Estd. 1962
NAAC 'A' Grade
MHRD-NIRF- 28th Rank

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दुरध्वनी (ईपीएबीएक्स) २६०९००० (अभ्यास मंडळे विभाग– २६०९०९४)
फॅक्स : ००९१-०२३१-२६९१५३३ व २६९२३३३.e-mail:bos@unishivaji.ac.in

SU/BOS/Sci. & Tech/7400 **Date: 21/07/2018**

To,

The Principal/ Director,
All affiliated Engineering Colleges/ Institute,
Shivaji University, Kolhapur.

Subject : Regarding Guidelines, structure, of CBCS B. Tech. Program and syllabus of First Year B. Tech. Program under Faculty of Science and Technology.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the University Authorities have accepted and granted approval to Guidelines, structure of CBCS B. Tech. Program and syllabus of First Year B. Tech. Program to following branches under Faculty of Science and Technology:

B. Tech. Programme (Branch)

1.	Civil Engineering & Technology
2.	Mechanical Engineering & Technology
3.	Production Engineering & Technology
4.	Automobile Engineering & Technology
5.	Electrical Engineering & Technology
6.	Chemcial Engineering & Technology
7.	Electronics Engineering & Technology
8.	Electronics and Telecommunication Engineering & Technology
9.	Biotechnology Engineering & Technology
10.	Information Technology Engineering & Technology
11.	Environmental Engineering & Technology
12.	Computer Science Engineering & Technology

The revised syllabi shall be implemented from the academic year 2018-19 (i.e. from July 2018) onwards. A soft copy containing CBCS Guidelines, structure, and syllabus of First Year B. Tech. is enclosed herewith. The syllabus is also made available on university website www.unishivaji.ac.in.

Further, it is hereby informed that the question papers on the pre-revised syllabi shall be set for the examination to be held in October/November 2018 and April/May 2019. These chances are available for repeater students, if any.

You are therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,

Dy. Registrar

Encl-: as above.

Copy to-

1) I/c Dean, Faculty of Science & Technology
2) Director, Examination and Evaluation
3) The Chairman, respective BOS / Co-ordinating Committee

} For information

4) O.E. 4 Section
5) Appointment Section
6) Eligibility Section
7) Meeting Section

} For information & necessary action .

SHIVAJI UNIVERSITY, KOLHAPUR

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Accredided by NAAC 'A' Grade

Syllabus for

Bachelor of Technology

(B. Tech.) Program

(To be implemented from June, 2018 onwards)

SHIVAJI UNIVERSITY, KOLHAPUR

FIRST YEAR ENGINEERING AND TECHNOLOGY

Structure and Syllabus

(From the Academic Year 2018-2019)

(Course common to all branches except Architecture and Textile Engineering)

INSTRUCTIONS:

There are two groups in each semester:

1.Physics Group and

2.Chemistry Group

Allotment of groups to students:

a) Semester I: 50% students from each college will be admitted to Physics Group and remaining 50% will be admitted to Chemistry Group. The concerned College will decide the number and names of the students to be admitted in physics and chemistry groups and inform the same to the University.

b)Semester II: The students for Physics group in semester-I will be admitted to Chemistry Group in semester-II. The students for Chemistry Group in semester-I will be admitted to Physics Group in semester-II.

First Year Engineering and Technology – CBCS PATTERN (All Branches) (Sem I & II)

