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SHIVAJI UNIVERSITY, KOLHAPUR

A Revised syllabus of

(B.E. Mechanical Engineering)

Structure (Semester III to VIII)

and

Syllabus of

Semester (III and IV)

To be introduced from Academic Year 2014-15

i.e. from June 2014 Onwards

(Subject to the modifications will be made from time to time)

SHIVAJI UNIVERSITY, KOLHAPUR,

Structure of S.E. (MECHANICAL ENGINEERING) **Semester III**

WITH EFFECT FROM THE ACADEMIC YEAR JUNE/JULY 2014-2015

Sr. No.	Course Title	Teaching Scheme				Examination Scheme				
		L	T	P	Total Hrs	TP	TW	OE	POE	Total Mark
1	Engineering Mathematics - III	3	1	-	4	100	25	-	-	125
2	*Electrical Technology	3	-	2	4	100	25	-	-	125
3	Applied Thermodynamics	3	-	2	5	100	25	-	25	150
4	Metallurgy	3	-	2	5	100	25	25	-	150
5	Fluid Mechanics	3	-	2	5	100	25	-	25	150
6	Machine Drawing	--	--	2	2	-	25	-	-	25
7	Computer Graphics	--	--	2	2	-	25	-	-	25
8	*Computer Programming Using C++	-	--	2	1	-	25	-	-	25
9	Workshop Practice - III	-	-	2	2	-	25	-	-	25
Total		15	01	14	30	500	225	25	50	800

L: Lecture, T: Tutorial, P: Practical, TP: Theory Paper, TW: Term Work, OE: Oral Exam. , POE: Practical and Oral Exam.

*** Practical's to be conducted alternate weeks. For Electrical Technology And computer Programming C++ Term work assessment consist of 25 marks for each Electrical Technology And computer Programming C++ separately. And combined marks out of 50 obtained by each student should be forwarded to Shivaji University, Kolhapur**

SHIVAJI UNIVERSITY, KOLHAPUR,

Structure of S.E. (MECHANICAL ENGINEERING) **Semester IV**

WITH EFFECT FROM THE ACADEMIC YEAR JUNE/JULY 2014-2015

Sr. No.	Course Title	Teaching Scheme				Examination Scheme				
		L	T	P	Total Hrs.	TP	TW	OE	POE	Total Marks
1	Applied Numerical Methods	3	-	2	5	100	25	-	-	125
2	Analysis of Mechanical Elements	3	-	2	5	100	25	-	-	125
3	Fluid and Turbo Machinery	3	-	2	5	100	25	-	25	150
4	Theory of Machines – I @	3	-	2	5	100	25	-	-	125
5	Machine Tools and Processes	4	-	-	4	100	-	-	-	100
6	Testing and Measurement	-	-	2	2	-	25	25	-	50
7	Computer Aided Drafting	-	-	2	2	-	50	-	-	50
8	Workshop Practice - IV	-	-	2	2	-	25	-	50	75
Total		16	00	14	30	500	200	25	75	800

L: Lecture, T: Tutorial, P: Practical, TP: Theory Paper, TW: Term Work, OE: Oral Exam. , POE: Practical and Oral Exam.

@ Theory paper of 04 (four hour) Durations
Unless mentioned, theory paper examination duration 3 hours

SHIVAJI UNIVERSITY, KOLHAPUR,

Structure of T.E. (MECHANICAL ENGINEERING) **Semester V**

WITH EFFECT FROM THE ACADEMIC YEAR JUNE/JULY 2015-2016

Sr. No.	Course Title	Teaching Scheme				Examination Scheme				
		L	T	P	Total Hrs.	TP	TW	OE	POE	Total Marks
1	Control Engineering	3	-	2	5	100	25	-	-	125
2	Theory of Machine - II	3	-	2	5	100	25	25	-	150
3	Heat and Mass Transfer	3	-	2	5	100	25	-	25	150
4	Machine Design - I	3	1	-	4	100	25	-	-	125
5	Manufacturing Engineering @	3	-	2	5	100	25	-	-	125
6	CAD/CAM Laboratory	-	-	2	2	-	25	-	25	50
7	Professional Skill Development	1	-	-	1	-	25	-	-	25
8	Workshop Practice - V	-	-	2	2	-	25	-	-	25
9	Mini-Project- I	-	-	1	1	-	25	-	-	25
Total		16	01	13	30	500	225	25	50	800

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@ Theory paper of 04 (four hour) Durations

Unless mentioned, theory paper examination duration 3 hours

SHIVAJI UNIVERSITY, KOLHAPUR,

Structure of T.E. (MECHANICAL ENGINEERING) **Semester VI**

WITH EFFECT FROM THE ACADEMIC YEAR JUNE/JULY 2015-2016

Sr. No.	Course Title	Teaching Scheme				Examination Scheme				
		L	T	P	Total Hrs.	TP	TW	OE	POE	Total Marks
1	Industrial Management and Operation Research	3	1	-	4	100	25	-	-	125
2	Industrial Fluid Power	3	-	2	5	100	25	-	-	125
3	Metrology and Quality Control	3	-	2	5	100	25	25	-	150
4	Machine Design - II	3	1	-	4	100	25	25	-	150
5	Internal Combustion Engines	3	-	2	5	100	25	-	25	150
6	Computer Integrated Manufacturing Lab	-	-	2	2	-	25	-	-	25
7	Seminar	-	-	2	2	-	25	-	-	25
8	Workshop Practice -VI	-	-	2	2	-	25	-	-	25
9	Mini-Project- II	-	-	1	1	-	25	-	-	25
Total		15	02	13	30	500	225	50	25	800

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SHIVAJI UNIVERSITY, KOLHAPUR,

Structure of B.E. (MECHANICAL ENGINEERING) **Semester VII**

WITH EFFECT FROM THE ACADEMIC YEAR JUNE/JULY 2016-2017

Sr. No.	Course Title	Teaching Scheme				Examination Scheme				
		L	T	P	Total Hrs.	TP	TW	OE	POE	Total Marks
1	Refrigeration and Air Conditioning	3	-	2	5	100	25	-	25	150
2	Mechanical System Design	3	-	2	5	100	25	25	-	150
3	Finite Element Analysis	3	-	2	5	100	25	-	-	125
4	Elective I	3	-	2	5	100	25	-	-	125
5	Elective II	3	-	2	5	100	25	-	-	125
6	Industrial Training @	-	-	-	0	-	50	-	-	50
7	Project Phase -I	-	-	2	2	-	50	25	-	75
Total		15	00	12	27	500	225	50	25	800

Sr. No.	Elective I	Elective II
1	Experimental Mechanics	Total Quality Management
2	Human and Professional Ethics	Industrial Product Design
3	Automobile Engineering	Advanced Forming Processes
4	Computational Fluid Dynamics	Design of Thermal Systems
5	Process Equipment Design	Smart Materials
6	Advanced Foundry Processes	Design for Sustainability
7	Introduction to Aircraft Systems	Flexible Manufacturing Systems

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@ Industrial training of minimum two (2) weeks should be done after T.E. (II) in summer vacation and it's assessment will be done in B.E. (I) based on report submitted Work load of the assessment can be assigned to the project seminar guide.

SHIVAJI UNIVERSITY, KOLHAPUR,

Structure of B.E. (MECHANICAL ENGINEERING) **Semester VIII**

WITH EFFECT FROM THE ACADEMIC YEAR JUNE/JULY 2016-2017

Sr. No.	Course Title	Teaching Scheme				Examination Scheme				
		L	T	P	Total Hrs.	TP	TW	OE	POE	Total Marks
1	Mechatronics	3	-	2	5	100	25	25	-	150
2	Energy and Power Engineering	3	-	2	5	100	25	-	-	125
3	Noise and Vibration	3	-	2	5	100	25	25	-	150
4	Elective III	3	-	2	5	100	25	-	-	125
5	Elective IV	3	-	2	5	100	25	-	-	125
6	Project Phase -II	-	-	4	4	-	50	75	-	125
Total		15	00	14	29	500	175	125	00	800

Sr. No.	Elective III	Elective IV
1	Industrial Engineering	Industrial Automation and Robotics
2	Production Management	Cryogenics
3	Fracture Mechanics	Enterprise Resource Planning
4	Reliability Engineering	Micro Electro Mechanical Systems
5	Advanced I.C. Engine	Advanced Refrigeration
6	Machine Tool Design	Tribology
7	Design of Aircraft Systems	Precision Engineering

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Shivaji University Kolhapur

T.E. (MECHANICAL ENGINEERING) **Semester V**

Control Engineering

Teaching Scheme:	**Examination Scheme:**
Lecturers: 3 Hrs/ Week	**Theory: 100 Marks**
Practical's: 2 Hrs/ Week	**Term work: 25 Marks**

Course Objective:-

1. Student should be able to understand control system, its type and applications.
2. Student should be able to model physical system.
3. Student should be able to determine system stability and system response.
4. Student should be able to understand various control actions.
5. Student should be able to use MATLAB software to analyze control system.

