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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 Marks
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

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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 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**

1. CONTROL ENGINEERING

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

Course Objectives:

The course aims to:

1. Study the control system, its type and applications.
2. Prepare mathematical model of physical simple systems.
3. Study concept of system stability and system response.
4. Study various control actions.
5. Learn to use MATLAB software to analyze control system.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Understand control system, its type and applications.
2. Understand model of physical simple systems.
3. Determine system stability and system response.
4. Understand various control actions.
5. 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 [08]

Unit-2

Representation of Control System: Linearization of Non Linear Functions, Linearization of Operating Curves, Block Diagram Algebra, Rules for Reduction of Block Diagram. [06]

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 and Sinusoidal). Damping Ratio and Natural Frequency, Transient Response Specification. [06]

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. [07]

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). [07]

Unit-6

State Space Analysis: System Representation, Direct, Parallel, Series and General Programming. [06]

Term Work:

A)

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. Assignment based on use of Software 'MATLAB' on Unit 3,4,5,6.

B) One assignment on each Unit

Text Books:

1. "Control System Engineering", R Anand Natarajan, P. Ramesh Babu, SciTech Publication, 2nd Edition.

2. "Control Systems" ,A. Anand Kumar, Prentice Hall Publication.

3. "Automatic Control Engineering", F.H. Raven Tata McGraw Hill Publication, 5th Edition.

Reference Books:

1. "Modern Control Systems", K Ogata, , Prentice Hall Publication ,3rd Edition.
2. "Automatic Control Systems", B.C. Kuo, Willey India Ltd. / Prentice Hall Publication, 7th Edition.
3. "Automatic Control Engineering" , D. Roy and Choudhari, Orient Longman Publication Calcutta.
4. "Modern Control Engineering", K. Ogata, Pearson Education.

SHIVAJI UNIVERSITY, KOLHAPUR

T.E. (Mechanical Engineering) **Semester V**

2. THEORY OF MACHINES – II

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

Course Objectives:

The course aims 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:

Upon successful completion of this 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 and cycloidal, Theory of Spur, Helical and 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 out of the 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 the following
    a. Slider crank mechanism
    b. Four bar mechanism
11. Industrial visit based on above syllabus.

Text Books:

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

Reference Books:

1. “Theory of Machines and Mechanisms” Shigley, Tata McGraw Hill.
2. “Theory of machines” Thomas Beven Pearson Education , 3rd Edition.
3. “Theory of Machines” Jagdishlal, Metropolitan Publication.
4. “Mechanisms and Dynamics of machines” J.Srinivas, SciTech Publication.
5. “Kinematics, Dynamics and Design of Machinery” , Walidron, Wiley India Publication, 2nd Edition.
6. “Kinematics, Dynamics of Machinery”, Wilson, sadler, Pearson Education.

SHIVAJI UNIVERSITY, KOLHAPUR

T.E. (Mechanical Engineering) **Semester V**

3. HEAT AND MASS TRANSFER

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

Course Objectives:

The course aims to:

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:

Upon successful completion of this course, the student will be 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 [07]

1.1 Basic Concepts

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, Analogybetween 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:

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 [06]

2.1 One dimensional steady state heat conduction with heat generation

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

2.2 One dimensional unsteady state heat conduction

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 [07]

Boundary and Initial conditions

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 [07]

4.1 Fundamentals of convection

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

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

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, absorptivity, reflectivity, transmissivity, emissive power and emissivity,spectral 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 [07]

6.1 Heat Exchangers

Classification and types ofHeat 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)

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.

Term Work:

- Experiment must be set simultaneously and the No. of students in each group working on a setup shall not exceed 05
- 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 Nonblack 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. Performance analysis of extended surfaces
  14. Any two computer programs assignment

Text Books:

1. "Heat Transfer", J.P. Holman, Tata McGraw Hill Book Company, NewYork, 2nd Edition.
2. "Fundamentals of Heat and Mass Transfer",R.C. Sachdeva, Willey Eastern Ltd.,
3. "A Text Book on Heat Transfer", Dr. S. P. Sukhatme, Orient Longman Publication Hyderabad.
4. "Heat and Mass Transfer", S.C.Arrora and S. Dokoundwar, Dhanpat Rai and Sons, Delhi.
5. "Fundamentals of Heat and Mass Transfer",C.P. Kothandaraman.
6. "Heat and Mass Transfer", R.K.Rajput, S. Chand and Company Ltd., New Delhi.,5th Edition.
7. "Heat and Mass Transfer", Dr.D.S. Kumar, S.K.Kataria and Sons,Delhi.
8. "Heat Transfer", P.K.Nag,TataMcGraw hill Publishing Company Ltd., New Delhi.
9. "Heat and Mass Transfer",G.Kamraj, Raveendran, SciTech Publication.

