Shivaji University, Kolhapur

T.E. (MECHANICAL ENGINEERING)(REVISED) Sem.-V

WITH EFFECT FROM THE ACADEMIC YEAR JUNE- 2009

Sr. No.	Subject	L	TUT	P	Dr	Total	PT	TW	OE	POE	Total
1	Theory of machine II	3	-	2*	-	4	100	25	25	--	150
2	Heat and mass transfer	3	-	2	-	5	100	25	--	25	150
3	Machine design I	3	-	2*	-	4	100	25	--	--	125
4	Metrology & Quality Control	3	-	2*	-	4	100	25	25	--	150
5	Manufacturing Engineering @	3	-	2*	-	4	100	25	--	--	125
6	Control Engineering	3	-	2	-	5	100	25	--	--	125
7	Workshop Practice V $	-	-	2	-	2	-	-	-	--	--
8	CAD Laboratory	-	-	2	-	2	-	25	-	-	25
	Total	**18**	**-**	**12**	**-**	**30**	**600**	**175**	**50**	**25**	**850**

@ Theory paper – 4 Hrs. duration

* Practical's to be conducted alternate weeks.

1) Theory of Machine II & Machine Design I

2) Manufacturing Engineering & Metrology & Quality control

$ Term work assessment of composite job will be done at end of T.E.(MECH.) PART -II In Work shop Practice VI

NOTE

Theory Paper Duration UNLESS Specified, always it will be 03 (THREE) Hours Duration

T.E. (MECHANICAL ENGINEERING)(REVISED) Sem.-VI

Sr. No.	Subject	L	TUT	P	Dr	Total	PT	TW	OE	POE	Total
1	Machine Design II	3	-	2	-	5	100	25	25	--	150
2	Renewable Energy Engineering	3	-	2*	-	4	100	25	--	--	125
3	I.C. Engines	3	-	2	-	5	100	25	--	25	150
4	Industrial Fluid Power	3	-	2	-	5	100	25	--	--	125
5	Computer Integrated Manufacturing	3	-	2	-	5	100	25	--	--	125
6	Industrial Management And Operation Research	3	-	2*	-	4	100	25	--	--	125
7	Workshop Practice VI $	-	-	2	-	2	-	25	--	25	50
8	Testing & Measurement	-	-	2	-	2	-	25	25	--	50
	Total	**18**	**-**	**14**	**-**	**32**	**600**	**200**	**50**	**50**	**900**

* Practical's to be conducted alternate weeks.

Industrial training of minimum two (2) weeks should be done after T.E. (II) and its

Assessments will be done in B.E. (I) based on its report

$ Term work assessment of Work shop practice-V, Part of composite job will be

Done at end of T.E.(MECH.) PART -II In Work shop Practice VI

NOTE
Theory Paper Duration UNLESS Specified, always it will be 03 (THREE) Hours Duration

T.E. (MECHANICAL) Sem.-V
1. THEORY OF MACHINES – II

Teaching Scheme :
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Alternate Week

Examination Scheme :
Theory: 100 Marks (3 hrs duration)
Term work: 25 Marks
Oral : 25 Marks

SECTION - I

1. Toothed Gearing: (05)
Geometry of motion, Gear geometry, Types of gear profile- involute & cycloidal, Theory of Spur, Helical & Spiral gears, Interference in involute tooth gears and methods for its prevention, Path of contact, Contact ratio ,Efficiency and center distance of spiral gears.

2. Gear Trains: (05)
Types of Gear trains- Simple, Compound, Reverted, Epicyclic gear train, Tabular method for finding the speeds of elements in epicyclic gear train, Differential gear box. Equivalent mass and Moment of Inertia applied to gear trains.

3. Gyroscope: (04)
Gyroscopic couple, Spinning and Precessional motion, Gyroscopic couple and its effect on – i) Aero plane ii) Ship iii) Four-Wheeler iv) Two –Wheeler.

4. Balancing: (06)
Static and Dynamic balancing of rotary and reciprocating masses. Primary and Secondary forces and couples. Direct and Reverse cranks. Balancing of Single cylinder, Multi cylinder-In-line and V-Engines for four wheeler.

SECTION – II

5. Fundamentals of Vibrations: (03)
Basic concepts and definitions, vibration measuring parameters- Displacement, Velocity and acceleration, Free and forced vibrations, Equivalent Springs. Types of damping.

6. Single degree of freedom systems: (06)
Free vibrations with and without damping (Rectilinear, Torsional & Transverse), degree of damping. Logarithmic decrement, equivalent viscous damping, Coulomb damping.

7. **Forced vibrations** with viscous damping, magnification factor, frequency response curves, vibration isolation and transmissibility, forced vibrations due to support excitation. **(06)**

8. Critical speeds of shafts: (05)
Critical speed of shaft with and without damping, secondary critical speed, natural frequency of shafts with different type of end conditions.

TERM WORK

1. Experiment on Gyroscope.
2. Generation of involute profile using rack cutter method.
3. Problems on Epicyclic gear train using tabular method.
4. Balancing of rotary masses (Static and Dynamic)
5. a) Experiment on Longitudinal vibrations of helical springs.
   b) Determination of logarithmic decrement (Free Damped Vibrations) .
6. Forced vibration characteristics (Undamped and Damped vibrations)
7. Experiment on Whirling of shaft
8. Industrial visit based on above syllabus.

REFERENCE BOOKS

1. Theory of Machines by Rattan S.S. (Tata McGraw Hill)
2. Theory of Machines & Mechanisms by Shigley (Tata McGraw Hill)
3. Mechanical Vibrations by Grover G.K., Nemchand Publi.
4. Mechanism and Machine Theory by Rao, Dukkipati, New Age International.
5. Theory of Machines by Dr. V.P.Singh, Dhanpat Rai Publications.
6. Theory of Machines by Ballaney, Khanna Publications.
7. Theory of Machines by Jagdishlal, Metropolitan Publi.
8. Theory of Machines by R.K.Bansal (Laxmi Publications)
9. Mechanical Vibrations by S.S.Rao, Pearson Education Publi.
10. Theory of vibrations with applications by W.T. Thomson (CBS Publications)
11. Mechanical vibrations by Tse, morse and Hinkle (PHI Publications)
12. Mechanical Vibrations by V.P. Singh, Dhanpat Rai Publications.
13. Solved vibrations in Mechanical Vibrations, Schaums Series
14. Mechanisms and Dynamics of machines by J.Srinivas (SciTech Publications)
15. Kinematics, Dynamics and Design of Machinery by Walidron, Wiley India Publi.
16. Theory of Vibration with applications by W.T.Thomson M.D.Dahleh.C.Padmanabhan Pearson Education
17 Kinematics, Dynamics of Machinery by Wilson, sadler Pearson Education

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2. HEAT AND MASS TRANSFER

Teaching Scheme :
Lectures : 3 Hrs. /Week
Practical : 2 Hrs./Week

Exam Scheme :
Theory Paper : 100 Marks
Pract. & Oral Exam.: 25 Marks
Term Work : 25 Marks

SECTION – I

Unit 1 : Modes of Heat Transfer **(02)**

Modes of heat transfer. Basic laws of heat transfer, Introduction to combined modes of heat transfer, Thermal conductivity and its variation with temperature for various Engg. materials (Description only). Nano fluids.