Unit -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

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 (8)

Unit-2:

Representation of control system : Linearization of non linear functions, Linearization of operating curves, Block Diagram Algebra, Rules for Reduction of Block Diagram. (6)

Unit -3:

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.
(6)

Unit -4:

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)

Unit -5:

Frequency Response Analysis: Frequency Response Log Magnitude Plots and Phase angle Plots, Gain Margin, Phase Margin, Evaluation of Gain 'K', Polar Plots (No numerical), and Stability analysis. Introduction to system Compensation: Types of Compensators, Lead, Lag,

Lead-Lag Compensators (No numerical). (7)

Unit-6:

State Space Analysis: System Representation, Direct, Parallel, Series and General Programming. (6)

TERM WORK

1. Study of Control System Components – Tachometer, D.C. Servomotor, Hydraulic Servomotor, Stepper Motor, Jet – Pipe Amplifier, Pneumatic Amplifier.
2. Study of On-Off Controller for Flow/ Temperature.
3. Study of Control Modes like P, PD, PI, PID for Pressure / Temperature / Flow.
   4 to 9. One assignment on each unit
10. Assignment based on use of Software 'MATLAB' on Unit 3,4,5,6.

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 (5th ed.), Tata McGraw Hill Publi.
4. Modern Control Systems: K Ogata, 3rd Ed, Prentice Hall Publi.
5. Automatic Control Systems: B.C. Kuo, 7th 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

SHIVAJI UNIVERSITY, KOLHAPUR,
T.E. (MECHANICAL ENGINEERING) **Semester V**
THEORY OF MACHINES – II

Teaching Scheme:	**Examination Scheme:**
Lecturers: 3 Hrs/ Week	**Theory: 100 Marks**
Practical: 2 Hrs/ Week	**Term Work: 25 Marks**
	Oral: 25 Marks

Course objectives:
The students are required to:
1. Know the basic theory on gears.
2. Analyze the various types of gear trains used for transmission of motion and power.
3. Study the gyroscopic effects on vehicles, aero plane and ship.
4. Study and analyze the problems on balancing of rotary and reciprocating masses.
5. Study force analysis of simple mechanisms
6. Study turning moment diagram.

Course Outcomes:
After completion of the course, the student will be able to
1. Indentify the various types of gears.
2. Select a gear drive for practical purpose.
3. Analyze the gyroscopic effects for practical life.
4. Solve a balancing problem.
5. Do the balancing of practical devices to reduce vibration.
6. Do force analysis of mechanisms

Unit-1
Toothed Gearing: (07)

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.

Unit-2
A. Gear Trains: (07)

Types of Gear trains - Simple, Compound, Reverted, Epicyclic gear train, Tabular method for finding the speeds of elements in epicyclic gear train, Torques in epicyclic gear train, Differential gear box.

B. Equivalent mass and Moment of Inertia applied to gear trains.

Unit-3
Gyroscope: (06)

Gyroscopic couple, spinning and Precessional Motion, Gyroscopic couple and its effect on i) Aero plane ii) Ship iii) Four-Wheeler iv) Two –Wheeler.

Unit-4
Static and dynamic Force analysis of Mechanisms: (07)

Velocity and acceleration of slider crank mechanism by analytical method, Inertia force and torque, D'Alembert's principle, Dynamically equivalent system, force analysis of reciprocating engine mechanism and four bar chain mechanism.

Unit-5

Balancing **(07)**

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 Radial Engines for four wheeler.

Unit-6

Flywheel: **(06)**

Turning moment diagrams, Fluctuation of energy, Coefficient of fluctuation of speed, Rimmed flywheel

TERM WORK

Any Ten of following

1. Generation of involute profile using rack cutter method.
2. Experiment on Torque Measurement in epicyclic Gear Train.
3. Experiment on Gyroscope.
4. Determination of M.I. using Bifilar suspension system.
5. Determination of M.I. using Trifilar Suspension system.
6. Experiment on Balancing of rotary masses (Static and Dynamic).
7. Problems on balancing of reciprocating masses. (Minimum 3)
8. Determination of M.I. of connecting rod by Compound pendulum method.
9. Assignment on Flywheel.
10. Computer aided force analysis of any one of following
    a. Slider crank mechanism
    b. Four bar mechanism
11. Industrial visit based on above syllabus.

TEXT BOOKS

1. Theory of Machines by Rattan S.S. (Tata McGraw Hill)
2. Mechanism and Machine Theory by Rao, Dukkipati, New Age International.
3. Theory of Machines by Dr. V.P.Singh, Dhanpat Rai Publications.
4. Theory of Machines by Sadhu Singh ((Pearson, Edition 3rd)
5. Theory of Machines by Ballaney, Khanna Publications.
6. Theory of Machines by R.K.Bansal (Laxmi Publications)

REFERENCE BOOKS

1. Theory of Machines & Mechanisms by Shigley (Tata McGraw Hill)
2. Theory of machines by Thomas Beven (Pearson, Edition 3rd)
3. Theory of Machines by Jagdishlal, Metropolitan Publi.
4. Mechanisms and Dynamics of machines by J.Srinivas (SciTech Publications)
5. Kinematics, Dynamics and Design of Machinery by Walidron, Wiley India Publi.
6. Kinematics, Dynamics of Machinery by Wilson, sadler Pearson Education

SHIVAJI UNIVERSITY, KOLHAPUR,

T.E. (MECHANICAL ENGINEERING) Semester V

HEAT AND MASS TRANSFER

Teaching Scheme :	**Exam Scheme :**
Lectures : 3 Hrs. /Week	Theory Paper : 100 Marks
Practical: 2 Hrs./Week	Term work: 25Marks
	Practical and Oral Exam: 25Marks

COURSE OBJECTIVES:

1. Students will learn about what is heat transfer, what governs the rate of heat transfer and importance of heat transfer.
2. They will also learn the three major modes of heat transfer viz., conduction, convection, and radiation. In addition to these three main modes of heat transfer, students will also learn the phenomena of heat transfer during phase change (boiling and condensation heat transfer).

COURSE OUTCOMES:

Students will able to,

1. Formulate basic equations for heat transfer problems.
2. Apply heat transfer principles to design and evaluate performance of thermal systems.
3. Calculate the effectiveness and rating of heat exchangers.
4. Calculate heat transfer by radiation between objects with simple geometries.
5. Calculate and evaluate the impact of boundary conditions on the solutions of heat transfer problems.
6. Evaluate the relative contributions of different modes of heat transfer.

UNIT 1: INTRODUCTION TO HEAT AND MASS TRANSFER:

1.1 Basic Concepts: (03)

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. Introduction to mass transfer: Modes of mass transfer, Analogy between heat, mass and momentum transfer, Fick's law of diffusion, various dimensionless numbers.

Derivation of Generalized differential equation of Heat Conduction in Cartesian co-ordinates, its reduction to Fourier, Laplace and Poisson's equations. Generalized Heat conduction equation in cylindrical and spherical coordinates (no derivation)

1.2 One dimensional steady state heat conduction without heat generation: (04)

Reduction of Generalized differential equation of Heat Conduction to one dimension (1D), Heat conduction through plane wall, cylinder, sphere; electrical analogy; concept of thermal resistance and conductance, composite slab, composite cylinder and composite sphere, critical radius of insulation for cylinder and sphere. Economic thickness of insulation.

UNIT 2: HEAT CONDUCTION WITH HEAT GENERATION AND UNSTEADY STATE HEAT CONDUCTION:

2.1 One dimensional steady state heat conduction with heat generation: (03)

One dimensional steady state heat conduction with uniform heat generation for plane wall cylinder, and sphere.

2.2 One dimensional unsteady State Heat Conduction

(03)

Lumped Heat capacity Analysis, Biot and Fourier number and their significance,(Numericals based on Lumped Heat capacity Analysis). Use of Hiesler and Grober Charts (No numerical based on Hiesler and Grober Charts) .

UNIT 3: EXTENDED SURFACES:

Boundary and Initial conditions:

(07)

Temperature boundary conditions, heat flux boundary condition, convection boundary condition and radiation boundary condition.

Heat transfer through extended surfaces:

Types and applications of fins, Heat transfer from rectangular and pin fins. Fin effectiveness and efficiency, Error estimation in temperature measurement in thermo well.