10. “Heat Transfer”,V C Rao, University press.
11. “Heat Transfer”,Dr. S. N. Sapali , Techmach Publication Pune.
12. “Heat and Mass transfer”, M.M.Rathod, Laxmi Publications.
13. “Heat Transfer”, S.P.Venkateshan , Ane Books Pvt.Ltd., 2nd Edition.

Reference Books:

1. “Heat Transfer – A Practical approach”,Yunus. A .Cengel, Tata McGraw Hill.
2. “Heat Transfer” Chapman A.J., Tata McGraw Hill Book Company, NewYork.
3. “Fundamentals of Heat and Mass Transfer”, Frank P.Incropera, David P.Dewitt,Wisley India. 5th Edition.

SHIVAJI UNIVERSITY, KOLHAPUR
T.E. (Mechanical Engineering) **Semester V**
4. MACHINE DESIGN – I

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

Course Objectives:
The course aims:
1) Study basic principles of machine design.
2) Understand the principles involved in evaluating the dimensions of a component to satisfy functional and strength requirements.
3) Learn use of catalogues and design data book.

Course Outcomes:
Upon successful completion of this 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 1 Fundamentals of Machine Design [05]
Concept of Machine design, Types of loads, Factor of safety- its selection and significance, Review of theories of elastic failure and their applications, Basic procedure of design of machine elements, Review and selection of various engineering material properties and I.S. coding for ferrous materials, Factors governing selection of Engineering materials.

Unit 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 3 Design of Shaft,Keys, and Couplings [06]
Design of solid and 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 4 Design of springs [05]
Types of springs and their applications, Styles of end, Design of Helical Compression Spring subjected to static loading.

Unit 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 and nuts, Introduction to Recirculating ball Screw.

Unit 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 A2 size drawing Sheet containing details and assembly.
2) 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",V.B.Bhandari., Tata McGraw Hill Publication, 3rd Edition.
2) "Machine Design", R.K.Jain, Khanna Publication.
3) "Machine Design", Pandya Shah, Charotar Publication.
4) "Design of Machine Elements", P. Kannaiah, Scitech Publication.
5) "Machine Design A Basic Approach", Dr. S.S.wadhwa S S Jolly Dhanapat Rai and Sons.
6) "Machine Design", U.C.Jindal, Pearson Education.

Reference Books:

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

SHIVAJI UNIVERSITY, KOLHAPUR
T.E. (Mechanical Engineering) **Semester V**
5. MANUFACTURING ENGINEERING

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

Course Objectives:
The course aims to:

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

Course Outcomes:
Upon successful completion of this 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 and 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 and fixtures, sheet metal.

Text Books:
1) "Elements of Workshop Technology Vol. II", S. K Hajra Choudhury , Media Promoters and Publishers, Mumbai.
2) "Text Book of Production Engineering", P.C. Sharma, S. Chand Publication, 11th Edition.
3) "Machine Tool Engineering" G.R. Nagarpal, Khanna Publication.
4) "Principles of Modern Manufacturing", Groover, Wiley Publication., 5th Edition.