Unit 2 :

Chapter 2.1 – Steady State Heat Conduction **(06)**

Derivation of Generalized Heat Conduction equation in Cartesian co-ordinate, its reduction to Fourier, Laplace and Poisson;s equations. Generalized Heat conduction equation in cylindrical and spherical coordinates (no derivation) and its reduction to one dimension (1D), Heat conduction through plane wall, cylinder, sphere; composites, critical radius of insulation for cylinder and sphere. One dimensional steady state heat conduction with uniform heat generation for wall & cylinder).

Chapter 2.2 – Extended Surfaces **(03)**

Types and applications of fins, Heat transfer through rectangular and circular fins. Fin effectiveness and efficiency, error estimation in temperature measurement in thermo well. Applications of microfins.

Chapter 2.3 – Unsteady State Heat Conduction **(02)**

Systems with negligible internal resistance, Biot and Fourier number and their significance, Lumped Heat capacity Analysis. Use of Hiesler and Grober Charts. (No mathematical Treatment).

Unit 3 : Radiation **(08)**

Nature of thermal radiation, definitions of absorbitivity, reflectivity, transmissivity, monochromatic emissive power. Total emissive power and emmissivity, Concept of black body & gray body, Kirchoff's law, Wein's law and Planck's law. Deduction of Stefan Boltzman equation. Lambert cosine rule, Intensity of radiation. Energy exchange by radiation between two black surfaces with non-absorbing medium in between and in absence of reradiating surfaces. Geometric shape factor. Energy exchange by radiation between two gray surfaces without absorbing medium and absence of reradiation and Radiosity. Radiation network method, network for two surfaces which see each other and nothing else.

Unit 4 : Convection **(01)**

Concept of Hydrodynamic and thermal boundary layer, local and average convective coefficient for laminar and turbulent for flat plate and pipe.

Chapter 4.1 – Forced Convection **(04)**

Dimensional analysis, Physical significance of dimensionless numbers, Reynolds analogy for laminar flow, Numerical correlations to solve various problems, Flow over Tube bundles.

Chapter 4.2 – Natural Convection **(04)**

Dimensional analysis, Physical significance of dimensionless numbers, Numerical correlations to solve natural convection problems, Combined free and forced convection problems.

Unit 5 : Boiling and condensation **(02)**

Pool boiling curves, Forced boiling, Techniques for enhancement of boiling, Nusselt's theory of condensation, Condensation number, Filmwise and dropwise condensation.

Unit 6 : Heat Exchangers **(06)**

Classification & Types of Heat exchangers, Fouling factor, Overall heat transfer coefficient, Analysis by LMTD and NTU method for parallel and counter flow, Design consideration for Heat exchangers. Heat pipe.

Unit : 7 : Mass Transfer **(02)**

Introduction, Modes of mass transfer, Analogy between heat and mass transfer, Mass diffusion (Mass basis, Mole basis), Fick's law of diffusion, Significance of various dimensions numbers.

LIST OF EXPERIMENTS

- Experiment must be set simultaneously and the no. of students in each group working on a setup shall not exceed 05 students.
- Any 10 Experiments based on following list plus two computer application assignments .

1. Determination of thermal conductivity of insulating powder.
2. Determination of thermal conductivity of Composite wall or lagged pipe.
3. Determination of thermal conductivity of Metals at different temperatures
4. Determination of Heat Transfer Coefficient for natural convection.
5. Determination of Heat Transfer Coefficient for forced convection.
6. Determination of Emissivity.
7. Determination of Stefan Boltzamann Constant.
8. Boiling Heat Transfer.
9. Condensation Heat Transfer.
10. Trail on Heat Exchangers.
11. Heat Pipe Demonstration/Trial.
12. Determination of mass transfer coefficient in Solid.
13. Determination of diffusivity of volatile liquid.
12. Two computer programs assignments.

Instructions for Practical Exam :

1. Four to Five experiments shall be selected for Practical Examination.
2. The Number of Students for each practical set up would not be more than 04 Students.
3. Oral will be based on the Practical performed in the examination and the experiments included in the Journal.

REFERENCE BOOKS :

1. Heat Transfer by J.P. Holman , McGraw Hill Book Company, New York.
2. Fundamentals of Heat and Mass Transfer by R.C. Sachdev, Willey Eastern Ltd.,
3. Heat Transfer – A Practical approach by – Ynus -A – Cengel (Tata McGraw Hill)
4. A Text Book on Heat Transfer by Dr. S. P. Sukhatme, Orient Longman Publi. Hyderabad
5. Heat Transfer by Chapman A.J. McGraw Hill Book Company, New York.
6. Heat and Mass Transfer, S.C. Arrora and S. Dokoundwar, Dhanpat Rai and Sons, Delhi.
7. Fundamentals of Heat and Mass Transfer by C.P. Kothandaraman
8. Heat and Mass Transfer by R.K. Rajput, S. Chand & Company Ltd., New Delhi. 110055
9. Heat and Mass Transfer by Dr. D. S. Kumar S.K. Kataria & Sons, Delhi.
10. Heat Transfer by P.K. Nag, Tata McGraw hill Publishing Company Ltd., New Delhi.
11. Fundamentals of Heat & Mass Transfer (Fifth Edi.), Frank P. Incropera, David P. Dewitt, Wisley India.
12. Heat & Mass Transfer, G. Kamraj, P.Raveendran SciTech Publi.

14 Heat Transfer V C RAO University press

15 Heat Transfer Dr. S. N. Saphali Techmach publication Pune

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T.E. (MECHANICAL) Sem.-V

3. MACHINE DESIGN – I

Teaching Scheme :
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Alternate Week

Examination Scheme :
Theory: 100 Marks
Term work: 25 Marks

SECTION - I

1. Concept of Machine design, Types of loads, Factor of safety- its selection & significance, Theories of elastic failure & their applications, General design procedure, Review & selection of various engineering materials properties & I.S. coding of various materials, Factors governing selection of Engineering materials. **(05)**

2. Design of machine elements against static loading, knuckle joint, Turn buckle, Levers etc. **(04)**

3. **Design of welded & bolted joints subjected to transverse and eccentric loads.** Bolted joint subjected following conditions – i) Bolted joints in shear ii) Bolted joints subjected to load perpendicular to the axis of bolt iii) Bolted joints subjected to eccentric load on circular base. **(04)**

4. Design of solid & hollow shafts, transmission & line shafts, splined shafts, Types of Couplings, Design of Muff, Rigid flange & Flexible bushed pin type flanged coupling, Design of keys & splines. **(07)**

SECTION – II

5. Design of Springs : (05)
Various types of springs and their applications, Design of Helical, Compression & Tension springs subjected to static loading. Stresses induced in helical springs.

6. Design of Power Screw : (06)
Forms of threads, Design of power screw & nuts, Types of induced stresses efficiency of power screw, self locking and overhauling properties, Introduction to recirculating bal screw.

7. Design of flywheel & pulley : (05)
Fundamental equation of motion, Torque analysis, Stresses in flywheel rim & spokes. Design of solid & rimmed flywheels. Design of pulley – Flat & V belt pulley.

8. Selection of flat belt, V belt and rope drives as per the standard manufacturer's catalogue. Introduction to timing belts. **(04)**

TERM WORK

Part A : Assignment based on the following.

a) Selection of materials for various engineering applications showing their IS codes, composition and properties
b) Two problems on design of helical Springs subjected to static load.
c) One problem each on bolted and welded joints subjected to eccentric loading.