Sr. No		TEACHING SCHEME									EXAMINATION SCHEME							
		THEORY			TUTORIAL			PRACTICAL			THEORY					PRACTICAL (Term wok)		
		Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Hours	Mode	Marks	Total Marks	%Min	Hours	Max	%Min
SEMESTER - I																		
1	BSC-P-101 / BSC-C-101	3	3	3	-	-	-	1	2	2		CIE	30	100	40%	As per BOS Guidelines	25	40%
												ESE	70					
2	BSC-M-I-102	3	3	3	1	1	1	-	-	-		CIE	30	100	40%		25	40%
												ESE	70					
3	ESC-103	3	3	3	-	-	-	1	2	2		CIE	30	100	40%		25	40%
												ESE	70					
4	ESC-104	3	3	3	-	-	-	1	2	2		CIE	30	100	40%		25	40%
												ESE	70					
5	ESC-105	3	3	3	-	-	-	1	2	2		CIE	30	100	40%		25	40%
												ESE	70					
6	HM-I-106	1	1	1	-	-	-	1	2	2		-	-	-	-		25	40%
7	ESC-W-I-107	1	1	1	-	-	-	1	2	2		-	-	-	-		50	40%
	TOTAL	17	17	17	1	1	1	6	12	12				500			200	
SEMESTER –II																		
1	BSC-P-201 / BSC-C-201	3	3	3	-	-	-	1	2	2		CIE	30	100	40%	As per BOS Guidelines	25	40%
												ESE	70					
2	BSC-M-II-202	3	3	3	1	1	1	-	-	-		CIE	30	100	40%		25	40%
												ESE	70					
3	ESC-203	3	3	3	-	-	-	1	2	2		CIE	30	100	40%		25	40%
												ESE	70					
4	ESC-204	3	3	3	-	-	-	1	2	2		CIE	30	100	40%		25	40%
												ESE	70					
5	ESC-205	3	3	3	-	-	-	1	2	2		CIE	30	100	40%		25	40%
												ESE	70					
6	HM-II -206	1	1	1	-	-	-	1	2	2		-	-	-	-		25	40%
7	ESC-W-II-207	1	1	1	-	-	-	1	2	2		-	-	-	-		50	40%
	TOTAL	17	17	17	1	1	1	6	12	12				500			200	
	TOTAL	34	34	34	2	2	2	12	24	24				1000			400	

CIE – Continuous Internal Evaluation ESE – End Semester Examination

Candidate contact hours per week : 30 Hours(Minimum)
Total Marks for B.Tech I. Sem I & II :**1400**
Theory and Practical Lectures : 60 MinutesEach
Total Credits for B.Tech.-I (Semester I & II) :**48**
IntheoryexaminationtherewillbeapassingbasedonseparateheadofpassingforexaminationofCIEandESE
There shall be separate passing for theory and practical (term work)courses
Non-Credit Self Study Course : Compulsory Civic Courses(CCC) **For Sem I: CCC – I :** Democracy, Elections and Good Governance
Non-Credit Self Study Course : Skill Development Courses (SDC) For Sem II: SDC – I : Any one from following (i) to(v) i) Business Communication & Presentation ii) Event management iii) Personality Development, iv) Yoga & Physical Management v) Resume, Report & proposal writing

Note:
1.BSC : Basic Science Course arecompulsory.
2.HM : Humanities and Management arecompulsory.
3.ESC : Engineering Science Course **: ESC- P**for courses (subjects) are mandatory**Physics** group, while **ESC – C** courses (subjects) are mandatory for **Chemistry**group.
4.There will be two groups for Sem I & II Physics and Chemistry. The Candidate's those opting Physics group in Sem I shall appear for Chemistry group in Sem II andVice-versa.
5.ESC-W: Engineering Science Course-Workshop arecompulsory.

Course List

Semester – I

Physics Group			
Sl. No	**Code No.**	**Subject**	**Credits**
1.	BSC-P-101	Engineering Physics	4
2.	BSC-M-I-102	Engineering Mathematics-I	4
3.	ESC-P-103	Basic Electrical Engineering	4
4.	ESC-P-104	Basic Civil Engineering	4
5.	ESC-P-105	Engineering Graphics	4
6.	HM-I-106	Professional Communication-I	2
7.	ESC-W-I-107	Workshop Practice-I	2
		Total	24

Chemistry Group			
Sl. No	**Code No.**	**Subject**	**Credits**
1.	BSC-C-101	Engineering Chemistry	4
2.	BSC-M-I-102	Engineering Mathematics-I	4
3.	ESC-C-103	Fundamentals of Electronics and Computer Programming	4
4.	ESC-C-104	Applied Mechanics	4
5.	ESC-C-105	Basic Mechanical Engineering	4
6.	HM-I-106	Professional Communication-I	2
7.	ESC-W-I-107	Workshop Practice-I	2
		Total	24

Semester II

Chemistry Group			
Sl. No	**Code No.**	**Subject**	**Credits**
1.	BSC-C-201	Engineering Chemistry	4
2.	BSC-M-II-202	Engineering Mathematics-II	4
3.	ESC-C203	Fundamentals of Electronics and Computer Programming	4
4.	ESC-C204	Applied Mechanics	4
5.	ESC-C205	Basic Mechanical Engineering	4
6.	HM-II-206	Professional Communication-II	2
7.	ESC-W-II-207	Workshop Practice-II	2
		Total	24