Reference Books:
1) "Production Technology", HMT –Tata McGraw-Hill Publishing Ltd,. ISBN, 0070964432, 9780070964433., (2001).
2) "Metal Cutting Theory and Tool design" Mr. Arshinnov, MIR Publication.
3) "Fundamentals of Tool Design" ASTME,Prentice-Hall of India Private Ltd., New Delhi Publication, (1976).
4) "Tool Design", Donaldson,THM Publication, 3rd Edition.
5) "Machine Tool Engineering", G.R. Nagarpal, Khanna Publication.
6) "Theory of Metal Cutting", Sen and Bhattacharya, New Central Book Agency, (1965).
7) "Production Engg. Design (Tool Design)", S. Chandar and K. Surendra, Satya Prakashan, Delhi.
8) "Production Tooling Equipment" , S.A.J.Parsan.
9) "Jigs and Fixtures", Kempster ,ELBS.
10) "Metal Cutting and Machine Tools", Thirupati Reddy, Scitech Publication, 1st Edition.
11) "Production Technology", Thirupati Reddy, Scitech Publication, 1st Edition.
12) "Principals of Metal Cutting", C.Kuppuswamy Sangam Books.
13) "Fundamentals of Manufacturing Engineering", D.K.Singh, Anes Book Pvt. Ltd., 2nd Revised Edition.

SHIVAJI UNIVERSITY, KOLHAPUR

T.E. (Mechanical Engineering) Semester V

6. CAD/CAM LABORATORY

Teaching Scheme:	Examination Scheme:
Practical: 2 Hrs/Week	Term Work: 25 Marks
	Practical and Oral Exam: 25 Marks

Course Objectives:

The course aims to:

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

2) 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:

Upon successful completion of this course, the student will be able to:

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

Unit 1 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 2 Surface Modeling [04]

Introduction, various commands in surface modeling.

Unit 3 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 4 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 5 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 6 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. "CAD/CAM- Principals and Applications", P.N. Rao, Tata McGraw Hill, 2nd Edition.
2. "CAD/CAM/CAE",N.K. Chougule, SciTech Publication, Revised Edition.

Reference Books:

1. "Machine Drawing", N. D. Bhatt and V.M. Panchal, Charoter Publications
2. ASME Y14.5, (2009)
3. "Mastering CAD CAM",Ibrahim Zeid, Tata McGraw-Hill, Special Indian Edition, (2007).
4. Help Manuals and Tutorials of Referred Software
5. "Machine Drawing", N. Siddheshwar, P. Kannaiah, V V S Sastry, Tata McGraw Hill Publications, 2nd Edition.
6. "CAM/CAM – Theory and Practice",Ibrahim Zeid, R. Sivasubramaniam, Tata McGraw Hill,2nd Edition.
7. "CAD/CAM – Concepts and applications", Chennakesava R. Alavala – Prentice Hall of India

SHIVAJI UNIVERSITY. KOLHAPUR

T.E. (Mechanical Engineering) **Semester V**

7. PROFESSIONAL SKILL DEVELOPMENT

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

Course Objectives:-

The course aims to:

1. Communicate effectively in business situations
2. Practice and improve technical skills
3. Utilize collaborative and management skills in a team context
4. Develop presentation skills.

Course Outcomes:-

Upon successful completion of this course, the student will be able to:

1. Strengthen technical and soft skills necessary for workplace success
2. Increase awareness of marketability on the job market and confidence in abilities
3. Effectively make the transition from school to the workplace
4. Manage their career by navigating through the working world more effectively

Unit 1Technical Writing and Business Communication:

Informal and formal letter writing ,quotations, purchase orders, enquiry letter, invitation and acceptance letter, notice of meeting ,circular, agenda and minutes of meeting. [02]

Unit 2Report 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. [02]

Unit 3The e-English:

Writing email to an unknown person, guidelines for continuing the conversation on emails, the top ten Do's, Business emails, marketing emails. [02]

Unit 4Team Building and 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. [04]

Unit 5Corporate Etiquettes:

Business dress and grooming, office etiquettes, telephone etiquettes, dining etiquettes, meeting etiquettes, travel etiquettes. [02]

Unit 6Writing 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. [02]

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.

Text Books:

1. "Soft skills for managers",Dr. T. Kalyana Chatravarthi, Dr. T. Latha Chatravarthi Biztantra.
2. "Soft skills for young managers", by Prof. M. S. Rao Wiley India Pvt. Limited.

Reference Books:

1. "Technical English", Dr. M. Hemamalini, Published by Wiley India Pvt.ltd.
2. "Soft skills", S. Hariharan MJP Publiishers Chennai , (2010).