UNIT 4: CONVECTION

4.1 Fundamentals of convection: (01)

Mechanism of natural and forced convection. Concept of Hydrodynamic and thermal boundary layer, local and average convective coefficient for laminar and turbulent flow for flat plate and pipe

4.2 Forced Convection: (03)

Dimensional analysis, Physical significance of dimension less numbers, Reynolds analogy for laminar flow, correlations for forced convection over flat plate and closed conduits.

4.3 Natural or Free Convection: (03)

Dimensional analysis, Physical significance of dimensionless numbers, correlations for natural convection over vertical plate cylinder sphere and flow patterns.

UNIT 5: RADIATION: (06)

Nature of thermal radiation, absorbitivity, reflectivity, transmissivity, emissive power and emmissivity, spectural and total concept, blackbody, gray body, and white body Kirchoff's law, Wein's law and Planck's law, and deduction of Stefan Boltzmann law. 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. Shape factor and its characteristics .Energy exchange by radiation between two gray surfaces without absorbing medium , concept of radiosity and irradiation. Radiation network method, network for two surfaces which see each other and nothing else, radiation shields.

UNIT 6: HEAT EXCHANGERS AND PHASE CHANGE PHENOMENON

6.1 Heat Exchangers:
(05)

Classification and types of Heat exchangers, Fouling factor, and Overall heat transfer coefficient, Heat Exchanger Analysis using LMTD and NTU methods for parallel and counter flow, Design consideration of Heat exchangers and introduction to design standards like TEMA.

6.2 Boiling and Condensation (Descriptive treatment only):
(02)

Types of boiling, pool boiling and Forced convection boiling, Nusselt's theory of condensation for vertical plate, condensation correlations for practical applications, Film wise and drop wise condensation, promoters.

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 a Metal rod
  3. Determination of thermal resistance and temperature distribution in a Composite wall.
  4. Determination of thermal conductivity of insulating material in Lagged pipe.
  5. Determination of local and average heat transfer coefficient in Natural convection heat transfer from a vertical cylinder.
  6. Determination of Heat Transfer Coefficient under forced convection to air from a heated pipe.
  7. Determination of Emissivity of a non black surface.
  8. Determination of Stefan Boltzmann Constant.
  9. Determination of Critical Heat flux
  10. Determination of heat transfer coefficient in dropwise and filmwise condensation
  11. Determination of overall heat transfer coefficient and effectiveness in a Parallel flow and Counter flow Heat Exchanger.
  12. Study and Demonstration of Heat Pipe
  13. Any two computer programs assignment

Instructions for Practical Exam:

1. Four to Five experiments shall be selected for Practical Examination.
2. The Number of Students for each practical setup 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.

TEXT and REFERENCE BOOKS:

1. Heat Transfer by J.P. Holman, McGrawHill Book Company, NewYork.
2. Fundamentals of Heat and Mass Transfer by R.C. Sachdeva, Willey Eastern Ltd.,

3. Heat Transfer – A Practical approach by Yunus. 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 Hil lBook Company, NewYork.
6. Heat and Mass Transfer, S.C.Arrora andS. Dokoundwar, DhanpatRai 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. HeatTransfer by P.K.Nag,TataMcGrawhill Publishing Company Ltd., New Delhi.
11. Fundamentals of Heat & Mass Transfer (FifthEdi.), Frank P.Incropera, DavidP.Dewitt,Wisley India.
12. Heat&Mass Transfer, G.Kamraj, Raveendran SciTechPubli
13. Heat Transfer V C RAO University press
14. HeatTransfer Dr. S. N. Sapali Techmach publication Pune
15. Heat and Mass transfer by M.M.Rathod, Laxmi Publications
16. Heat Transfer by S.P.Venkateshan , Ane Books Pvt.Ltd. 2nd edition.

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SHIVAJI UNIVERSITY, KOLHAPUR,
T.E. (MECHANICAL ENGINEERING) **Semester V**
MACHINE DESIGN – I

Teaching Scheme:	**Examination Scheme:**
Lecturers: 3 Hrs/ Week	**Theory: 100 Marks**
Tutorial: 1 Hr/ Week	**Term Work: 25 Marks**

Course Objectives:

1) To study basic principles of machine design.
2) To understand the principles involved in evaluating the dimensions of a component to satisfy functional and strength requirements.
3) To learn use of catalogues and design data book.

Course Outcomes:

After completion of the course, the student will be able to

1) Apply basic principles of machine design.
2) Design machine elements on the basis of strength concept.
3) Use design data books and standard practices.
4) Select machine elements from Manufacturer's catalogue.

Unit No.1 Fundamentals of Machine Design (05)

Concept of Machine design, Types of loads, Factor of safety- its selection & significance, Review of theories of elastic failure & their applications, Basic procedure of design of machine elements, Review & selection of various engineering material properties & I.S. coding for ferrous materials, Factors governing selection of Engineering materials.

Unit No.2 Design of Joints and Machine Elements (09)

Design of machine elements under static loading- Knuckle joint, Turn buckle and bell crank Lever. Design of bolted joints subjected to following conditions- 1) Joints in shear 2) joints subjected to load perpendicular to the axis of bolt. Design of welded joints- 1)Strength of transverse and parallel fillet welds 2) Eccentric load in the plane of weld 3) Welded joint subjected to bending moment.

Unit No.3 Design of Shaft, Keys, and Couplings (06)

Design of solid & hollow shafts, splined shafts, ASME code for shaft design, Types and Design of Keys, Types of Couplings, Design of Muff, Rigid Coupling, flexible bushed pin type flanged coupling.

Unit No.4 Design of Springs: (05)

Types of springs and their applications, Styles of end, Design of Helical Compression Spring subjected to static loading.

Unit No.5 Design of Power Screw: (09)

Forms of threads, Terminology of threads, Torque requirement (lifting and lowering load) Self locking and overhauling properties, Efficiency of square threaded, Self locking screw, Trapezoidal and Acme thread, collar friction torque, Design of power screw & nuts, Introduction to Recirculating ball Screw.

Unit No. 6 Design of Pulley and Selection of Belts (06)

Design of Pulley- flat and V belt pulley, Selection of flat belt, V belt as per the standard manufacturer's catalogue, Introduction to timing belts.

TERM WORK

1) Selection of materials for various engineering applications showing their IS codes, composition and properties.
2) Design and Drawing of Knuckle joint.
3) Design and Drawing of flexible bushed pin type flanged coupling.
4) Design of helical compression spring subjected to static load.
5) Design of Power Screw.
6) Selection of Belts as per the manufacturer's catalogue.

NOTE

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

TEXT BOOKS:

1) Design of Machine Elements by V.B.Bhandari., Tata McGraw Hill Publi.
2) Machine Design by R.K.Jain, KhannaPubli.
3) Machine Design by Pandya Shah, CharotarPubli.
4) Design of Machine Elements by P. Kannaiah, Scitech Publication.
5) Machine Design A Basic Approach ByDr, s.s.wadhwa S s Jolly DhanapatRai& Sons
6) Machine Design by U.C.Jindal, Pearson Education.

REFERENCE BOOKS:

1) Machine Design Hall,Holowenko Laughlin Tata McGraw Hill Publi. Schaums Outline
2) Design of Machine Element by J.F. Shigley, McGraw Hill Publi.
3) Design of Machine Element by M.F.Spotts, Pearson Education Publication
4) PSG Design data Book
5) Mechanical Analysis & Design by H.Burr&Cheatam, Prentice Hall Publi.
6) Design of Transmission Systems by P. Kannaiah, Scitech Publication
7) Machine Design – 2nd Ed. by P. Kannaiah, Scitech Publication.
8) Machine Component Design by Robert C. Juvniall, Willey Ltd
9) Machine Design An Integrated Approach By R.L Norton, Pearson Education Publication
10) Mechanical Design of Machine Elements and Machines Jack A Collis Henry Busby,George Staab wiley ltd.2nd Ediion.

SHIVAJI UNIVERSITY, KOLHAPUR,
T.E. (MECHANICAL ENGINEERING) **Semester V**
MANUFACTURING ENGINEERING

Teaching Scheme:	**Examination Scheme :**
Lecturers: 3 Hrs/ Week	Theory: 100 Marks (4 Hrs)
Practical: 2 Hrs/Week	Term Work: 25 Marks

Pre-Requisites: Machine tool, Manufacturing process, Workshop practice, Machine Drawing.

Course objectives:

1. Study of metal cutting technology including the process, measurements, design and selection of various cutting tools and their industrial specifications.
2. To introduce the students to the design practices of toolings (Jigs and Fixtures) and die design for presswork.
3. To introduce the students to the design practices of Single spindle automat.
4. Study of various aspects of CNC machine technology and its tooling.

Course outcomes:

At the end of the course, the student will be able to

1. Identify parameters of single and multipoint cutting tools
2. Design jigs and fixtures
3. Understand Single spindle automat, tool layout, cam design.
4. Select and design dies for press working operations
5. Understand and apply CNC technology.