Physics Group			
Sl. No	**Code No.**	**Subject**	**Credits**
1.	BSC-P-201	Engineering Physics	4
2.	BSC-M-II-202	Engineering Mathematics-II	4
3.	ESC-P-203	Basic Electrical Engineering	4
4.	ESC-P-204	Basic Civil Engineering	4
5.	ESC-P-205	Engineering Graphics	4
6.	HM-II -206	Professional Communication-II	2
7.	ESC-W-II-207	Workshop Practice-II	2
		Total	24

FIRST YEAR ENGINEERING AND TECHNOLOGY
Semester I and II
EngineeringPhysics

SECTION – I

Unit 1.Diffraction and Polarization of Light :(12 Marks)(7)

Diffraction : Diffraction- Concept and types (Fresnel and Fraunhofer diffraction), Diffraction grating – construction and theory, resolving power of planetransmission grating.

Polarization:

Introduction, double refraction, Huygens' theory (positive and negative crystals), Optical Activity, Specific Rotation, Laurent's half shade polarimeter.

Unit 2. Laser and FibreOptics:(12 Marks)(7)LASER :

Absorption, spontaneous emission, stimulated emission, pumping, population inversion, Ruby laser, characteristics of laser, Holography (construction and reconstruction)

Fibre Optics:

Total Internal Refection, structure of opticalfibre, acceptance angle, acceptance cone, numerical aperture and fractional refractive index change (noderivation), fibre optic communication system, advantages of optical fibres.

Unit 3. Sound: (11 Marks)(7)

Conditions for good acoustics, Reverberation, Reverberation time, Sabine's formula for reverberation time (no derivation), Absorption coefficient, Factors affecting architectural acoustics and their remedy.

SECTION – II

Unit 4.Crystal Physics: (12 Marks)(7)

Space Lattice, Basis and Crystal structure, Unit cell, Seven crystal system, number of atoms per unit cell, coordination number, atomic radius, packing fraction, relation between density and lattice constant, Miller indices - procedure, features and sketches for differentplanes, symmetry elements of cubic crystal,Bragg's law for X-ray diffraction.

Unit 5. Physics of Nano-materials: (12 Marks)(7)

Concept- Nanomaterial, Nanoscience and Nanotechnology, production techniques(Top down and bottom up), Ball milling and Colloidal technique for synthesis of nano particles, Types of Nanomaterial, Tools- Scanning Tunneling Microscope and Atomic Force Microscope, properties and applications of nano-materials.

Unit 6.QuantumMechanics (11 Marks)(7)

Wave-particle duality of light, dual nature of matter (De-Broglie's concept of matter waves) Wavelength of matter wave in terms of K.E. and P. D., Properties of matter waves, Heisenberg's uncertainty principle for position and momentum, Compton Effect (Statement, explanation and experimental verification).

List of Experiments;

Minimum 8 experiments should be performed from the following list.

01. Bi-prism experiment
02. Diffraction at Cylindrical obstacle.
03. Calculation of divergence of LASER beam.
04. Determination of wavelength of LASER using diffraction grating.
05 Wavelength of different spectral lines of mercury using grating.
06. Polarimeter.
07. Verification of inverse square law of intensity of light.
08. Resolving power of Telescope
09. Measurement of band gap energy.
10. Study of crystal structure.
11. Study of symmetry elements of cubic crystal.
12. Determination of 'd' (interplaner distance) using XRD pattern.
13. Study of Planes with the help of models related Miller Indices.
14. Determination of e/m of an electron
15. R. P. of grating

References :