SHIVAJI UNIVERSITY, KOLHAPUR
T.E. (Mechanical Engineering) **Semester V**

8. WORKSHOP PRACTICE – V

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

Course Objectives:

The course aims to:

1. Understand and perform the various machining operations.
2. Implement principles of metrology.
3. Design the sequence of various processes required to manufacture the components.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Select the suitable machining operations and prepare process sheet to manufacture a component and implement the same.
2. Control key dimensions on a component using principles of metrology and assembly

To make any one assembly / sub – assembly comprising of minimum three components in Workshop Practice V and Workshop Practice VI

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

Note:

1. For each component, at least one dimension should be monitored within close tolerance.

Textbooks:

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

Reference Books:

1. "Production Technology", P. C. Sharma, S. Chand Publication ,11th Edition.
2. "Production Technology", HMT handbook
3. "Workshop Practice Manual",V. Venkata Reddy, 6th edition

SHIVAJI UNIVERSITY, KOLHAPUR
T.E. (Mechanical Engineering) **Semester V**
9. MINI PROJECT – I

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

Course Objectives:
The course aims:
1. To train the students for team work to realize an engineering task.
2. To practice the steps involved for the selection, execution and reporting of the project.
3. To train the students to apply their engineering knowledge to real life problem solving.

Course Outcomes:
Upon successful completion of this course, the student will be able to:

1. Work in a group on specific assignment.
2. 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 9 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 from 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 Point Font
7. Line Spacing: 1.5 Lines

8. Page Numbers: Right Aligned at Footer. Font 12 Point. Times New Roman
9. Headings: Times New Roman, 14 Point 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 to individual student. Certificate should have signatures of Guide, Head of Department and Principal/ Director.
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, Journal/Conference Details, Year

SHIVAJI UNIVERSITY, KOLHAPUR
T.E. (Mechanical Engineering) **Semester VI**
1. INDUSTRIAL MANAGEMENT AND OPERATION RESEARCH

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

Course Objectives:
The course aims 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:
Upon successful completion of this 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 and 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 required 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, 9^{th} Edition.
2. "Operations Research", J. K. Sharma, McMillan India Publication New Delhi,5^{th} Edition.
3. "Operations Research", Hira and Gupta, S.Chand and Co. New Delhi.
4. "Industrial Management and Operation Research", Nandkumar Hukeri, Electrotech Publication.
5. "Industrial Engineering and Management", Vishwanath ,Scitech Publication,1^{st} Edition.
6. "Optimization in Engineering", Biswal, Scitech Publication,2^{nd} Edition.
7. "Operations Research", Manohar Mahajan Dhanapat Rai and Sons.
8. "Engineering Optimisation Methods and Application", A Ravindran ,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 and H.Weinrich, Tata McGraw Hill Publication,12^{th} Edition.
4. "Human Behaviour at Work Organizational Benhviour", Keith Davis, Tata McGraw Hill Publication, New Delhi,1^{st} Edition.
5. "Business Management", J.P.Bose, S. Talukdar, New Central Agencies (P) Ltd.,
6. "Marketing Management", Philip Kotler, Prentice Hall of India, New Delhi, 8^{th} Edition.
7. "Production and Operation Management", Tripathy, Scitech Publication, 2^{nd} Edition.
8. "Engineering Management", Chithambaranathan, Scitech Publication.
9. "Introduction to Operation Research", Paneer-Selvam, Prentice Hall of India publication, 2^{nd} Edition.
10. "Operation Research", Pradeep J. Jha, Tata McGraw Hill Publication.
11. "Operation Research", S.R. Yadav, A.S. Mallik, Oxford University Press,(2014).
12. "Operation Research – Principle and Applications", Shriniwasan, Prentice Hall of India Publication, 2^{nd} Edition.
13. "Operation Research", Natrajan, Pearson Publication. 2^{nd} Edition.
14. "Operation Research", Mariappan, Pearson Education.

SHIVAJI UNIVERSITY, KOLHAPUR
T.E. (Mechanical Engineering) Semester VI
2. INDUSTRIAL FLUID POWER

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

Course Objectives:

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

Course Outcomes:

Upon successful completion of this course, the student will be able to:

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

Unit 1 Introduction to Fluid Power [06]

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 and Application of pneumatics, Physical properties, Principles, basic requirement of pneumatic system, comparison with hydraulic system.

Unit 2 Hydraulic System Elements [07]

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 and their applications.