Unit 1: Theory Of Metal Cutting (07)

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.

Unit 2: Tool life and Tool geometry (07)

A. 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.

B. 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.

Unit 3: Form Tools and Automat (06)

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.

Unit 4: Drilling Jigs and Milling Fixtures (08)

Applications, basic elements, principles and types of locating, clamping and indexing elements, auxiliary elements like tenon, setting block etc. Type of Drilling jigs and Milling fixtures-Design consideration of Jigs and fixtures with respect to different operations. Introduction to modular fixtures.

Unit 5 : Press Tools (06)

Dies, punches, types of presses, clearances, types of dies, strip layout, calculation of press capacity, center of pressure, Design consideration for die elements(Theoretical treatment only).

Unit 6 : CNC Technology and Tooling (06)

CNC Technology and CNC tooling: Introduction, Construction and working of CNC, DNC and machining center. CNC axes & drives. Automatic Tool Changer (ATC) and Automatic pallet changer (APC) New trends in Tool Materials, Turning tool geometry, Tool inserts (coated and uncoated), Modular tooling system for Turning. Milling tooling systems, Tools presetting, Work holding.

TERM WORK

1) Study of Broaching machine (Theoretical treatment only)
2) Study and Demonstration of Grinding machine.
3) Study of Slotting machine (Theoretical treatment only)
4) Design and drawing of any one Drilling jig.
5) Design and drawing of any one Milling fixture.
6) Tool layout, process sheet and cam design for single spindle automat.
7) Study and Demonstration of tools used in CNC machining.
8) Industrial visit to study jig & fixtures, sheet metal.

TEXT BOOKS

1) S. K Hajra Choudhury, Elements of workshop technology – Vol. II,, Media Promoters And Publishers, Mumbai
2) Text Book of Production Engg.- P.C. Sharma- S. Chand Publication
3) Machine Tool Engg.-G.R. Nagarpal- Khanna Publication
4) Principles of Modern manufacturing, Groover, Fifth Edition, Wiley.

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) Machine tool Engg.-G.R. Nagarpal- Khanna Publication
6) Theory of Metal Cutting-Sen Bhattacharya
7) Production Engg. Design (Tool Design)-S. Chandar & K. Surendra Satya Praka.-Delhi
8) Production Tooling Equipment-S.A.J.Parsan
9) Jigs & Fixtures- Kempster ,ELBS.
10) Metal cutting and Machine Tools By Thirupati Reddy, Scitech Publication
11) Production Technology By Thirupati Reddy, Scitech Publication.
12) Principals of Metal cutting C.Kuppuswamy Sangam books

13) Fundamentals of Manufacturing Engineering, D.K.Singh, Anes Book Pvt. Ltd.

SHIVAJI UNIVERSITY, KOLHAPUR,

T.E. (MECHANICAL ENGINEERING) Semester V

CAD/CAM LABORATORY

Teaching Scheme:
Practical: 2 Hrs/Week

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

Pre-requisites: Computer Graphics, Computer aided Drafting, Engineering Graphics, and Machine Drawing

Course Objectives:

1) To understand -
   a) Parametric Modeling Fundamentals and Procedure
   b) Computer Aided Manufacturing Fundamentals and Procedure

2) To develop an ability to
   a) Create constrained 2-D Sketches
   b) Create Solid Models of machine components with drafting
   c) Create assembly model (minimum 5 components)with drafting
   d) Prepare part programs

Course Outcomes: At the end of this course, Students are able to

1. Understand and read engineering Drawings
2. Prepare design intent.
3. Apply appropriate command to construct solid model
4. An ability to use the techniques, skills, and computer aided tools necessary for advance engineering practice

Unit I: Introduction to CAD/CAM, GUI, Solid Modeling (06)

Introduction – Introduction to CAD/CAM in PLC, modeling, simulation, analysis and optimization. Introduction to Graphical User Interface (GUI), Parametric solid modeling – fundamentals, apply/modify constraints and dimensions; transform the parametric 2-D sketch into a 3D solid, feature operations.

Unit II: Surface Modeling (04)

Introduction, various commands in surface modeling.

Unit III: Assembly Modeling and Production Drawing (06)

Assembly modeling – Defining relationship between various parts of machine, creation of constraints, generation of exploded view.
Production drawing – Generation of 2-D sketches from parts and assembly 3-D model, appropriate dimensioning and tolerancing

Unit IV: Geometric Dimensioning and Tolerance (02)

Introduction to ASME Y14.5 – 2009, straightness, perpendicularity, flatness, angularity, roundness, concentricity, cylindricity, runout, profile, true position, parallelism, orientation.

Unit V: Part Programming (04)

Introduction to manual part programming, use of G and M codes to generate parts on turning centers, VMC's, HMC's etc.

Unit VI: Computer Aided Manufacturing (04)

Introduction to data exchange formats, integration of CAD/CAM software to generate tool path using suitable software, CADEM-doNC, SeeNC, CutVIEW, MillVIEW, MasterCAM, Esprit or equivalent.

TERM WORK

1. Solid Modeling with drafting - 2 Exercises
2. Surface Modeling like mouse, badminton racket, monitor, hair dryer etc. - 2 Exercises
3. Assembly with minimum 5 components like crane hook, tail stock, screw jack, universal coupling etc.
4. Part programming for CNC turning center – 2 parts
5. Part programming for Vertical Machining Center – 2 parts
6. Tool path generation by using suitable CAM software – 2 parts

Important Notes:

1. Submission of all above assignments should be in Hard as well as electronic format (preferably in single CD/DVD for all batches/students) and should be reviewed by external examiner at the time of Practical Examination
2. Practical examination for this subject shall consist of creation of part models and assembly of a machine with minimum five components and tool path generation using G and M Codes.

TEXT BOOKS:

1. P.N. Rao - CAD/CAM- Principals and applications –McGraw Hill
2. N.K. Chougule, CAD/CAM/CAE, SciTech Publication.

REFERENCE BOOKS

1. N. D. Bhatt and V.M. Panchal, Machine Drawing, Charoter Publications
2. ASME Y14.5 – 2009
3. Ibrahim Zeid, Mastering CADCAM, McGraw-Hill
4. Help manuals and tutorials of referred software
5. N. Siddheshwar, P. Kannaiah, V V S Sastry, Machine Drawing, Tata McGraw Hill Publications
6. Ibrahim Zeid, R. Sivasubramaniam- CAM/CAM – Theory and Practice - McGraw Hill
7. P.N. Rao - CAD/CAM- Principals and applications –McGraw Hill
8. Chennakesava R. Alavala – CAD/CAM – Concepts and applications – PHI

Shivaji University Kolhapur

T.E. (MECHANICAL ENGINEERING) Semester V

PROFESSIONAL SKILL DEVELOPMENT

Teaching Scheme:	**Examination Scheme:**
Lecturers: 1 Hr/ Week	**Term work: 25 Marks**

Unit 1. **Technical Writing and Business Communication:**

Informal and formal letter writing ,quotations, purchase orders, enquiry letter, invitation & acceptance letter, notice of meeting ,circular, agenda and minutes of meeting. (2)

Unit 2. **Report and proposal writing**:

Different types of report, structure of a report, characteristics of a good report, project report, structure of a general format proposal, importance of a proposal. (2)

Unit 3. **The e-English:**

Writing email to an unknown person, guidelines for continuing the conversation on emails, the top ten Do's, Business emails, marketing emails. (2)

Unit 4. **Team Building & Time Management:**

Interpersonal skills, what is needed to form smart team. Different approaches to team building. Techniques of a time management: ABC analysis, Pareto analysis, fit analysis, POSEC method, Eisenhower method, Prerequisite of time management. (4)

Unit 5. **Corporate Etiquettes:**

Business dress and grooming, office etiquettes, telephone etiquettes, dining etiquettes, meeting etiquettes, travel etiquettes. (2)

Unit 6. **Writting a research article and mastering presentation skills:**

General form, title page, abstract, methods, results, literature cited, Microsoft office power points creating presentation, formatting, adding Graphics, animation videos. (2)

Term Work:

1. Quotation and Purchase order for the Engineering goods.
2. Agenda, notice and minutes of a meeting.
3. One report based on the project /literature review/comparison etc.
4. One proposal for research /Business etc.
5. One term paper based on recent trends based on Mechanical Engineering.

References:

1. Dr. T. Kalyana Chatravarthi, Dr. T. Latha Chatravarthi, Soft skills for managers published by Biztantra
2. Prof. M. S. Rao, Soft skills for young managers
3. Dr. M. Hemamalini, Technical English, Published by Wiley India Pvt.ltd.
4. S. Hariharan et. at. softskills; MJP Publiishers-2010.

