grant, R.S. Legvenwoorth , Tata Mcgraw Hill.
6. Quality control and Total quality management : Jain Tata McGraw Hill
7. Quality control : Besterfield Prentice hall New Jercy.

T.E. (Mechanical) Part II

DYNAMICS OF MACHINES

Teaching Scheme :
Lectures : 2 Hrs/Week
Practical : 2 Hrs/Week

Examination Scheme:
Paper :40Marks(2 Hrs Duration)
Term work : 25 Marks
Practical Exam : 25 Marks

UNIT-I **(06 Hrs)**

BALANCING:

Balancing of rotating masses, static and dynamic balancing, determination of balancing masses in two plane balancing, balancing of internal combustion engines, balancing of in-line engines, firing order.

UNIT-II **(04 Hrs)**

Balancing of V-twin and radial engines, forward and reverse crank method, balancing of rotors, swaying couple, Hammer-blow & Variation of Tractive force.

UNIT-III

MECHANICAL VIBRATION: **(06Hrs)**

One dimensional longitudinal transverse, and torsional vibrations, natural frequency, effect of damping on vibrations, different types of damping.

UNIT-IV **(04 Hrs)**

Forced vibration, forces and displacement, transmissibility, vibration isolation, vibration sensors: seismometer and accelerometers. Whirling of shafts with single rotor.

EXPERIMENTS TO BE PERFORM (MINIMUM SIX EXPERIMENTS)

1. To find out the oscillations of simple pendulum with universal vibration apparatus.
2. To find out the oscillations of Compound pendulum with universal vibration apparatus.
3. To find out the radius of gyration of bi-filler suspension with universal vibration apparatus.
4. To find out undamped torsional vibration of single rotor system with universal vibration apparatus.
5. To find out the frequency of damped torsional vibration of single rotor system with universal vibration apparatus.
6. To measure the frequency of torsional vibrations of single rotor system with universal vibration apparatus.
7. To study force damped vibration of a spring mass system and simple supporte beam with universal vibration apparatus.
8. To verify the static and dynamic balancing for different planes and masses by balancing apparatus.

TEXT BOOKS:

1. Theory of Machine- S.S.Rattan- TMH.
2. Theory of Machines – J.E. Shigley – McGraw Hill.

REFERENCE BOOKS:

1. Theory of Mechanisms and Machines – A.Ghosh, A.K. Malik – EWP Press
2. The Theory of Machines – Thoas Bevan, - CBS Publications.