1. R. K. Gaur & Gupta S. L, Engineering Physics -DhanapatRai Publication.
2. M. N. Avadhanulu& P. G. Kshirsagar - A Text Book of EngineeringPhysics -S. Chand Publication.
3. B. L. Theraja -Modern Physics - S. Chand & Company Ltd., Delhi.
4. Subramanyam&BrijLal, A Text Book of Optics –S. Chand & Company (P.) Ltd.
5. B. K. Pandey and S. Chaturvedi- EngineeringPhysics, Cengage Learning-2012
6. S. O. Pillai, Solid State Physics : Structure & Electron Related Properties,Eastern Ltd,, New Age International Ltd.
7. Charles Kittle, Introduction to Solid State Physics - Wiley India Pvt. Ltd.(8^{th}Edtion).
8. V. Rajendran – Engineering Physics- Mc. Graw Hills
9. Alan Giambattista and others- Fundamentals of physics, Tata Mc. Graw Hills
10. Vijay Kumari- Engineering Physics, Vikas Publications
11. ResnickHalliday, Physics Volume-I, Krane -John Wiley & Sons Pub.
12. ResnickHalliday, Physics Volume-II, Krane -John Wiley & Sons Pub.
13. Hitendra K. Malik, A. K. Singh – Engineering Physics - Tata Mc. Graw Hills Education Private Ltd.
14. A. Beiser – Concepts of Modern Physics - Tata Mc. Graw Hills
15. L. J. Schiff – Quantum Mechanics - Tata Mc. Graw Hills

FIRST YEAR ENGINEERING AND TECHNOLOGY
Semester -I

EngineeringMathematics-I

SECTION I

Unit 1: Matrices and Solution of Linear System Equations(8)(Weightage 15 Marks in Shivaji Uni Exam of 70 marks)

1. Rank of matrix: definition, normal form and echelon form
2. Consistency of linear system equations
3. System of linear homogeneous equations
4. System of linear Non-homogeneous equations

Unit 2: Eigen Values and Eigen vectors (7)

(Weightage 10 Marks in Shivaji Uni Exam of 70 marks)

1. Eigen Values
2. Properties of Eigen Values
3. Eigen vectors
3. Properties of Eigen vectors
4. Cayley-Hamilton's theorem (Without proof)

Unit 3: Complex Numbers (6)

(Weightage 10 Marks in Shivaji Uni Exam of 70 marks)

1. De Moivre's Theorem (Without proof)
2. Roots of complex numbers by using De Moivre's Theorem
3. Expansion of sinnθ and cosnθ in powers of sinθ and /or cosθ.
4. Circular functions of a complex variable - definitions

5Hyperbolic and Inverse Hyperbolic Functions- definitions .

SECTION II

Unit 4: Numerical Solution of linear simultaneous equations: (6)(Weightage 10 Marks in Shivaji Uni Exam of 70 marks)

1. Gauss elimination method
2. Gauss-Jordan method
3. Jacobi's iteration method
4. Gauss-Seidel iteration method

Unit 5: Expansion of Functions and Indeterminate forms: (7)(Weightage 10 Marks in Shivaji Uni Exam of 70 marks)

1. Maclaurin's theorem
2. Standard expansions
3. Taylor's theorem
4. Indeterminate forms and L' Hospital's rule

Unit 6: Partial Differentiation:(8)(Weightage 15 Marks in Shivaji Uni Exam of 70 marks)

1. Partial derivatives: Introduction
2. Total derivatives
3. Differentiation of implicit function
4. Euler's theorem on homogeneous function of two variables
5. Jacobian and its Properties .
6. Maxima and Minima of functions of two variables

General Instructions:

1. Batch wise tutorials are to be conducted. The number of students per batch should be as per the university pattern for practical batches.
2. Minimum number of assignments should be 8 covering all topics.

Recommended Books:

1. A text book of Applied Mathematics, Vol.I by P. N. Wartikar& J. N. Wartikar, Pune VidyarthiGrihaPrakashan, Pune.
2. Higher Engineering Mathematics by Dr. B. S. Grewal, Khanna Publishers, Delhi.

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley India Pvt. Ltd.
2. Advanced Engineering Mathematics by H. K. Dass, S. Chand, New Delhi.
3. A text book of Engineering Mathematics Volume I by Peter V. O'Neil and Santosh K.Sengar, Cengage Learning.
4. Mathematical methods of Science and Engineering by Kanti B. Datta, Cengage Learning.
5. Numerical methods by Dr. B. S. Grewal, Khanna Publishers, Delhi.
6. A text book of Engineering Mathematics by N. P. Bali, Iyengar, Laxmi Publications (P) Ltd.,NewDelhi.