SHIVAJI UNIVERSITY, KOLHAPUR,
T.E. (MECHANICAL ENGINEERING) **Semester V & VI**
WORKSHOP PRACTICE – V & VI

Teaching Scheme:	**Examination Scheme:**
Practical: 2 Hrs/Week	Term Work: 25 Marks for each Sem.

Pre- Requisite: Machine tools & Processes, Metrology

Course objectives:

1. To understand and perform the various machining operations.
2. To implement principles of metrology.
3. To design the sequence of various processes required to manufacture the components.

Course outcomes:

1. Students will be able to select the suitable machining operations and prepare process sheet to manufacture a component and implement the same.
2. Students will be able to control key dimensions on a component using principles of metrology and assembly

TERM WORK: Combined Term Work for Semester V and VI: (Not combine in structure)

To make any one assembly / sub – assembly comprising of minimum three components.

For Workshop Practice V:

A. To prepare process sheets with working drawings of all components.
B. To manufacture the components as per the drawing requiring following operations
i. Turning, ii. Boring iii. Drilling

C. A visit report based on the industrial visit to study the following machining processes
i. Broaching, ii. Slotting, iii. Grinding

For Workshop Practice VI:

D. To manufacture the components as per the drawing requiring at least four of the following operations
i. Milling, ii. Shaping, iii. Grinding, iv. Tapping, v. Die threading
iv. Slotting

E. To carry out assembly of all components.
F. A visit report based on the industrial visit to study at – least two of the following machining processes
1. CNC Turning / Milling, 2. Honing, 3. Thread rolling

Note:

1. For each component, at least one dimension should be monitored within close tolerance.
2. Work carried out during first semester should assessed for 25 marks
3. Work carried out during Second semester should assessed for 25 marks

TEXTBOOKS:

1. Workshop Technology Vol. II – by Raghuvanshi
2. Workshop Technology Vol. II – by Hajara Choudhary, Media Promoters and Publishers, Mumbai

REFERENCE BOOKS:

1. Production technology by P. C. Sharma
2. Production technology by HMT handbook
3. Workshop practice manual 6^{th} edition by V. Venkata Reddy

SHIVAJI UNIVERSITY, KOLHAPUR,
T.E. (MECHANICAL ENGINEERING) **Semester V**
MINI PROJECT – I

Teaching Scheme:	**Examination Scheme :**
Practical: 1 Hr/Week/Batch	Term Work: 25 Marks

Pre-Requisites: All relevant subjects.

Course Objectives:-

- To train the students fro team work to realize an engineering task.
- To practice the steps involved for the selection, execution and reporting of the project.
- To train the students to apply their engineering knowledge to real life problem solving.

Course Outcome :

- Students are able to work in a group on specific assignment.
- Students are able to think creatively to come out with feasible solution for engineering real life problem.

Project Load:
Maximum 4 to 5 students in one group are allowed. A batch of 15 students shall work under one faculty member. Group of one student is not allowed under any circumstances.

Project Definition:
Project work shall be based on any of the following:

1. Design of any equipment /test setup/product
2. Hardware/numerical or theoretical analysis /review of survey study/research and development work

The subject content of the mini project shall be form emerging/thrust areas, topic of current relevance. The completion of work, the submission of the report and assessment should be done at the end of Part-I (First semester).

- Term work will be assessed by the project guide along with one colleague appointed by the head of department.
- The project work preferably be extended for mini project II at T.E. (Mech.) Sem. VI with same group working under guidance of same faculty assigned for mini project I.

Project Report Format:

Project report should be of 15 to 20 pages (typed on A4 size sheets). For standardization of the project reports the following format should be strictly followed.

1. Page Size: Trimmed A4
2. Top Margin: 1.00 Inch
3. Bottom Margin: 1.32 Inches
4. Left Margin: 1.5 Inches
5. Right Margin: 1.0 Inch
6. Para Text: Times New Roman 12 Pt. font
7. Line Spacing: 1.5 lines
8. Page Numbers: Right aligned at footer. Font 12 Pt. Times New Roman

9. Headings: New Times Roman, 14 Pt., Bold face
10. Certificate: All students should attach standard format of Certificate as described by the department. Certificate should be awarded to batch and not individual student. Certificate should have signatures of Guide, Head of Department and Principal.
11. Index of Report:
    a. Title Sheet
    b. Certificate
    c. Acknowledgement
    d. Table of Contents.
    e. List of Figures
    f. List of Tables
12. References: References should have the following format

For Books: "Title of Book", Authors, Publisher, Edition

For Papers: "Title of Paper", Authors, Conference Details, Year

Mark Distribution:

Concept – 05 Marks, Work Done – 10 Marks, Presentation – 05 Marks, Report – 05 Marks

SHIVAJI UNIVERSITY, KOLHAPUR,
T.E. (MECHANICAL ENGINEERING) **Semester VI**
INDUSTRIAL MANAGEMENT AND OPERATION RESEARCH

Teaching Scheme:	**Examination Scheme:**
Lecturers: 3 Hrs/ Week	Theory: 100 Marks
Practical: 1 Hr/Week	Term Work: 25 Marks

Pre-Requisites: Machine Tools & Processes.

Course Objective:
At the end of course, student should able to –

1. State the various functions of management.
2. Know various functional areas of management.
3. Aware about the norms of industrial safety, business ethics, MIS, Industrial Safety and procedure to start small scale industries.
4. Apply the various models of operation research such as assignment model, transportation model, Linear programming model, Decision Theory Model, Network Model and Sequencing Model.

Course Outcomes:
At the end of the course, the student will be able to

1. Understand the concepts of Industrial management and operations research approaches.
2. Formulate and solve engineering and managerial situations as LPP.
3. Formulate and solve engineering and managerial situations as Transportation and Assignment problems.
4. Formulate and solve engineering and managerial situations as Decision theory, Network model and Sequencing models.

Unit 1: Functions of Management: [08]
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, departmentation, 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.

Unit 2: Marketing management, Materials management and Costing [07]

I. Marketing Management: Marketing Concepts –Objective –Types of markets – Market Segmentation, Market strategy – 4 AP's of market, Market Research, Salesmanship, Advertising.

II. Materials Management : Definition , Scope, advantages of materials management, functions of materials management, Purchase Objectives, 5-R Principles of purchasing, Functions of Purchase department, Purchasing cycle, Purchase policy & procedure, Evaluation of Purchase Performance.

III. Costing: Elements of Costs, Cost estimation, Cost control and Cost reduction.

Unit 3: Ethics, EDP, SSI, Industrial Safety, MIS [05]

I. Environmental factors influencing business, Business ethics and social responsibility of business, effect of globalization.
II. Concept of an entrepreneur, Entrepreneurship development, Qualities requires to become entrepreneurs,
III. Definition, Procedure to start Small Scale Industry. Assistance and Incentives offered to SSI, Problems of SSI, Feasibility report writing.
IV. Industrial Safety – Reasons for accidents, prevention of accidents, Promotion of Safety mindness.
V. Introduction to management information system, Introduction to ISO 9001 procedure

Unit 4: Introduction to OR and Linear Programming Problems: (06)

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

Linear Programming Problems: Formulation of problem, Graphical solution, Simplex procedure for maximization and minimization, Big M Method, Duality concept.

Unit 5: Assignment Model and Transportation Model: (06)

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

Transportation Model: Mathematical formulation, methods to obtain initial basic feasible solution (IBFS), NWCR, Least Cost and VAM, conditions for testing optimality, MODI method for testing optimality solution of balanced and unbalanced problems,

Unit 6: Decision Theory, Network Model and Sequencing (08)

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

Network Model: CPM – Construction of networks, critical path, forward and backward path, floats and their significance, PERT – Time estimates, construction of networks, probability of completing projects by given date.

Sequencing: Sequencing of n jobs on two machines, n jobs on three machines.

TERM WORK

Any three case studies on:

1) Purchasing activities,
2) Recruitment Procedure,
3) MIS,
4) Office communication,
5) Venture capital Funding.

Any Three assignments out of the following:

i) Formulation of LPP and Graphical Solution.
ii) Assignment on Maximization and Minimization problems using Simplex method.
iii) Assignment on assignment problems.

iv) Assignment on Transportation Problems.
v) Assignment on Decision Theory.
vi) Assignment on Sequencing Problems.
vii) Development of PERT/CPM Network for any live project involving at least seven activities.