Part B : Design , Drawing of the following. (Any Two)

1. Knuckle joint or turn buckle.
2. Rigid or flexible flange coupling.
3. Application of power screw.

NOTE:

1) A detail report of design procedure calculation and sketches should be submitted alongwith A 2 size drawing Sheet containing details & assembly.
2) All the assignments should be solved by using standard design procedure using design data book such as PSG design Data book.

REFERENCE BOOKS :

1) Design of Machine Elements by V.B.Bhandari., Tata McGraw Hill Publi.
2) Machine Design by R.K.Jain, Khanna Publi.
3) Machine Design by Pandya Shah, Charotar Publi.
4) Machine Design Hall,Holowenko Laughlin Tata McGraw Hill Publi. Schaums Outline
5) Design of Machine Element by J.F. Shigley, McGraw Hill Publi.
6) Design of Machine Element by M.F.Spotts, Pearson Education Publication
7) PSG Design data Book
8) Design of Machine Elements by P. Kannaiah, Scitech Publication.
9) Mechanical Analysis & Design by H.Burr & Cheatam, Prentice Hall Publi.
10) Design of Transmission Systems by P. Kannaiah, Scitech Publication
11) Machine Design – 2nd Ed. by P. Kannaiah, Scitech Publication.
12) Fundamentals of Machine Component Design by J Marshek Willey Eastern Ltd
13) Machine Design An Integrated Approach By R.L Norton, Pearson Education Publication
14) Machine Design A Basic Approach By Dr, s.s.wadhwa S s Jolly Dhanapat Rai & Sons

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T.E. (MECHANICAL) Sem.-V

4. METROLOGY & QUALITY CONTROL

Teaching Scheme :
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Alternate Week

Examination Scheme :
Theory: 100 Marks (3 hrs duration)
Term work: 25 Marks
Oral : 25 Marks

SECTION - I

1) **Measurements :** International standards of length-Line and end measurement, Need of measurement, possible errors in measurement, slip gauges. **(03)**

2) **Tolerances and gauging :** Unilateral and bilateral tolerances, Limits, Fits, Types of Fits, IS specifications of limits. Importance of limits, System in mass production, limit gauges used for plain and taper works. **(04)**

3) **Magnification :** Principles and characteristics of measuring instruments, Mechanical, Optical, electrical, Pneumatic method of magnification, different types of Verniers, Micrometers, Dial gauges, Mechanical and pneumatic, Types of comparators. Use of comparators in inspection. **(04)**

4) **Measurement of angles, tapers and radius :** Bevel Protractor, Spirit level, Clinometers, angle Decker, standard balls and rollers for angle measurement, angle slip gauges, radius measurement of circular portion, measurement of concave and convex surface radius. **(04)**

5) **Interferometry :** Principle of Interferometry and application in checking of flatness, angle and height. **(03)**

6) **Straightness and Flatness :** Straight edge, use of level beam comparator, auto-collimator testing of flatness of surface plate(Theoretical treatment only) **(02)**

SECTION – II

7) **Surface finish :** Types of textures obtained during machine operation, range of C.L.A. value in different operations in numerical assessment of surface finish (B.I.S. Specifications of C.L.A. value)-sample length of different machining operations. Direction of lay, texture,symbols , instruments used in surface finish assessment. **(03)**

8) **Measurement of External Threads :** Different errors in screw threads, measurement of forms of thread with profile projector, pitch measurement, measurement of thread diameter with standard wire, screw thread micrometer. **(04)**

9) **Measurement of Spur Gears :** Run out checking, Pitch measurement, profile checking, backlash checking, tooth thickness measurement, alignment checking, errors in gears, checking of composite errors. **(04)**

10) **Quality control:** Concept of Quality and quality control, elements of quality & its growth, purpose, setup, policy & objective, factors controlling & quality of design

and conformance, balance between cost and quality and value of quality. Specification of quality ,planning through trial lots and for essential information. **(03)**

11) **Statistical Quality Control :** Importance of statistical method in quality control, measuring of statistical control variables and attributes. Measurement/inspection, different types of control charts(X Bars, R, P. charts) and their constructions and their application. **(03)**

12) **Acceptance Sampling :** Sampling inspection & percentage inspection, basic concept of sampling inspection, operating characteristic curves, conflicting interests of consumer and producer, producer and consumers risks, AWQL, LTPD, ADGL, single and double sampling plans. **(03)**

TERM WORK

Any Six experiments based on below referred areas

1) Study and use of linear measuring Instruments
2) Study and Use of comparators
3) Study & Use of Angle Measuring instruments
4) Screw Thread measurement
5) Gear measurements & inspection.
6) Use of Optical profile projector
7) Study & Use of Control charts
8) Operating characteristics curves

REFERENCE BOOKS

1) Engg. Metrology- I.C. GUPTA, Dhanpat Rai Publications.
2) Practical Engg. Metrology- Sharp K.W.B. Pitman, London
3) Statistical quality control-A.L. Grant, McGraw Hill International, New York.
4) Engg. Metrology-R.K.Jain, Khanna Publisher
5) Metrology-Taher
6) Statistical Quality control-R.C. Gupta
7) I.S. 919/1963
8) I.S. 2709/1964
9) Engg. Metrology-Hume K.G.,MC Donald, Technical & Scientific ,London
10) Quality Control and Industrial Statistics – Duncon A.J., D.B. Taraporevela & Co. Bombay.
11) Statistical quality Control – MahajanM., Dhanpat Rai & Sons, Delhi.
12) Engineering Metrlogy-2nd Ed. By P. Narayana, Scitech Publication
13) Metal working & Metrology By P. Narayana et.al Scitech Publication
14) Quality control 7 ed D.H. Besterfield Pearson education

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T.E. (MECHANICAL) Sem.-V

5. MANUFACTURING ENGINEERING

Teaching Scheme :
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Alternate Week

Examination Scheme :
Theory: 100 Marks (4 Hrs.duration)
Term work: 25 Marks

SECTION - I

1) Theory Of Metal Cutting- Wedge action, Concept of speed, Feed and depth of cut, orthogonal and oblique cutting. Mechanics of metal cutting-Chip formation, Types of chips, cutting ratio, shear plane and shear angle, velocity relationships, force measurement by tool dynamometers, cutting tool materials and their properties, Advanced cutting tools.
Machinability of Metals- Factors affecting, improvement and machinability index. Tool life - Types of wear, relationship with cutting parameters, Taylor's equation, improvement measures. Surface finish- Factors affecting, effect of cutting parameters, improvements. Heat generation in machining, its effect on cutting force, tool life and surface finish, types and selection criteria of cutting fluids. **(12)**

2) Tool geometry-Parts, angles and types of single point cutting tools, tool geometry of single point cutting tool, tool geometry of multipoint cutting tools.-drills, milling cutters, reamers. **(02)**

3) Form tools and Automat –Types (Flat, circular, Dovetail) Correction of form tools with and without rake angles, tool layout of single spindle, automat, process sheet, cam profile, tool layout, calculation of production rate. **(06)**

SECTION – II

4) Jigs and Fixtures- Applications ,basic elements, principles and types of locating, clamping and indexing elements, auxiliary elements like tenon, setting lock etc. Type of Jigs and Fixtures-Design consideration of Jigs and fixtures with respect to different operations. **(10)**

5) Press tools – Dies, punches, types of presses , clearances, types of dies, strip layout, calculation of press capacity, center of pressure ,Design consideration for die elements. **(06)**

6) Economic aspect of tooling-Elements of costs, method of costing and cost estimation, depreciation, economic of tooling –Tool selection and tool replacement with respect to small tools. **(04)**

TERM WORK

Any three sheets

1) Design and drawing of any one jig.
2) Design and drawing of any one fixture.
3) Tool layout, process sheet and cam design for single spindle automat.
4) Design and drawing of one die-set.
5) Industrial visit to study jig & fixtures, sheet metal.