Unit 3 Control of Fluid Power Elements **[07]**

a) Requirements of Pressure control, direction control and flow control valves.
b) Principle of pressure control valves, directly operated and pilot operated pressure relief valve, pressure reducing valve, sequence valves, counter balance valve.
c) Principles and 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 and pressure compensated flow control valve.

Unit 4 Elements of Pneumatic System **[07]**

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 and twin pressure valve. Solenoid operated, pilot operated valves, , Pneumatic actuators, Rotary and 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 **[07]**

a) Hydraulic Circuits and its Application

i. Speed control circuits – Meter-in, Meter-out, Bleed off, Regenerative, Fast approach and slow traverse.
ii. Sequence circuits – Travel dependent and Pressure dependent
iii. Synchronizing circuit.
iv. Regenerative circuit.

b) Pneumatic Circuits and its Application-

i. Speed control circuits
ii. Impulse operation circuit.
iii. Sequence circuits.
iv. Time delay circuit.

Unit 6 **[06]**

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

Term Work:

1. Study and Demonstration of basic hydraulic and pneumatic system.
2. Study and Demonstration of ISO/JIC Symbols for hydraulic and pneumatic systems.
3. Study and Demonstration of different types of valves used in hydraulic and pneumatic system.
4. Study and Demonstration of accumulators/actuators/intensifiers/hydraulic and pneumatic power brakes.
5. At least five circuit preparations on hydraulic trainer kit.
6. At least five circuit preparations on pneumatic trainer kit.
7. At least two Circuit preparations using Fluid Simulation Software.
8. 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.
9. Industrial visits are recommended for applications of pneumatic and hydraulic system and their reports.

Text Books:

1. "Oil hydraulics Systems", S. R. Mujumdar, Tata McGraw Hill Publication.
2. "Pneumatic Systems", S. R. Mujumdar- Tata McGraw Hill Publication.
3. "Industrial Fluid Power",D. S. Pawaskar, Nishant Prakashan.
4. "Hydraulics and Pneumatics", Shaikh and Khan, R.K. Publication.
5. "Fluid Power with Application", Esposito, Pearson Education , 7th Edition.
6. "Basic Hydraulic – Festo Manual"
7. "Basic Pneumatic – Festo Manual"

Reference Books:

1. "Industrial Fluid Power", S.S. Kuber, Nirali Prakashan, 3rd Edition.
2. "Hydraulic and Pneumatic",H.L.Stewart,Industrial Press.
3. "Industrial Hydraulic", J. J. Pipenger ,Tata McGraw Hill.
4. "Power Hydraulics", Goodwin 1st Edition.
5. "Introduction to Hydraulic and Pneumatics",S. Ilango and V Soundararajan, Prentice Hall of India, 2nd Edition.
6. "Pneumatic Control",Joji P.,Wiley. ,1st Edition.
7. "Fluid Power",Jagadeesha T. , Wiley Publications.
8. "Eaton (Vickers) Manual."

SHIVAJI UNIVERSITY, KOLHAPUR
T.E. (Mechanical Engineering) **Semester VI**
3. METROLOGY AND QUALITY CONTROL

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

Course Objectives:
The course aims to:

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

Course Outcomes:
Upon successful completion of this course, the student will be able to:

1. Identify and use various measuring instruments and select appropriate instrument for particular feature measurement.
2. Distinguish and understand quality assurance and quality control. They can use control charts and sampling plans to manufacturing and service sector problems.
3. 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 and ring gauges.

Unit 2 Comparators and Angle Measurement [06]
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 **[07]**
Importance of statistical method in quality control, ND curve, Different types of control charts (X Bar, R, P and 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 two experiments on quality control)

1) Study and use of Linear Measuring Instruments
2) Study and Use of Comparators
3) Study and 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" ,N.V.Raghvendra and L. Krishnamurthy Oxford University Press.