TEXT BOOKS:

1. Operation Research an Introduction – Hamdy A. Taha, Pearson, 9th Edition.
2. Operations Research – J. K. Sharma, McMillan India Publi. New Delhi
3. Operations Research – Hiza & Gupta, S.Chand & Co. New Delhi
4. Industrial Management and Operation Research – Nandkumar Hukeri, Electrotech Publi.
5. Industrial Engineering and Management Vishwanath scitech publication
6. Optimization in Engineering –Biswal scitech publication
7. Operations Research Manohar Mahajan Dhanapat Rai And Sons
8. Engineering Optimisation Methods And Application ARavindran K.M. Ragdell G.V. Rklaitis Willey India Ltd

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. Production and Operation Management -Tripathy scitech publication
8. Engineering Management Chithambaranathan scitech publication
9. Introduction to Operation Research – Paneer-Selvam, PHI publication.
10. Operation Research, Pradeep J. Jha, McGraw Hill Publi.
11. Operation Research, S.R. Yadav, A.S. Mallik, Oxford.
12. Operation Research – Principle and Applications, Shriniwasan, PHI Publi.
13. Operation Research, Natrajan, Pearson Publi. IInd Edi,
14. Operation Research, Mariappan, Pearson Publications

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SHIVAJI UNIVERSITY, KOLHAPUR,
T.E. (MECHANICAL) Part III SEM.-VI
4. INDUSTRIAL FLUID POWER

Teaching Scheme:	**Examination Scheme:**
Lecturers: 3 Hrs/ Week	Theory: 100 Marks
Practicals: 2Hrs/ Week	Term work: 25 Marks

Course Objective:

1) Classify & understand various hydraulic & pneumatic ISO/JIC symbols.
2) Discuss hydraulic & pneumatic system components.
3) Illustrate hydraulic & pneumatic circuits with its application.
4) Discuss maintenance & safety regulation in hydraulics & pneumatics.
5) Describe fluidics & its application.

Course Outcomes:

At the end of course student should be able to

1) Explain & draw different ISO/JIC symbols used in hydraulic & pneumatic circuits.
2) Demonstrate hydraulic & pneumatic system components.
3) Interpret the hydraulic & pneumatic circuits with their application.
4) Explain safety regulations & troubleshooting in hydraulic & pneumatic system.
5) Explain fluidics & their application.

Unit 1 Introduction to fluid Power: (6)

a) 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.
b) Principle of hydraulic system, Types of hydraulic fluids and their properties, selection of fluid, effect of temperature on fluids.
c) Introduction & Application of pneumatics, Physical properties, Principles, basic requirement of pneumatic system, comparison with hydraulic system.

Unit 2 Hydraulic system elements: (7)

a) Classification, types of seals, sealing material, pipes, hoses, compatibility of seal with fluid, sources of contamination and its control, strainer, filter, heat-exchanger, reservoir.
b) Pumps-types, selection of pumps from Gear, vane, piston, screw, ball pump etc for various applications.
c) Actuators-linear and rotary, hydraulic motors, types of hydraulic cylinders and their mountings.
d) Accumulators, intensifier & their applications.

Unit 3 Control of fluid Power elements: (7)

a) Requirements of Pressure control, direction control and flow control valves.
b) Principle of pressure control valves, directly operated & pilot operated pressure relief valve, pressure reducing valve, sequence valves, counter balance valve.
c) Principles & Types of direction Control valves-2/2, 3/2, 4/2, 4/3, 5/2. Open center, close center, tandem center, manual operated, mechanical operated solenoid, pilot operated direction control valves, check valves.
d) Principles of flow control valves, temperature compensated, pressure compensated, temperature & pressure compensated flow control valve.

Unit 4 Elements of Pneumatic System: (7)

a) 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, time delay valve, shuttle valve & twin pressure valve. Solenoid operated, pilot operated valves, , Pneumatic actuators, Rotary & reciprocating cylinders–types and their mountings, Air motor – types, Comparison with hydraulic and electric motor.
b) Serving of compressed air – types of filters, regulators, lubricators (FRL unit), mufflers, dryers.

Unit 5 (7)

a. Hydraulic circuits & its application
1. Speed control circuits – Meter-in, Meter-out, Bleed off, Regenerative, Fast approach & slow traverse.
2. Sequence circuits – Travel dependent & Pressure dependent
3. Synchronizing circuit.
4. Regenerative circuit.

b. Pneumatic circuits & its application-
1. Speed control circuits
2. Impulse operation circuit.
3. Sequence circuits.
4. Time delay circuit.

Unit 6 (6)

a) Hydraulic & Pneumatic servo system for linear& rotary motion.
b) Maintenance, troubleshooting and safety of hydraulic & pneumatic systems.
c) Introduction to fluidics – study of simple logic gates, turbulence, amplifiers. Pneumatic sensors, applications.

TERM WORK:

a) Study & Demonstration of basic hydraulic & pneumatic system.
b) Study & Demonstration of ISO/JIC Symbols for hydraulic and pneumatic systems.
c) Study & Demonstration of different types of valves used in hydraulic and pneumatic system.
d) Study & Demonstration of accumulators/actuators/intensifiers/hydraulic and pneumatic power brakes.
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 preparations using Fluid simulation software.
h) Design of hydraulic / pneumatic system and related components for any one of thefollowing:1)Shaping machine 2)Broaching machine 3)Slotting machine 4) Hydraulic clamps 5) Pneumatic clamp 6) Any one industrial application.
i) Industrial visits are recommended for applications of pneumatic and hydraulic system and their reports.

TEXT and REFERENCE BOOKS:

1. Oil hydraulics Systems- S. R. Mujumdar- McGraw Hill.
2. Pneumatic Systems- S. R. Mujumdar- McGraw Hill.
3. Industrial fluid power – D. S. Pawaskar, Nishant Prakashan.
4. Hydraulics & Pneumatics – Shaikh & Khan, R.K. Publication.
5. Industrial Fluid Power – S.S. Kuber, Nirali Prakashan.
6. Fluid Power with Application – Esposito, Pearson.
7. Hydraulic and Pneumatic- H.L.Stewart,Industrial press.
8. Industrial hydraulic- J. J. Pipenger ,McGraw Hill.
9. Power Hydraulics- Goodwin,
10. Introduction to hydraulic & pneumatics- S. ilango & V soundararajan, PHI
11. Pneumatic control-Joji P.,Wiley.
12. Fluid power Jagadeesha T. Wiley.
13. Basic hydraulic – Festo
14. Basic pneumatic – Festo
15. Eaton(Vickers) Manual.

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SHIVAJI UNIVERSITY, KOLHAPUR,
T.E. (MECHANICAL ENGINEERING) **Semester VI**
METROLOGY AND QUALITY CONTROL

Teaching Scheme:	**Examination Scheme:**
Lecturers: 3 Hrs/ Week	Theory: 100 Marks
Practical: 2 Hrs/Week	Term Work: 25 Marks
	Oral Exam: 25 Marks

Pre-requisites: Machine tools and Processes, Machine Drawing

Course Objectives:

1) To understand the use of standards in measurement, limits, fits and tolerances.
2) To understand the principle/s, construction, working and use of comparators and angle measuring instruments.
3) To study the measurement of geometrical forms and surface roughness
4) To study the methods used for the measurement of screw threads and gears
5) To understand the concept of quality and various SQC Techniques.

Course Outcomes:

1. Students can identify and use various measuring instruments and select appropriate instrument for particular feature measurement.
2. Students can distinguish and understand quality assurance and quality control. They can use control charts and sampling plans to manufacturing and service sector problems.
3. Students can prepare and understand drawings with general dimensions, tolerances and surface finish.

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Unit 1: Linear Measurements, Tolerances and Gauging: (07)

Need of measurement, International standards of length, line and end measurement, errors in measurement, slip gauges. Importance of limits system in mass production, IS specifications of limits, Unilateral and bilateral tolerances, Types of Fits, design of plug & ring gauges.

Unit 2: Comparators and Angle Measurement: (07)

Principle and characteristics of a comparator, Mechanical, Optical, Electrical, Pneumatic methods of magnification, Dial gauges, Mechanical and pneumatic types of comparators and their uses in inspection. Bevel Protractor, Spirit level, Angle gauges, Sine bar, Clinometer, Angle Deckker, Auto collimator, Standard balls and rollers for angle measurement

Unit 3: Measurement of Straightness, Flatness and Surface Roughness: (07)

Concept of straightness and flatness. Use of straight edge, level beam comparator and auto collimator for testing of flatness of surface plate. Principle of interferometry and application for checking flatness. Surface roughness terminology, Direction of lay, textures, symbols, Numerical assessment of surface roughness, Instruments used in surface roughness assessment.

Unit 4: Measurement of Screw Threads and Gears: (07)

Different errors in screw threads, measurement of forms of thread with profile projector, pitch measurement, measurement of thread diameters with standard wire, screw thread micrometer. Errors in gears, Measurement of Spur Gears, Run out checking, Pitch measurement, Profile

checking, backlash checking, tooth thickness measurement, alignment checking, checking of composite errors.