REFERENCE BOOKS

1) Production Technology-HMT –Tata McGraw-Hill Publishing Ltd.
2) Metal cutting theory & Tool design- Mr. Arshinnov MIR Publication.
3) Fundamentals of Tool Design design-ASTME Publication.
4) Tool Design-Donaldson –THM Publication
5) Text Book of Production Engg.- P.C. Sharma- S. Chand Publication
6) Machine tool Engg.-G.R. Nagarpal- Khanna Publication
7) Thoery of Metal Cutting-Sen Bhattacharya
8) Production Engg. Design (Tool Design)-S. Chandar & K. Surendra Satya Prakashan-Delhi
9) Production Tooling Equipment-S.A.J.Parsan
10) Jigs & Fixtures- Kempster ,ELBS.
11)Metal cutting and Machine Tools By Thirupati Reddy, Scitech Publication
12) Production Technology By Thirupati Reddy, Scitech Publication.
13) Principals of Metal cutting C.Kuppuswamy Sangam books

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T.E. (MECHANICAL) Sem.-V

6. CONTROL ENGINEERING

Teaching Scheme :
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Week

Examination Scheme :
Theory: 100 Marks
Term work: 25 Marks

SECTION - I

1. Introduction to Automatic Control: Generalized Control System Types, Open Loop and Closed Loop, Linear and Non-Linear, Time Variant and Time invariant Systems with examples. Advantages of Automatic Control Systems **(3)**

2. Mathematical Model of Control System: Mechanical Translational Systems, Rotational System, Grounded Chair Representation, Electrical Elements, Analogous Systems, Force – Voltage Analog, Force – Current Analog, Mathematical Model of Liquid Level System, Hydraulic/Pneumatic System, Thermal System, Gear Train **(6)**

3. Block Diagram Algebra and Control Components: Rules for Reduction of Block Diagram, Control System Components – Tachometer, D.C. Servomotor , Hydraulic Servomotor, Stepper Motor, Jet – Pipe Amplifier, Pneumatic Amplifier. **(6)**

4. Transient Response : General Form of Transfer Function, Concept of Poles and Zeros, Distinct, Repeated and Complex Zeros. Response of systems (First and Second Order) to Various Inputs (Impulse, Step, Ramp & Sinusoidal). Damping Ratio and Natural Frequency. Transient Response Specification. **(5)**

SECTION – II

5. Stability and Root Locus Technique: Routh's Stability Criteria, Significance of Root Locus, Construction of Root Loci, General Procedure, Effect of Poles and Zeros on the System Stability. **(7)**

6. State Space Analysis: System Representation , Direct, Parallel, Series and General Programming, Conversion of State Space Model to Transfer Function. **(5)**

7. Frequency Response Analysis: Frequency Response Log Magnitude Plots and Phase angle Plots, Gain Margin , Phase Margin, Evaluation of Gain 'K' , Polar Plots. **(6)**

8. System Compensation: Types of Compensators, Lead, Lag, Lead-Lag Compensators. **(2)**

TERM WORK

1. Study of On-Off Controller for Flow/ Temperature.
2. Study of Control Modes like P, PD, PI, PID for Pressure / Temperature / Flow.

3. Design of Automatic System for Temp./ Speed with : a)Plant Layout b) Block Diagram c) Controller d)Steady State Analysis
4. Assignment on Root Locus
5. Assignment on State Space Analysis
6. Assignment on Bode Plots and Polar Plots
7. Use of Software 'MATLAB' on Topics 2,3,4,5,6 & 7.

REFERENCE BOOKS :

1. Control System Engineering : R Anandnatarajan, P. Ramesh Babu, SciTech Publi.
2. Control Systems: A. Anand Kumar, Prentice Hall Publi.
3. Automatic Control Engineering : F.H. Raven (5^{th} ed.), Tata McGraw Hill Publi.
4. Modern Control Systems: K Ogata, 3^{rd} Ed, Prentice Hall Publi.
5. Automatic Control Systems: B.C. Kuo, 7^{th} Ed, Willey India Ltd./ Prentice Hall Publi.
6. Automatic Control Engineering: D. Roy and Choudhari, Orient Longman Publi. Calcutta
7. Modern Control Engineering K.Ogata Pearson Education

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T.E. (MECHANICAL) Sem.-V

7. WORKSHOP PRACTICE – V

Teaching Scheme :
Practicals: 2 Hrs/ Week

1. Composite Job consisting of various operations like turning, milling, threading, shaping etc. using machines in the workshop should be completed during T.E. Part-I and II.

The work done during T.E. (Mechanical) Part-I should be assessed as term work for Workshop Practice-VI.

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8. CAD LABORATORY (Proposed)

Teaching Scheme :
Practical: 2 Hrs/ Week

Examination Scheme :
Term work: 25 Marks

No.	Content	Assignments
1.	Introduction to CAD/CAM.	**01**
2.	Generation of Solid models of any four components (Preferably industrial drawing with G; D and T annotations) using any Appropriate high end CAD software	**03**
3.	Generation of surface models of any three components (preferably industrial drawings with G, D and T annotations) using any appropriate high end CAD software	**02**
4.	Building two composite assemblies of components (consisting at least five components) along with all relevant details using any appropriate high end CAD software	**02**
5.	Analysis of multi-body dynamics, mechanism analysis using high end softwares like IDEAS, UG NX4 or equivalent.	**01**
6	Application of C/C++ programming to develop and execute for Design problems	**03**

Note: **1)** Any Ten assignments are to be completed by each student.
2) The print outs of above models should taken on A3 size paper/sheet only.
3) All above models should be converted into 2-D.
4) Topic No. 5 as introduction and demonstration only.

REFERENCE BOOKS

1. CAD/CAM by M.P.Grover. and E.W.Zimmer, Prentice Hall of India Pvt. Ltd.,
2. CATIA V6R16 for Engineers and Designers, Prof.Shyam Tickoo and Deepak Maini, DreamTech Press.
3. CAD/CAM/CIM, Radhakrishnan, Subramanyam, Raju (2^{nd} Ed.), New Age International Publishers.
4. Respective Software manuals.
5. CAD/CAM/CAE Chougule N.K SCITECH PUBLICATION

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T.E. (MECHANICAL) Sem.-VI

1. MACHINE DESIGN – II

Teaching Scheme :
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Week

Examination Scheme :
Theory: 100 Marks
Term work: 25 Marks
Oral Exam : 25 Marks

SECTION - I

1. Design for fluctuating loads: (06)

Stress concentration - causes & remedies, fluctuating stresses, S-N. diagram under fatigue load, endurance limit, notch sensitivity, endurance strength- modifying factors, design for finite and infinite life under reversed stresses, cumulative damage in fatigue failure, Soderberg and Goodman diagrams, modified Goodman diagram, fatigue design for components under combined stresses such as shafts, and springs.

2. Interaction of materials, processing and design : (03)

General principles of designing for manufacture, such as use, manufacture & design functions. Design for casting, forging and machining, design for assembly and designing with plastics.