FIRST YEAR ENGINEERING AND TECHNOLOGY
Semester -I and II

Basic Electrical Engineering

SECTION I

Unit1: Analysis of D.C. circuits: (8)

(Weightage 12 Marks in Shivaji Uni Exam of 70 marks)

Concept of E.M.F, Potential Difference, Current, Resistance, Ohm's Law Kirchhoff's laws, mesh and node analysis

(Numerical on Mesh and Nodal Analysis of Two loops)

Unit 2:Magnetic circuits:(8)

(Weightage 11 Marks in Shivaji Uni Exam of 70 marks)

Concept of mmf, reluctance, magnetic flux, Magnetic Flux density, Magnetic field strength, BH curve, magnetic leakage, fringing, Comparison of Electric and Magnetic circuit, series magnetic circuits (Theoretical Concepts only).

Unit 3: Single phase AC Circuits: (8) (Weightage 12 Marks in Shivaji Uni Exam of 70 marks)

Fundamentals of Alternating quantities, Faraday's Law, Types of Induced E.M.F ,Generation of sinusoidal voltage, concept of R.M.S. & Average value, form factor, Peak Factor, Pure Resistive, Inductive, Capacitive , R-L, R-C, R-L-C series circuits, powers, Significance of power factor.

(Numerical Treatment on Series R-L, R-C, R-L-C circuits)

SECTION II

Unit 4: Three phase A.C. Circuits (7) (Weightage 12 Marks in Shivaji Uni Exam of 70 marks)

Advantages of 3 phase system, Generation of 3 phase AC supply, balanced 3 phase load, relation between line and phase quantities for star connected circuit and delta connected circuit.

Unit 5:Earthing and lamps: (7) (Weightage 11 Marks in Shivaji Uni Exam of 70 marks)

Necessity of Earthing, Earthing methods, Fuse (rewireble and HRC). MCB, Incandescent Lamp, Fluorescent tube, CFL, LED lamp, Mercury vapour lamp, single line diagram of electrical systems.

Unit 6: Single phase Transformer: **(8)** (Weightage 12 Marks in Shivaji Uni Exam of 70 marks)

Construction, operating principle, Types, emf equation, Ratios of voltage and current, operation on no load and with load, power losses, efficiency, voltage regulation, applications.

(Numerical Treatment on E.M.F Equations &Transformer losses and Efficiency)

List of Experiments

Minimum 8 experiments should be performed from the following list.

1. Laboratory Sessions covering,General Introduction to Electrical Engineering laboratory, Experimental Set ups, Instruments etc.. Electrical Symbols.
2. Electric Shocks and precautions against shocks(Do's and Don'ts) .
3. Study of Ohm's Law.
4. Verification of Kirchhoff's Voltage Law and Kirchhoff's Current Law.
5. B-H curve of magnetic material.
6. Study of Faraday's law.
7. Determination of Reactance's for Series R-L- C Circuit.

8. Measurement of active and reactive power in balanced 3-phase circuit using Two-watt meter method.
9. Study of Basic methods of Earthing. Use of Fuse and Miniature Circuit breaker.
10. Study of different luminaries including Incandescent lamp, Mercury vapor lamps, fluorescent tube, CFL, and LED lamps.
11. Polarity and Ratio Test for single Phase Transformer.
12. Pre-determination of efficiency and regulation by Open Circuit and Short circuit tests on single phase transformer.
13. Determine the Efficiency of single Phase Transformer by Direct Loading Test

Reference books:

1. P.V.Prasad and S.Shivan Raju – Electrical Engineering concepts and Applications – Cengage learning.
2. B.L.Theraja – Electrical Technology vol.1. – S.Chand.
3. B.L.Theraja – Electrical Technology vol.2. – S.Chand.
4. NagrathI.J. and D.P.kothari – Basic Electrical Engineering(2001) – Tata McGraw Hill.
5. .BharatiDwivedi and AnurasgTripathi – Fundamentals of Electrical Engineering – Willey Precise

FIRST YEAR ENGINEERING AND TECHNOLOGY

Semester -I and II

Basic Civil Engineering

SECTION I

Unit 1: Relevance of Civil Engineering and Building Planning(7)

Introduction, branches of civil engineering, application of civil engineering inother alliedfields.Principles of planning, introduction to Bye-Laws regarding building line, height of building, open space requirements, F.S.I., setbacks, ventilation, sanitation as per municipal corporation area requirement.

Unit 2: Components of Building (7)

A) Sub-structure: Types of soil and rocks as foundation strata, concept of bearing capacity,types of foundations i.e. shallow and deep and their suitability. Shallow foundation such as wall foundation, isolated foundation, deep foundation such as pile foundation.