Unit 5: Quality Control (06)

Concept of Quality, quality control and quality assurance, Specification of quality, factors controlling quality of design and conformance, cost of quality, balance between cost and quality and value of quality, seven QC tools.

Unit 6: Statistical Quality Control and Acceptance Sampling (06)

Importance of statistical method in quality control, ND curve, Different types of control charts (X Bar, R, P & C charts), their constructions, interpretation and applications, Basic concept of sampling inspection, operating characteristic curves, conflicting interests of consumer and producer, producer and consumers risks, Single and double sampling plans.

TERM WORK

Minimum eight experiments from the following list should be performed (minimum 2 experiments on quality control)

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) Spur Gear measurement
6) Study and use of optical flat
7) Use of Tool Makers Microscope
8) Use of Optical Profile Projector
9) Study and use of CMM
10) Study of Normal distribution curve
11) Use of Control charts
12) Operating characteristics curves

TEXT BOOKS

1) Engineering Metrology- I.C. Gupta, Dhanpat Rai Publications.
2) Engineering Metrology-R.K.Jain, Khanna Publisher
3) Engineering Metrology, M. Mahajan, Dhanpat rai and sons.
4) Engineering Metrology and Measurements by N.V.Raghvendra & L. Krishnamurthy by Oxford University Press.

REFERENCE BOOKS

1. Practical Engineering Metrology- Sharp K.W.B. Pitman, London
2. Statistical quality control-A.L. Grant, McGraw Hill International, New York.
3. Metrology-Taher
4. Statistical Quality Control-R.C. Gupta
5. I.S. 919/1963
6. I.S. 2709/1964
7. Engineering Metrology-Hume K.G., MC Donald, Technical & Scientific, London

8. Quality Control and Indl Statistics – Duncon A.J., D.B. Taraporevela & Co. Bombay.
9. Fundamentals of Quality Control and Improvement, Amitva Mitra
10. Statistical Quality Control, Douglas Montgomery, Wiley India Pvt. Ltd.
11. Statistical Quality Control, E. L. Grant, R. S. Levenworth
12. Quality Control 7 Edi. D.H. Besterfield Pearson education sections.
13. Metrology and Measurements by A.K.Bewoor by McGrawhill Publication.

SHIVAJI UNIVERSITY, KOLHAPUR,

T.E. (MECHANICAL ENGINEERING) Semester VI

MACHINE DESIGN – II

Teaching Scheme:	**Examination Scheme :**
Lecturer: 3 Hrs/ Week	**Theory: 100 Marks**
Tutorial: 1hrs/ Week	**Oral Exam: 25 Marks**
	Term Work: 25 Marks

Course Objectives:

1. To be able to design machine elements subjected to fluctuating loading.
2. To study the significance of interaction of manufacturing, assembly, and material election on product and process design.
3. To study effect of wear considerations and their relevance to design
4. To study and select rolling contact bearings used for mechanical Systems.
5. To design hydrodynamic bearing using Raimondi and Boyd's method and heat balance
6. To design various types of gears using strength and wear considerations.

Course Outcomes:

After completion of the course , the student will be able to

1. Design machine elements subjected to fluctuating loading.
2. Understand the effect and contribution of manufacturing, assembly, and material election on design of machine elements.
3. Understand effect of tribological considerations on design
4. Select rolling contact bearings from manufacturer's catalogue.
5. Design sliding contact bearings used in various mechanical systems.
6. Design various types of gears such as spur, helical, bevel and worm gear.

UNIT 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, springs, thin pressure vessels, beams subjected to point loads etc.

UNIT 2

Interaction of Materials, Processing and Design: (03)

General principles of designing for manufacture, such as use, manufacture & design functions. Significance of DFM and its effect on design quality, design for casting, forging and machining, design for assembly and designing with plastics.

UNIT 3

Design of Bearings:

i. Introduction to Tribological consideration in design Friction, Wear, Lubrication. **(02)**

ii. Rolling Contact Bearing: 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. **(04)**

iii. Sliding contact bearing: Bearing material and their properties: Sintered bearing materials, bearing types and their construction details. **(02)**

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.

UNIT 4

a) Introduction to Gears: **(07)**

Gear terminology, material selection, types of gear failure.

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

UNIT 5 **(09)**

a) Helical Gears:

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

b) Bevel Gear:

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 spiral bevel and hypoid gears.

UNIT 6

Worm Gears: **(04)**

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.

Note: Reference to Design Data Book is mandatory

TERM WORK:

A) Total two design project
A detail design report and A 2 Size sheet containing working drawing of details and assembly of a two stage gear box.
i) Spur gear/ Helical gear.
ii) Bevel gear / Worm and Worm Wheel.

B)

- Study of Ball bearing mountings and its selection preloading of bearings.
- Industrial visit based on above syllabus.

TEXT BOOKS

1. Design of Machine Elements by V.B. Bhandari Tata McGraw Hill
2. A text book of machine design by R.S. Khurmi and J.K.Gupta
3. Mechanical Engineering Design by J. E. Shigley Tata McGraw Hill
4. Design of Machine Elements by Sharma and Purohit Prentice – Hall India
5. Design of Machine Elements II by J.B.K.Das and P.L.S. Murthy Sapna Publishers

REFERENCE BOOKS

1) Machine Design Integrated approach by Robert L. Norton
2) PSG Design data Book
3) Bearing Manufacturers Catalogue.
4) Design of Machine Element by M.F.Spotts.
5) Mechanical Analysis & Design by H.Burr&Cheatam
6) Introduction to tribology by Mazumdar B.C.
7) Machine design by Black and Adams McGraw Hill International
8) Fundamentals machine component design by Robert C. Javinall Wiley India Edition 5-e.
9) Design of M/c Elements.Kannaiah SciTech Publication.

SHIVAJI UNIVERSITY, KOLHAPUR,
T.E. (MECHANICAL) Sem.-VI
I. C. ENGINES

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

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

Unit 1. Introduction to I.C. Engines: **(06)**

Introduction, Classification of I. C. Engines, applications, Selection of IC Engine for different applications, Engine specifications

Engine Cycles:

Engine cycles, Deviation of actual cycles from air standard cycles, Valve timing diagram for high & low speed engine, Port timing diagram.

Unit 2. Fuel systems for SI and CI Engines: **(10)**

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

Fuel Systems for C.I. Engines:

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.

Unit 3. Combustion in S. I. Engines: **(06)**

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.

Unit 4. Combustion in C.I. Engines: **(06)**

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.

Unit 5. Performance Testing of Engines: **(06)**

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.

Unit 6. Engine Emission and Control: **(06)**

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, Introduction to alternative fuels for I.C. engines, Introduction to Supercharging and Turbo-charging.

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, dismantling and assembly.
2 Study and Demonstration of Engine systems: Air intake, exhaust, Cooling, Lubrication systems.
3 Study and Demonstration of ignition systems, starting systems.
4 Study and Demonstration of Carburetor and Petrol injection system
5 Study and Demonstration 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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SHIVAJI UNIVERSITY, KOLHAPUR,
T.E. (MECHANICAL ENGINEERING) **Semester VI**
COMPUTER INTEGRATED MANUFACTURING LAB

Teaching Scheme:	**Examination Scheme :**
Practical: 2 Hrs/Week	Term work: 25 Marks

Pre-Requisites: Machine Drawing, Machine tools and processes, CAD/CAM, Basic programming knowledge, Basic knowledge of organization structure.

Course Objectives:

1. To study role of CAD/CAM in CIM and CIM implementation issues.
2. To use DBMS in factory data collection system
3. To study concepts of Computer Aided Production Planning and Control
4. To apply various classification and coding system in group technology.

Course Outcomes:

At the end of this course, students will be able to:

1. Locate modern techniques for integrating CAD/CIM in CIM
2. Obtain an overview of computer technology in Production Planning and Control including Computers, Data base and data collection, Networks, Machine Control, etc.
3. Apply classification and coding in Group Technology.
4. Elaborate Computer Aided Production Planning and Control.

TERM WORK **Practical**

1) Assignment on Introduction to CIM. **(01)**
   Meaning, Scope, Evolution, Architecture, Elements, Benefits, Limitations, Social Aspects, etc.
2) Assignment on Role of CAD/CAM in CIM. **(01)**
   Role of Computers in design and manufacturing, integration.
3) Exercise on Group Technology, Part Classification and Coding System. **(02)**
   OPITZ and MICLASS : one exercise on each.
4) Exercise on Material requirement planning (MRP-I) **(02)**
   Prepare material requirement planning through given bill of material (not more than 20 components)
5) Exercise on Factory Data Collection System. **(02)**
   Prepare Database using any DBMS packages or any spreadsheet software for Data collection, Sorting, Storing and Retrieval from various sections of factory using OpenCIM software or equivalent.
6) Two Case studies and presentations (by group of minimum 2 and maximum 4 students). **(02)**
   I. Computer Aided Process Planning
   II. Shop Floor Control
   III. Manufacturing Resource Planning (MRP-II)
   IV. CIM Planning and Implementation Issues
   V. ISO – OSI and MAP/TOP in communication and networking.