3. Design of bearings :

i) Introduction to Tribological consideration in design : (02)

Friction, Wear, Lubrication.

ii) Rolling Contact Bearing : (04)

Types, static and dynamic load capacities, Stribeck's equation. equivalent bearing load, load-life relationship, bearing life, load factor, Selection of bearing from manufactures catalogue. Ball and Roller bearing, Design for variable load and speed, Bearings with probability of survival other than 90 % . Lubrication and mountings, dismounting and preloading of bearings, Oil seal and packing.

iii) Sliding contact bearing : (02)

Bearing material and their properties : Sintered bearing materials, bearing types and their construction details.

iv) Hydro-dynamic lubrication : (03)

Basic theory, thick and thin film lubrication, Reynolds's equation, Sommerfield Number, Design consideration in hydrodynamic bearings, Raimondi and Boyd method relating bearing variables, Heat balance in journal bearings, Temperature rise, Introduction to hydro static bearings.

SECTION – II

4.a) Introduction to Gears : (06)

Design considerations of gears, material selection, types of gear failure. Introduction to noncircular gears, and

b) Spur Gear: Gear tooth loads, No. of teeth, face width, strength of gear teeth, static beam strength (Lewis equation .) Barth equation, dynamic tooth load (spott's equation) wear

strength (Bucking ham's equation), Estimation of module based on beam strength and wear strength. Gear design for maximum power, Methods of gear lubrication. Construction of gears such as hub, web, arm, rim type etc. Design construction of gear box .

5. Helical Gears: (04)

Formative number of teeth in helical gears, force analysis, beam & wear strength of helical gears, effective load & design of helical gear, Herringbone gears.

6. Bevel Gear : (05)

Straight tooth bevel gear terminology and geometrical relations. Guideline for selection of dimensions and minimum number of teeth, Force analysis, Mounting of bevel gear and bearing reactions, Beam and wear strength, Dynamic tooth load, Design of straight tooth bevel gears based on beam and wear strength, Introduction to design of spiral bevel and hypoid gears.

7. Worm Gears : (05)

Terminology and geometrical relations. Standard dimensions and recommendation of worm gearing, Force analysis, Friction, Efficiency of worm gear drive, Design of worm drive as per IS 7443-1974 based on beam strength and wear strength rating, Thermal consideration in worm drive, Worm and worm wheel material.

TERM WORK

A) Total two design project

A detail design report and A 2 Size sheet containing working drawing of details and assembly of project based on any relevant mechanical system consisting of

i) Spur gear/ Helical gear..

ii) Bevel gear / Worm and worm wheel.

B) Assignments based on

i) Four problems on fluctuating loads.

ii) Study of Ball bearing mountings and its selection preloading of bearings.

iii) Four problems on design of gear drives including all types gears

iv) Industrial visit based on above syllabus..

REFERENCE BOOKS

1) Machine Design Integrated approach by Robert L. Norton.

2) Design of Machine Elements by V.B.Bhandari.(New Edition Tata Mcgrahill)

3) PSG Design data Book

4) Machine Design by R.K.Jain.

5) Bearing Manufacturers Catalogue.

6) Machine Design by Pandya Shah.

7) Design of Machine Element by M.F.Spotts.

8) Mechanical Analysis & Design by H.Burr & Cheata

9) Design of Machine Elements by J.E. Shigely
10) Introduction to tribology by Mazumdar B.C.
11) Fundamentals machine component design by Robert C. Javinall / Kurt M.Marshek, Willey India Edition.
12) Design if M/c Elements.Kannaiah SciTech Publi.
13) Machine Design Kannaiah SciTech Publi
14) Machine Design A Basic Approach By Dr, s.s.wadhwa
S s Jolly Dhanapat Rai & Sons
15) Machine Design Hall,Holowenko Laughlin Tata McGraw Hill Publi.
Schaums Outline

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T.E. (MECHANICAL) Sem.-VI

2. RENEWABLE ENERGY ENGINEERING

Teaching Scheme :
Lecturers: 3 Hrs/ Week
Practicals: 2 Hr./ Alternate Week

Examination Scheme :
Theory: 100 Marks
Term work: 25 Marks

SECTION - I

1. Introduction : (04)

Fossil fuel based systems, Impact of fossil fuel based systems, World scenario of Energy Resources, Indian Scenario of Energy Resources now and Renewable energy – sources and features, Distributed and dispersed energy system.

2. Solar Thermal System : (06)

Solar potential, Solar radiation spectrum, Solar radiation geometry, Solar radiation data, Radiation measurement, Technologies of thermal energy collection, Types of Solar Collectors, Collection efficiency, Testing of Solar collectors – IS code, Applications of Solar Energy, Solar Pond, Solar Energy storage & types.

3. Solar Photovoltaic systems : (06)

Operating Principle, Photovoltaic cell concepts, Photo-cell materials, Cell module array, Series and parallel connections, Maximum power point tracking, Applications.

4. Fuel Cells : (04)

Introduction, Principle and operation of fuel cells, classification and types of fuel. Fuel for fuel cells, performance characteristics of fuel cells, application of fuel cells.

SECTION – II

5. Wind Energy : (04)

Wind parameters and wind data, Power from wind, Site selection, Wind energy conversion systems and their classification, Construction and working of typical wind mill, characteristics of wind generators, Design considerations for wind mills, Operation and maintenance of wind mills, present status.

6. Biomass : (04)

Introduction, Energy plantation, Combustion and fermentation, Anaerobic digester, Biomass gasification, Pyrolysis, various applications of Biomass energy, Bio-fuel – Relevance, types, and applications,

7. Ocean energy – Tidal energy : (03)

Introduction to OTEC, open and closed cycle OTEC systems, prospects in India.

8. Geothermal Energy : (02)

Types of geothermal resources, Methods of harnessing, Types of geothermal systems, sites of geothermal energy in India and in world. Environmental impact.

9. Hybrid Systems : (03)

a. Need for Hybrid systems,
b. Range and type of hybrid systems,
c. Case studies of Diesel-PV, Wind-PV, Microhydel-PV, Biomass-Diesel systems, hybrid electric vehicles, etc.

10. Energy Management : (02)

Overview, National Energy, Strategy of India. Energy planning, Energy conversion opportunities and measures.

11. Energy Auditing : (02)

Scope, types and case studies. Energy Costing for Solar systems.

TERM WORK

Any Six of the following.

1. Demonstration and measurement of Solar radiation.
2. Test and Trial on Solar flat plate collector.
3. Performance evaluation of PV cell.
4. Energy Audit – Case Study of an organization.
5. Visit to Wind Power plant.
6. Study and demonstration of fuel cell, application.
7. Visit to Biodiesel plant.

REFERENCE BOOKS :

1. Solar Energy by Dr. S.P.Sukhatme Tata McGraw Hill.
2. Non Conventional Energy Sources by G.D.Rai.- Khanna Publishers.
3. Energy Technology by S. Rao, Dr. B.B.Parulekar Khanna Publishers.
4. Energy Engineering by R.S. Kulkarni & Dr. S.V. Karmare.
5. Non Conventional Energy Sources by Dr. L. Umanand.
6. Introduction to Non Conventional Energy Resources by Raja, SciTech Publi.

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T.E. (MECHANICAL) Sem.-VI

3. I. C. ENGINES

Teaching Scheme :
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Week

Examination Scheme :
Theory: 100 Marks
Term work: 25 Marks
Practical & Oral: 25 Marks

SECTION - I

1. Introduction to I.C. Engines: (02)
Introduction, Basic engine components and nomenclature, Classification of I. C. Engines, applications.