Reference Books:

1. "Practical Engineering Metrology",Sharp K.W.B. Pitman, London
2. "Statistical Quality Control", A.L. Grant, Tata McGraw Hill International, New York. 6th Edition.
3. "Metrology",Taher ELBS
4. "Statistical Quality Control",R.C. Gupta,9th Edition.
5. I.S. 919/1963
6. I.S. 2709/1964

7. “Engineering Metrology”,Hume K.G., MC Donald, Technical and Scientific, London ,2nd Edition.
8. “Quality Control and Indl Statistics”, Duncon A.J., D.B. Taraporevela and Co. Bombay.
9. “Fundamentals of Quality Control and Improvement”,Amitva Mitra, 3rd Edition.
10. “Statistical Quality Control”,Douglas Montgomery, Wiley India Pvt. Ltd.,6th Edition.
11. “Statistical Quality Control”,E. L. Grant, R. S. Levenworth,5th Edition
12. “Quality Control”,D.H. Besterfield Pearson Education Sections,7th Edition.
13. “Metrology and Measurements”, A.K.Bewoor ,Tata Mc Graw Hill Publication.

SHIVAJI UNIVERSITY, KOLHAPUR

T.E. (Mechanical Engineering) **Semester VI**

4. MACHINE DESIGN – II

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/ Week	Theory Paper: 100 Marks
Tutorial: 1Hr/ Week	Term Work: 25 Marks
	Oral Exam: 25 Marks

Course Objectives:

The course aims to:

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

Course Outcomes:

Upon successful completion of this 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 and 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 and 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 **[11]**

i. Introduction to Tribological consideration in design Friction, Wear, Lubrication.
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.
iii. Sliding Contact Bearing: Bearing material and their properties: Sintered bearing materials, bearing types and their construction details.
iv. Hydro-Dynamic Lubrication:

    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's equation and Buckingham equation), Wear strength (Buckingham'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 and wear strength of helical gears, Effective load and design of helical gear.

b) Bevel Gear

Straight tooth bevel gear terminology and geometrical relations, Guidelines 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 A2 Size sheet containing working drawing of details and assembly of a gear box.

i) Spur gear/ Helical gear.

ii) Bevel gear / Worm and Worm Wheel.

B) Assignments based on

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

Text Books:

1. "Design of Machine Elements", V.B. Bhandari, Tata McGraw Hill, 3rd Edition.
2. "A Text Book of Machine Design", R.S. Khurmi and J.K.Gupta.
3. "Mechanical Engineering Design",J. E. Shigley, Tata McGraw Hill.
4. "Design of Machine Elements",Sharma and Purohit, Prentice Hall of India.
5. "Design of Machine Elements II", J.B.K.Das and P.L.S. Murthy ,Sapna Publishers, 2nd Edition.

Reference Books:

1) "Machine Design Integrated approach",Robert L. Norton, 5th Edition.
2) PSG Design Data Book
3) Bearing Manufacturers Catalogue.
4) "Design of Machine Element",M.F.Spotts, 3rd Edition.
5) "Mechanical Analysis and Design",H.Burr and Cheatam, 2nd Edition.
6) "Introduction to Tribology",Mazumdar B.C., 2nd Edition.
7) "Machine Design", Black and Adams ,Tata McGraw Hill International.
8) "Fundamentals Machine Component Design", Robert C. Javinall Wiley India , 5th Edition.
9) "Design of Machine Elements", Kannaiah SciTech Publication, 1st Edition.

SHIVAJI UNIVERSITY, KOLHAPUR
T.E. (Mechanical Engineering) Semester VI
5. INTERNAL COMBUSTION ENGINES

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

Course Objectives:
The course aims to:

1. Study constructional details and various types of internal combustion engine.
2. Understand and analyze thermodynamic cycles of IC engines.
3. Understand combustion phenomenon in SI engine and CI engines.
4. Impart knowledge about various systems on the IC engines
5. Impart knowledge about various engine performance characteristics and its testing

Course Outcomes:
Upon successful completion of this course, the student will be able to:

1. Demonstrate a basic understanding of engine construction, function of various parts of the engine.
2. Demonstrate combustion mechanism
3. Demonstrate importance and functions of various systems on the engine.
4. Demonstrate need and methods of engine testing.
5. Know the impact of vehicular pollution and ways to reduce or control the pollution.