B) Super-structure: Elements of super-structures and their functions

Unit 3: Building Materials and Design (7)

Use and properties of the following materials--Concrete – ingredients and grades, plain and reinforced cement concreteand ready mixconcrete, bricks, steel, timber, roofingmaterials etc.

Introduction to types of loads, load bearing and framed structures.

SECTION II

Unit 4: Linear and Angular Measurements(7)

Principles of surveying, Classification of surveys, Chain Surveying, Introduction to metricchain and tapes, error in chaining, nominal scale and R.F., ranging, chaining and offsetting, index plan, location sketch and recording of field book, Chain and compass survey, Meridian, bearing and its types, system of bearing, Types of compass: prismatic and surveyor's compass. Calculation

Ofincluded angles, correction for local attraction.

Unit 5: Leveling (7)

Terms used in leveling, use of Dumpy level and Auto Level, temporary adjustments.Methodsof reduction of levels, types of leveling, Contours, characteristics of contours, use of contour maps.Introduction and use of EDM's with special reference to Total Station.Measurement of area by planimeter – mechanical and digital.

Unit 6: Introduction to Transportation, Environmental and Irrigation Engineering (7)

Components of rigid and flexible pavement, components of railway track (Broad Gauge)Components of water supply scheme (flow diagram), Necessity of Irrigation, Types of Dams (Earthen and Gravity Dam)

Term work:

Student can choose either Model A or Model B for performing practical

Model A

List of Experiments: Minimum 8 experiments should be performed from the following list-Practicalexercises given be carried out and drawing sheets be plotted wherever necessary.

1. Introduction to Measurement of Distances.
2. Plotting the outlines of building by chaining, ranging and offsetting.

3. Plotting of closed traverse by prismatic compass.
4. Reduction of levels by rise and fall method.
5. Finding out gradient of line by rise and fall method
6. Measurement of area by mechanical
7. Study of total station for various measurements.
8. Site visit to study various construction processes and principles of planning.
9. Drawing sheet showing various building elements.
10. Drawing sheet showing various sign conventions

Model B

List of Experiments: Minimum 8 experiments should be performed from the following list- Practicalexercises given be carried out and drawing sheets be plotted wherever necessary.

1. Introduction to Measurement of Distances.
2. Plotting the outlines of building by chaining, ranging and offsetting.
3. Plotting of closed traverse by surveyor's compass.
4. Reduction of levels by collimation plane method.
5. Finding out gradient of line by collimation plane method.
6. Measurement of area by digital planimeter
7. Study of total station for various measurements.
8. Site visit to study various construction processes and principles of planning.
9. Drawing sheet showing various building elements.
10. Drawing sheet showing various sign conventions

Reference Books:

1. Basic Civil Engineering by S. S. Bhavikatti, New Age International Publications.
2. Civil Engineering Materials - Technical Teacher's Training Institute, Chandigarh
3. Surveying by N. Basak, Tata Mc-Graw Hill Publication.
4. Basic Civil Engineeringby G. K. Hiraskar, DhanpatRai Publication.
5. Surveying Vol.I, Vol.II, Vol.III by B.C. Punmia, Laxmi Publication.
6. Irrigation Engineering by B. C. Punmia, DhanpatRai Publications

FIRST YEAR ENGINEERING AND TECHNOLOGY

Semester -I and II

EngineeringGraphics

SECTION I

Unit1: Fundamentals of Engineering Graphics& Engineering Curves (6)

A) Fundamentals of Engineering Graphics: Introduction to Drawing instruments and their uses. Layout of drawing sheets, different types of lines used in drawing practice, Dimensioning system as per BIS (Theoretical treatment only)

B) Engineering curves: Construction of regular polygons (up to hexagon). Construction of Ellipse – (Directrix-Focus & Arcs of circle Method) Parabola-(Directrix-Focus & Rectangle Method) , Hyperbola-(Directrix-Focus & Rectangular Method), Involutes, Archimedian spiral and Cycloid only. (10 marks)

Unit 2: Projections of lines & Planes (9)

A) Projections of lines: Introduction to First angle and third angle methods of projection.
Projections of points on regular reference planes. Projections of horizontal, frontal and Profile lines on regular and auxiliary reference planes. Projection of oblique lines it's True length and angle with reference planes by rotation and auxiliary plane method. Concept of grade and bearing of line.