2. Engine Cycles: (04)
Engine cycles, Deviation of actual cycles from air standard cycles, Valve timing diagram for high & low speed engine, Port timing diagram.

3. Fuel systems for S.I. Engines: (05)
Engine fuel requirements, complete carburetor, Derivation for calculation of A/F ratio, Calculation of main dimensions of carburetors, Effect of altitude on Air fuel ratio. Electronic Petrol injection system (MPFI) – components such as sensors, ECU etc., merits and demerits

4. Combustion in S. I. Engines: (05)
Stages of combustion, Ignition lag, Flame propagation, Factors affecting flame speed, Abnormal combustion, Influence of engine design and operating variables on detonation, Fuel rating, Octane number, Fuel additives, HUCR, Requirements of combustion chambers of S.I. Engines and its types.

5. Supercharging and Turbo-charging: (04)
Necessity of supercharging, Thermodynamic cycle, Types of superchargers, Turbo charging, methods of turbo-charging Limitations of supercharging for S.I. and C.I. Engines.

SECTION – II

6. Fuel Systems for C.I. Engines: (04)
Requirements of injection system, Types of injection systems - Individual pump, Common rail and Distributor systems, Unit injector, Types of fuel nozzles- single hole, multi hole, pintle, and pintaux, Formation of Spray, Atomization and penetration. Governing of C.I. engines. Electronic diesel injection system. Calculations of main dimension of fuel injection system.

7. Combustion in C.I. Engines: (05)
Stages of combustion, Delay period, Factors affecting delay period, Abnormal combustion- Diesel knock, Influence of engine design and operating variables on diesel knock, Comparison of abnormal combustion in S I and C I engines, Cetane number, Additives. Requirements of combustion chambers for C.I.engines and its types.

8. Performance Testing of Engines: (05)
Performance parameters, I. S. Standard Code10000 (I to XI) to 10004 for testing of engines), Measurement of performance parameters like torque, power, Volumetric Efficiency, Mechanical Efficiency, BSFC, Brake and Indicated Thermal efficiencies. Numerical on Heat Balance Sheet & engine performance, Performance curves.

9. Alternative Fuels for I.C. engines: (02)

Alternative fuels for S. I. Engines & C. I. engines, S.I. engine operation using LPG, alcohol and hydrogen fuels. C.I. engine operation using CNG, bio-gas, bio diesels.

10. Engine Emission and Control: (02)

S.I. engine emission (HC, CO, NOx) Control methods- Evaporative (ELCD), Thermal, Catalytic converters, C.I. Engines Emission (CO, NOx, Smog, Particulate), Control methods- Chemical, EGR, Standard pollution Norms like EURO, Bharat.

11. Engine Selection: (02)

Selection of an I.C. engine for Automotive, Locomotive, Aircraft, Marine, Agriculture, and Power generation based on criteria such as operating cycle, fuel used, cooling method, cylinder numbers & arrangement, speed, fuel economy and power to weight ratio.

TEXT BOOKS :

1. Internal Combustion Engines – Mathur and Sharma, Dhanpat Rai Publi. Delhi
2. Internal Combustion Engines – V. Ganesan, Tata McGraw Hill Publi.
3. Internal Combustion Engines – Domkundwar, Dhanpat Rai Publi.
4. Internal combustion engines – Ramlingam, SciTech Publi.

REFERENCE BOOKS :

1. Internal Combustion Engines – Maleev, CBS Publi. & Distributors.
2. Internal Combustion Engines – J. B. Heywood, McGraw Hill.
3. Internal Combustion Engines – Gills and Smith
4. Diesel & High Compression Gas Engines – P. M. Kates.
5. Internal Combustion Engines Fundamentals – E. F. Obert, Harper & Row Pub. New York

6) Engg. Fundamentals of the I.C.Engines W.W.Pulkrabek Pearson educaton

TERM WORK

Study Group:

1 Constructional detail of I.C. engines by dismantling and assembly.
2 Study of Engine systems: Air intake, exhaust, Cooling, Lubrication systems.
3 Study of ignition systems, starting systems.
4 Study of Carburetor and Petrol injection system
5 Study of fuel injection system of diesel engine

Test Group: (any five)

1 Test on four stroke Diesel Engine.
2 Test on four stroke Petrol Engine.
3 Test on two stroke petrol engine. (Variable Speed Test)
4 Morse Test on multi cylinder Engine
5 Visit to a engine manufacturing company / repairing unit
6 Test on computer controlled I.C. Engine
7 Measurement of exhaust emissions of SI / CI engines.
8 Test on variable compression ratio engine

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T.E. (MECHANICAL) SEM.-VI

4. INDUSTRIAL FLUID POWER

Teaching Scheme :
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Week

Examination Scheme :
Theory: 100 Marks
Term work: 25 Marks

SECTION - I
HYDRAULIC SYSTEM

1. Introduction to fluid Power- Classification, general features, applications in various fields of engineering, various hydraulic and pneumatic ISO/JIC Symbols, transmission of power at static and dynamic states, advantages and disadvantages. **(3)**
2. Types of hydraulic fluids and their properties, selection of fluid, effect of temperature on fluids. **(1)**
3. Hydraulic system elements- Classification, types a) seals sealing material, pipes, hoses, compatibility of seal with fluid, sources of contamination and its control elements, strainer, filter, heat-exchanger, b) Pumps- types, classification, principle of working, power calculations, efficiency, characteristics curves, selection of pumps from vane, radial, piston, axial, screw, ball pump etc for various applications. **(5)**
4. Control of fluid Power elements :-
   a) Requirements of Pressure control, direction control, flow control valves **(1)**
   b) Principle of pressure control valves, direction control valves, pilot operated relief, pressure reducing, quick exhaust, sequence valves, flow control valves and their types, Meter-in and Meter-out circuit and flow through circuit. **(3)**
   c) Types of direction Control valves- two way two position, four way, two position, four way three position, open center, close center, tandem center, manual operated, solenoid, pilot operated direction control valves, check valves. **(2)**
   d) Actuators- linear and rotary, hydraulic motors, types of hydraulic cylinders and their mountings. **(1)**
   e) Calculation of piston velocity, thrust under static and dynamic operation and application, considerations of friction and inertia loads. **(2)**
5. Hydraulic circuit and applications study of accumulator, intensifier, jack, power pack etc linear and re- generative circuits with accumulator and intensifier, various hydraulic circuits, components, working and applications. **(4)**
6. Hydraulic servo- system for rotary and linear motion. **(1)**
7. Maintenance and safety of hydraulic system. **(1)**

SECTION-II
(PNEUMATIC SYSTEM)

8. Introduction: Application of pneumatics, Physical Principles, basic requirement of pneumatic system, comparison with hydraulic system. **(2)**

9. Elements of Pneumatic System: Air compressor- Types, selection criteria, capacity control, piping layout, fitting and connectors, Pneumatic controls, Direction control valves (two way, three way, four way), check valves, flow control valves, pressure control valves, speed regulators, quick exhaust valves, solenoid, pilot operated valves, Pneumatic actuators, Rotary & reciprocating cylinders – types and their mountings, Air motor – types, Comparison with hydraulic and electric motor. **(5)**
10. Serving of compressed air – types of filters, regulators, lubricators (FRL unit), mufflers, dryers. **(1)**
11. Pneumatic circuits- basic pneumatic circuit, impulse operation, speed control, pneumatic motor circuit, sequencing of motion, time delay circuit & their applications. **(3)**
12. Pneumatic servo system for linear & rotary motion. **(1)**
13. Maintenance, troubleshooting and safety of hydro pneumatic systems. **(1)**
14. Introduction to fluidics – study of simple logic gates, turbulence, amplifiers. Pneumatic sensors, applications. **(2)**

TERM WORK

a) Study of ISO/JIC Symbols for hydraulic and pneumatics systems.
b) Study of different types of valves used in hydraulics and pneumatic system.
c) Study of accumulators/actuators/intensifiers/hydraulic and pneumatic power brakes.
d) Design of hydraulic / pneumatic system and related components for any one of the following : 1) Shaping machine 2) Broaching machine 3) Slotting machine 4) Hydraulic clamps 5) Pneumatic clamp 6) Any one industrial application.
e) At least five circuit preparations on hydraulic trainer kit.
f) At least five circuit preparations on pneumatic trainer kit.
g) At least two Circuit preparation using Fluid simulation software.
h) Industrial visits are recommended for applications of pneumatic and hydraulic system and their reports.