Unit 1	**Introduction to I.C. Engines** 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 and low speed engine, Port timing diagram.	**[05]**
Unit 2	**Fuel Systems for SI and CI Engines** 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,	**[09]**

	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** 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.	**[06]**
Unit 4	**Combustion in C.I. Engines** 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.	**[07]**
Unit 5	**Performance Testing of Engines** 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 and engine performance, Performance curves.	**[06]**

Unit 6	**Engine Emission and Control** 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.	**[07]**

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 an 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

Text Books:

1. "Internal Combustion Engines",Mathur and Sharma, Dhanpat Rai Publication , Delhi.
2. "Internal Combustion Engines", V. Ganesan, Tata McGraw Hill Publication.
3"Internal Combustion Engines", Domkundwar, Dhanpat Rai Publication.
4. "Internal Combustion Engines",Ramlingam, SciTech Publication.

Reference Books:

1. "Internal Combustion Engines",Maleev, CBS Publication and Distributors.
2. "Internal Combustion Engines", J. B. Heywood,Tata McGraw Hill Publication .
3. "Internal Combustion Engines",Gills and Smith , Oxford and IBH Publishing Company
4. "Diesel and High Compression Gas Engines", P. M. Kates.
5. "Internal Combustion Engines Fundamentals", E. F. Obert, Harper and Row Publication , New York.
6. "Engineering Fundamentals of the I.C.Engines", W.W.Pulkrabek , Pearson Education.

SHIVAJI UNIVERSITY, KOLHAPUR
T.E. (Mechanical Engineering) **Semester VI**
6. COMPUTER INTEGRATED MANUFACTURING LAB

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

Course Objectives:
The course aims to:

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

Course Outcomes:

Upon successful completion of this course, the student 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:

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 Open CIM 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", M.P. Groover ,Prentice Hall of India.
2. "Computer Aided Manufacturing",P.N. Rao, N.K. Tewari and 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", Bedworth, Henderson Wolfe ,Tata McGraw Hill Publication.
2. "Principles of Computer Integrated Manufacturing",S. Kant Vajpayee ,Prentice Hall of India.
3. "CIM Handbook",Teicholtz and Orr, Tata McGraw Hill Publication.
4. "Computer Integrated Manufacturing", James Rehg, H.W. Kraebber, Pearson Education.

SHIVAJI UNIVERSITY, KOLHAPUR
T.E. (Mechanical Engineering**) Semester VI**
7. SEMINAR

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

Course Objectives:-

The course aims to:

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

Course Outcomes:-

Upon successful completion of this course, the student will be able to

1. Have and develop presentation skills.
2. Impart knowledge in different aspects of knowledge domains.
3. Make them aware of knowledge in industry perspective and new industry trends.
4. Build confidence and improve communication skills.
5. Collect ideas through literature survey about new innovations, analyze and present them.
6. Sharpen their personality and intelligence.

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.

Seminar work load

1. 2 hours work load/practical batch/faculty

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T.E. (Mechanical Engineering) **Semester VI**

8. WORKSHOP PRACTICE – VI

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

Course Objectives:

The course aims to:

1. Understand and perform the various machining operations.
2. Implement principles of metrology.
3. Design the sequence of various processes required to manufacture the components.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Select the suitable machining operations and prepare process sheet to manufacture a component and implement the same.
2. Control key dimensions on a component using principles of metrology and assembly

For Workshop Practice VI:

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

B. Slotting

C. To carry out assembly of all components.

D. A visit report based on the industrial visit to study at – least two of the following machining processes
   i. CNC Turning / Milling, ii. Honing, iii. Thread Rolling

Note:

For each component, at least one dimension should be monitored within close tolerance.

Textbooks:

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

Reference books:

1. "Production Technology", P. C. Sharma, S. Chand Publication ,11th Edition.
2. "Production Technology", HMT Handbook
3. "Workshop Practice Manual",V. Venkata Reddy, 6th Edition

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T.E. (Mechanical Engineering) **Semester VI**
9. MINI PROJECT – II

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

Course Objectives:
The course aims to:

1. 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.
2. 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:
Upon successful completion of this course, the student will be able to:

1. Work in a group on specific assignment.
2. 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 9 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 from 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 Point. Font
7. Line Spacing: 1.5 Lines
8. Page Numbers: Right Aligned at Footer. Font 12 Point. Times New Roman
9. Headings: Times New Roman, 14 Point, 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 to individual student. Certificate should have signatures of Guide, Head of Department and Principal/Director
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, Journal/Conference Details, Year

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