7) Industrial Visit exploring CMM, Material Handling and Storage System, Robotics/ Automation covering CIM major parts.

TEXT BOOKS:

1. Automation, Production systems and Computer Integrated Manufacturing by M.P. Groover (PHI)
2. Computer Aided Manufacturing by P.N. Rao, N.K. Tewari & T.K. Kundra, Tata McGraw Hill, ISBN 9780074631034
3. CAD/CAM Computer Aided Design and Manufacturing, M. Groover, E. Zimmers, Pearson Publications, ISBN 9788177584165.

REFERENCE BOOKS:

1. Computer Integrated Design and Manufacturing by Bedworth, Henderson Wolfe (McGraw Hill)
2. Principles of Computer Integrated Manufacturing by S. Kant Vajpayee (PHI)
3. CIM Handbook by Teicholtz and Orr (McGraw Hill)
4. Computer Integrated Manufacturing: James Rehg, H.W. Kraebber, Pearson Education.

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Shivaji University Kolhapur
T.E. (Mechanical Engineering) Semester-VI
SEMINAR

Teaching Scheme: **Examination Scheme:**
Practicals : 2 Hrs/ Week **Term work: 25 Marks**

Objectives

1. To create awareness about latest technological aspects
2. To improve presentation and communication skills
3. To improve skills related to search on the internet
4. To motivate for research in respective area
5. To provide platform for interaction amongst students on advanced and/or emerging topics of technology.

Schedule for the semester

1. 1st week: Discussion of relevance, objectives and outcome expectations with students.
2. 2nd to 4th week: Preliminary discussions, topic identification and synopsis submission topic approval by guide.
3. 5th to 10th week: Collecting detailed information, discussion with guide, , preparation of seminar report and PPT, approval from guide.
4. 11TH to 14th week: Seminar delivery by each student for 20 minutes followed by question-answer session and discussion for 10 minutes.

Each student should deliver seminar in front of other students from the batch, guide and another expert appointed by HOD

Topic selection

Individual student shall chose seminar topic from engineering/allied/applied field under the guidance of allotted guide. Student should collect information from reference books, handbooks, technical research journals, catalogues, etc. related with the topic and beyond the details covered in the curriculum of mechanical engineering undergraduate course.

Instructions for report writing and presentation

Prepare two hard copies of seminar report of 20 to 30 pages each (one for student and other for department). For standardization of the seminar reports the following format should be strictly followed. Student should also submit soft copy of the seminar report and presentation.

1. Page size: Trimmed A4
2. Top Margin: 1.00 Inches
3. Bottom Margin: 1.32 Inches
4. Left Margin: 1.5 Inches
5. Right Margin: 1.0 Inches
6. Para Text: Font - Times New Roman; 12 point
7. Line Spacing: 1.5 Lines

8. Page Numbers: Right aligned and in footer. Font Times New Roman; 12 point
9. Headings: Times New Roman, 14 point, Boldface
10. Certificate: All students should attach standard format

The entire seminar should be documented as one chapter. The usual steps involved in writing report are: (a) logical analysis of the subject-matter; (b) preparation of the final outline; (c) preparation of the rough draft; (d) rewriting and polishing; (e) preparation of the final bibliography; and (f) writing the final draft.

For more details about report writing and formats students and guide are advised to refer,

"Kothari, C.R., *Research Methodology Methods and Techniques,* New Delhi, New Age International (P) Ltd., Publishers, 2nd edition, 2004"

Record of the referred literature should be submitted in either hard or soft form at the time of seminar presentation.

Guidelines for awarding term work marks

Following points should be considered for awarding term work marks.

1. Relevance of the topic;
2. Quality and quantity of references;
3. Involvement of the student in the work assigned;
4. Presentation skills;
5. Communication skills;
6. Question answer session;
7. Participation in the discussion

Seminar work load

1. 2 hours work load/practical batch/teacher

SHIVAJI UNIVERSITY, KOLHAPUR,
T.E. (MECHANICAL ENGINEERING) **Semester VI**
MINI PROJECT – II

Teaching Scheme:	**Examination Scheme:**
Practical: 1 Hr/Week/Batch	Term Work: 25 Marks

Pre-Requisites: All relevant subjects.

Course Objectives:

- To provide an opportunity to students to work in a group on a topic/ problem/ experimentation selected by them and encourage them to think independently in a group on their own to bring out the conclusion under given circumstances and to expose them to industry.
- To encourage creative thinking process to help them to get confidence by planning and carrying out the work plan of the project and to successfully complete the same, through observations discussions and decision making process.

Course Outcome:

- Students are able to work in a group on specific assignment.
- Students are able to think creatively to come out with feasible solution for engineering real life problem.

Project Load:

Maximum 4 to 5 students in one group are allowed. A batch of 15 students shall work under one faculty member. Group of one student is not allowed under any circumstances.

Project Definition:

Project work shall be based on any of the following:

1. Fabrication of product/ testing setup of an experimentation unit/ apparatus/ small equipment, in a group.
2. Experimental verification of principles used in Mechanical Engineering Applications.
3. Critical analysis of any design or process for optimizing the same.
4. Software development for particular applications.

The subject content of the mini project shall be form emerging/ thrust areas, topics of current relevance. The completion of work, the submission of the report and assessment should be done at the end of Part-II (Second semester).

- Term work will be assessed by the project guide along with one colleague appointed by the Head of Department.
- Mini Project II content preferably be extension of work carried out in Mini Project I and to be carried out by same group under the guidance of same guide assigned for Mini Project I at T.E. (Mech.) Sem. V.

Project Report Format:

Project report should be of 15 to 20 pages (typed on A4 size sheets). For standardization of the project reports the following format should be strictly followed.

1. Page Size: Trimmed A4
2. Top Margin: 1.00 Inch
3. Bottom Margin: 1.32 Inches
4. Left Margin: 1.5 Inches
5. Right Margin: 1.0 Inch
6. Para Text: Times New Roman 12 Pt. font
7. Line Spacing: 1.5 lines
8. Page Numbers: Right aligned at footer. Font 12 Pt. Times New Roman
9. Headings: New Times Roman, 14 Pt., Bold face
10. Certificate: All students should attach standard format of Certificate as described by the department. Certificate should be awarded to batch and not individual student. Certificate should have signatures of Guide, Head of Department and Principal.
11. Index of Report:
    a. Title Sheet
    b. Certificate
    c. Acknowledgement
    d. Table of Contents.
    e. List of Figures
    f. List of Tables
12. References: References should have the following format

For Books: "Title of Book", Authors, Publisher, Edition
For Papers: "Title of Paper, Authors, Conference Details, Year

Mark Distribution:

Concept – 05 Marks, Work Done – 10 Marks, Presentation – 05 Marks, Report – 05 Marks

T.E. Mechanical Semester V

EQUIVALANCE

Sr. No.	Name of the Subject (Old Syllabus)	Semester (Old Syllabus)	Name of the Subject (New Syllabus)	Semester (New Syllabus)
1	Theory of Machine – II	V	Theory of Machine – II	V
2	Heat and Mass Transfer	V	Heat and Mass Transfer	V
3	Machine Design I	V	Machine Design I	V
4	Metrology and Quality Control	V	Metrology and Quality Control	VI
5	Manufacturing Engineering	V	Manufacturing Engineering	V
6	Control Engineering	V	Control Engineering	V
7	Workshop Practice V	V	Workshop Practice V	V
8	CAD Laboratory	V	CAD/CAM Laboratory	V

T.E. Mechanical Semester VI

EQUIVALANCE

Sr. No	Name of the Subject (Old Syllabus)	Semester (Old Syllabus)	Name of the Subject (New Syllabus)	Semester (New Syllabus)
1	Machine Design II	VI	Machine Design II	VI
2	Renewable Energy Engineering	VI	Energy and Power Engineering	VIII
3	Internal Combustion Engines	VI	Internal Combustion Engines	VI
4	Industrial Fluid Power	VI	Industrial Fluid Power	VI
5	Computer Integrated Manufacturing	VI	Computer Integrated Manufacturing Lab	VI
6	Industrial Management and Operation Research	VI	Industrial Management and Operation Research	VI
7	Workshop Practice – VI	VI	Workshop Practice – VI	VI
8	Testing and Measurement	VI	Testing and Measurement	IV