RECOMMENDED BOOKS :

1. D. A. Pease, Basic fluid Power-PHL.
2. Joji P., Pneumatic Controls, Wiley India Pvt.Ltd.
3. J. J. Pipenger- Industrial hydraulic- McGraw Hill.
4. H. L. Stewart- Hydraulic and Pneumatic- Industrial press.
5. Goodwin- power Hydraulics.
6. B. Lal- oil Hydraulics- Intl. Literature.
7. Yeaple- Fluid power design Handbook.
8. S. R. Mujumdar- Oil hydraulics Systems- Principles and Maintenance.
9. S. R. Mujumdar- Pneumatic Systems- Principles and Maintenance.
10. R. S. Warring- Pneumatic Handbook.
11. H. s. Stewart- practical guide to Fluid Power.
12. Fluid Power With Application 6e A Esposito Pearson Education

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T.E. (MECHANICAL) SEM.-VI

5. COMPUTER INTEGRATED MANUFACTURING

Teaching Scheme :
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Week

Examination Scheme :
Theory: 100 Marks
Term work: 25 Marks

SECTION - I

1) Introduction: Meaning, Scope, evolution, architecture, elements, benefits, limitations, obstacles in implementation, social aspects of CIM. **(2)**

2) CAD/CAM/CAE: Product design and CAD/CAM, role of computers in design and manufacturing, integration of CAD/CAM, Role of CAD/CAM in CIM. **(3)**

3) Group Technology: Concept, design and manufacturing attributes, part families, methods of grouping, PFA, different classification and coding systems (OPITZ and MICLASS), relevance of GT in CIM, benefits and limitations. **(4)**

4) Computer Integrated Planning: Aggregate planning, master production schedule, capacity planning, MRP-I, computer aided process planning. **(5)**

5) Computer Integrated Control: Shop floor control, factory data collection system, inventory management, MRP-II. **(4)**

6) Flexible Manufacturing Systems: Concept, difference between rigid and flexible manufacturing, concept of cellular manufacturing, structure of FMS, components of FMS. **(3)**

SECTION - II

7) Computer Aided Quality Control: Objectives, contact & non-contact inspection, types of contact and non-contact inspection, scope in CIMS, coordinate measuring machine : types, construction, working principle, working, applications, scope of CMM in CIMS, flexible inspection system. **(4)**

8) Material Handling and Storage: Introduction to MH, MH in CIMS, criteria for suitability of MH system for CIMS, MH equipments, AGV, Monorail vehicles, Robots in MH, AS/RS components, AS/RS control. **(3)**

9) Database Management System: Meaning of Data, database, DBMS, design requirements, criteria, comparison of DBMS with conventional file handling, types of DBMS model, scope of DBMS in CIMS. **(3)**

10) Robots in CIMS: Introduction, anatomy, configuration, scope of robots in CIMS. **(3)**

11) Communication in CIMS: Requirements of shop floor communication,hierarchy of computer communication, types and components of communication systems in CIMS, Networking concepts, network topology, access methods, media, ISO-OSI reference model, introduction to MAP/TOP, role of computer communication in CIMS. **(04)**

12) Planning and Implementation Issues: Need of planning, steps in planning, phases of CIMS implementation, partial and one time implementation, organization for CIM planning and implementation. **(02)**

TERM WORK

	Pract.Turn
1. Fundamentals of part programming, manual part programming, G & M Codes, Subroutines, Canned cycles, do loop.(One assignment)	(01)
2. Manual part programming for 2d and 3d machining. (Minimum four programs)	(06)
3. Tool path generation using any suitable CAM software for two simple components.	(02)
4. One exercise on G.T.	(01)
5. One exercise on M.R.P.	(01)
6. Assignment on factory data collection system.	(01)

REFERENCE BOOKS :

1. Automotion, Production systems and Computer Integrated Manufacturing by M.P.Groover (PHI)
2. Computer Integrated Design and Manufacturing by Bedworth, Henderson Wolfe (McGraw Hill)
3. Performance Modeling of Automated Production System by Narhari and Vishvanandhan (PHI)
4. Principles of Computer Integrated Manufacturing by S. Kant Vajpayee (PHI)
5. CIM Handbook byTeicholtz and Orr (McGraw Hill)
6. CAD/CAM/CIM: Radhakrishnan, Subramanyam, Raju.
7. Computer Integrated Manufacturing: James Rehg, H.W.Kraebber, Pearson Education.

8 CAD/CAM/CAE Chougule N.K SCITECH PUBLICATION

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T.E. (MECHANICAL) SEM.-VI

6. INDUSTRIAL MANAGEMENT AND OPERATION RESEARCH

Teaching Scheme :
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Alternate Week

Examination Scheme :
Theory: 100 Marks
Term work: 25 Marks

SECTION – I
INDUSTRIAL MANAGEMENT

1. Functions of Management : (09)

Definition of Management , Management environment.
Planning – Need, Objectives, Strategy, policies, Procedures, Steps in Planning, Decision making , Forecasting.
Organizing – Process of Organizing importance and principle of organizing, department-ation, Organizational relationship, Authority, Responsibility, Delegation, Span of control.
Staffing – Nature, Purpose, Scope, Human resource management, Policies, Recruitment procedure training and development, appraisal methods.
Leading – Communication process, Barriers, remedies, motivation, importance, Theories, Herzberg's theory, Maslow's theory, McGrager's theory, leadership style.
Controlling – Process, requirement for control Management , accountability.

2. Introduction : (05)

a) Marketing : Marketing Concepts –Objective –Types of markets – Market Segmentation, Market strategy – 4 AP's of market, Market Research, Salesmanship, Advertising.
b) Materials Management : Definition , Scope, advantages of materials management, functions of materials management,
c) Purchase Objectives, 5-R Principles of purchasing, Functions of Purchase department, ,Purchasing cycle, Purchase policy & procedure, Evaluation of Purchase Performance.

3. EDP and SSI : (04)

Concept of an entrepreneur, Scheumpeter's and Peter Drucker's concepts of an entrepreneur. Charms of being an entrepreneur. Entrepreneurship development.
SSI : Definition of SSI, Procedure to start Small Scale Industry. Institutions of offering assistance to SSI, Incentives offered to SSI, Problems of SSI, Feasibility report writing. Introduction to Venture Capital funding.

4. Introduction to E- Commerce : (02)

a) E-Commerce – Introduction to Management Information System (MIS), Introduction to ISO 9000 procedures.
b) Industrial Safety – Reasons for accidents , prevention of accidents, Promotion of safety mind ness.

SECTION – II
OPERATION RESEARCH

5. Introduction: (01)

History and development of OR, Applications, modeling in OR, OR models and their applications.

6. Linear Programming Problems: (05)

Formulation of problem, Graphical solution, Simplex procedure for maximization and minimization, Duality concept.

7. Assignment Model: (03)

Mathematical statement, Methods to solve balanced and unbalanced assignment problems, Maximization problems, Assignment with restrictions, Traveling salesman problem.

8. Transportation Model: (04)

Mathematical formulation, methods to obtain initial basic feasible solution (IBFS), NWCR and VAM, conditions for testing optimality, MODI method for testing optimality solution of balanced and unbalanced problems, Degeneracy and its resolution.

9. Decision Theory: (04)

Introduction, Pay off table, Opportunity loss or regret table, Decisions under uncertainty, Laplace Criterion, Maximin or minmax principle, maximax or minimax principle, Hurcuilicz principle, Decisions under risk–maximum likelihood criteria, Expectation principle, Expected opportunity loss or expected regret decision trees.

10. Queuing Model: (03)

Introduction, Kendall's notation, Classification of queuing models, Sequencing of n jobs and 2 & 3 machines, 2 jobs and m machines.

Note : The university question paper shall include numerical treatment all topics in Section – II except topic No. 5.

TERM WORK

SECTION – I

Any three case studies on :

Purchasing activities, Recruitment, Procedure, MIS, Management of funds, Office communication, Venture capital Funding.

SECTION – II

Any Three assignments out of the following :

1) formulation of LPP and Graphical Solution.
2) Assignment on Maximization and Minimization problems using Simplex method.
3) Assignment on assignment problems.
4) Assignment on Transportation Problems.
5) Assignment on Decision Theory.
6) Assignment on Sequencing Problems.

REFERENCE BOOKS :

1. Management – James A.F. Stoner, R. Edward Freeman, Prentice Hall of India New Delhi.
2. Management, Today – Principles and Practice – Gene Burton and Manab Thakur, Tata McGraw Hill Publishing Company, New Delhi.
3. Essentials of Management – Koontz & H.Weinrich, Tata McGraw Hill Publil.
4. Human Behaviour at Work Organisational Benhviour – Keith Davis, Tata McGraw Hill Publi. New Delhi.
5. Business Management – J.P.Bose, S. Talukdar, New Central Agencies (P) Ltd.,
6. Marketing Management – Philip Kotler, Prentice Hall of India, New Delhi.
7. Operations Research – J.K. Sharma, McMillan India Publi. New Delhi
8. Operations Research – Hiza & Gupta, S.Chand & Co. New Delhi
9. Introduction to Operation Research – Hamdy A. Taha, Prentice Hall India Publi.
10 Production and Operation Management -Tripathy SCITECH PUBLICATION
11 Engineering Management Chithambaranathan SCITECH PUBLICATION
12 Industrial Engineering and Management Vishwanath SCITECH PUBLICATION
13 Optimisation in Engineering –Biswal SCITECH PUBLICATION
14 Operations Research Manohar Mahajan Dhanapat Rai And Sons
15 Engineering Optimisation Methods And Application ARavindran K.M. Ragdell G.V. Rklaitis Willey India Ltd

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T.E. (MECHANICAL) SEM.-VI

8. TESTING & MEASUREMENT

Teaching Scheme :
Practicals: 2 Hrs/ Week

Examination Scheme :
Oral exam.:-25 marks
Term work: 25 Marks

The Journal based on experiments listed below is to be submitted as part of term work.

Expt. No.	**Content**
1.	Angular speed measurement using stroboscope, photo-electric pick up and magnetic pick up.
2.	Formation of thermocouple tip and calibration of thermocouple.
3.	Measurement of temperature using, thermocouple RTD, thermisters and pyrometers.
4.	Testing of Mechanical pressure gauge using Dead weight pressure gauge tester.
5.	Vacuum measurement using Mc-Lead gauge and Pirani gauge.
6.	Measurement of displacement using LVDT.
7.	Flow measurement using, rotometer, turbine meter and anemometer and target meters.
8.	Force and torque measurement using strain gauges.
9.	Vibration testing using contact and non-contact type instruments.
10.	Design of measuring system for pressure, flow temperature etc.

REFERENCE BOOKS

1. Mechanical Measurement & Control – D.S. Kumar, Metropolitan Book Co.
2. Mechanical Measurements – Shirohi & Radha Krishnan H.C., New Age International, New Delhi.
3. Mechanical Measurement– Beckwith & Buck, Prentice Hall of India, New Delhi.
4. Measurement Systems – Doebelin Emesto, McGraw Hill Publishing Co. New York.
5. Mechanical Measurement and Control – A.K. Sawhney and P. Sawhney, Dhanpat Rai & Co

6 Engineering Practices Laboratory Kannaiah Scitech Publication.

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T.E. (MECHANICAL) SEM.-VI

7. WORKSHOP PRACTICE – VI

Teaching Scheme :
Practical: 2 Hrs. per Week

Exam Scheme :
Term work : 25 marks
Practical Exam : 25 marks
Practical Exam : 6 hours

1. Composite Job incomplete in T.E. (Mechanical) Part-I should be completed during T.E. (Mechanical) Part-II. The work done during T.E. (Mechanical) Part-II should be Assessed as term work for Workshop Practice-VI at the end of Part-II. Practical Examination of 6 Hrs. duration having component of 2 to 3 parts.

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Shivaji University, Kolhapur

Equivalences of T.E. Sem.-V Mechanical for repeater students

Sr. No.	SUBJECT IN OLD SYLLABUS PRE-REVISED W.E.FROM WHICH IS W.E.FROM A.C.YEAR 2004-2005	SUBJECT IN NEW SYLLABUS PRE-REVISED W.E.FROM A.C. 2009-2010
1	Theory of machine II	Theory of machine II
2	Heat and mass transfer	Heat and mass transfer
3	Machine design I	Machine design I
4	Fluid And Turbo Machinery	Fluid And Turbo Machinery At S.E. (Mech) Part-II Of New course W.E..From Academic Year 2008-2009
5	Tool Engineering	Manufacturing Engineering @
6	Mechanical Measurement & Control	Control Engineering
7	Workshop Practice V	Workshop Practice V $ Fluid And Turbo Machinery
8	CAD/CAM Laboratory	CAD Laboratory
9	General Proficiency-II	Only term Work Need not require Equivalence
10	Industrial Case Study	Only term Work Need not require Equivalence

Equivalences of T.E. Sem.-VI Mechanical for repeater students

Sr. No.	SUBJECT IN OLD SYLLABUS PRE-REVISED W.E.FROM WHICH IS W.E.FROM A.C.YEAR 2004-2005	SUBJECT IN NEW SYLLABUS PRE-REVISED W.E.FROM A.C. 2009-2010
1	Machine Design II	Machine Design II
2	Energy Engineering	Renewable Energy Engineering
3	Metrology & Quality Control	Metrology & Quality Control At T.E. (Mech) Part-I Of New course W.E..From Academic Year 200 9-2010
4	Automatic Control & Fluid system	Industrial Fluid Power
5	Advanced Production System	Computer Integrated Manufacturing
6	Industrial Management	Industrial Management And Operation Research
7	Workshop Practice VI	Workshop Practice VI $
8	CAD/CAM Laboratory-II	Examination to be conducted It is only P.O.E.
9	Industrial Case Study	Only term Work Need not require Equivalence