B) Projections of planes: Projections on regular and on auxiliary reference planes. Types of planes (horizontal, frontal, oblique and Profile planes). Edge view and True shape of a Plane. Angles made by the plane with Principle reference planes. Projections of plane figures inclined to both the planes. (Circle and regular polygon) (15 marks)

Unit 3: Projections of solids (5)

Projections of Prisms, Pyramids, Cylinder and Cones inclined to both referenceplanes(Excluding frustum and sphere)(10 marks)

SECTION- II

Unit 4: Orthographic Projections (7)

Orthographic views: lines used, Selection of views, spacing of views, dimensioning and sections. Drawing required views (any two views) from given pictorial views (Conversion of pictorial view into orthographic view) including sectional orthographic view. (15 marks)

Unit 5: Isometric projections (6)

Isometric projections: Introduction to isometric, Isometric scale, Isometric projections and Isometric views / drawings. Circles in isometric view. Isometric views of simple solids and objects. (10 marks)

Unit 6: Development of plane and curved surfaces (7)

Development of plane and curved surfaces: of the solids, Prisms, Pyramids, Cylinders and Cones along with cutting planes (Solids in simple position only). (10 marks)

Note: The above syllabus is to be covered according to the first angle method of projection.
Self-Study: Geometrical constructions and free hand sketches**,** Missing Views

Term work:

The following six sheets are to be drawn based on the above topics. All these sheets should be drawn on half imperial (A3 size) drawing sheets only.

1. Engineering curves	01
2. Projections of lines and planes	01
3. Projections of solids	01
4. Orthographic projections	01
5. Isometric projections	01
6. Sections of solids and development of surfaces	01

Reference Books:

1. Engineering Drawingby N. D. Bhatt, Charotor Publication House, Bombay
2. Fundamentals of Engineering by W. J. Luzadder, Drawing, Prentice Hall of India.
3. Engineering Design and Visualization by Jon M.Duff,William A. Ross, CENGAGE Learning
4. Machine Drawing by N. D. Bhatt, Charotor Publication House, Bombay.
5. Graphic Science by French and Vierck, Mc-Graw Hill International.
6. Engineering Drawing and Graphics by K. Venugopal, New Age Publication
7. A text book of Engineering Drawing by R. K. Dhawan, S. Chand and Co.
8. Machine Drawing by K. L. Narayana, New Age Publication
9. Engineering Drawing by N. B. Shaha and B. C. Rana, Pearson Education.
10. Engineering Drawing and Graphics Using AutoCAD by T. Jeyapoovan, Vikas Publication.
11. Engineering Drawing by Prof. Amar Pathak, WIELY India Publication.

FIRST YEAR ENGINEERING AND TECHNOLOGY
Semester -I
Professional Communication-I

Unit 1: Understanding Communication **(3)**

1. Introduction, nature and importance
2. Process of communication
3. Basic types of communication- Verbal and Non- verbal
4. Barriers and filters of communication

Unit 2: Grammar and Vocabulary **(2)**

1. Forms of Tenses
2. LSRW skills
3. Developing vocabulary (synonyms, antonyms, confused words etc.)

Unit 3: Phonetics **(2)**

1. Understanding Phonetics and its alphabets
2. Transcription practices

Unit 4: Developing Oral Skills **(3)**

1. Importance and techniques of spoken language.
2. Techniques of formal speech, meetings, Elocution, Extempore etc.

Unit 5: Professional Correspondence **(4)**

1. Importance, language and style, formats (British & American)
2. Letter Writing – Simple letter (seeking permission regarding absence etc.),
3. Preparation of technical events information broacher and manuals.

Term Work: Minimum 8 should be performed from the following list.

1. Elocution
2. Vocabulary building
3. Phonetic Alphabets (Listen & repeat)
4. Pronunciation
5. Fluency Tips
6. Extempore
7. Teamwork- story making
8. Effective reading (newspaper articles)
9. Active listening (memorizing)
10. Letter writing
11. Situational conversation

Instructions:

1. Minimum 7 assignments should be covered.
2. Use of language lab is mandatory for both the semesters.

Reference Books:

1. Handbook for Technical Writingby David A. McMurrey, Joanne Buckley, Cengage.
2. A Course in Englishby J.D. O'Connor.
3. Better English Pronunciation by J.D. O'Connor.
4. Communication Skills Handbook: How to succeed in written and oral communication by Jane Summers, Brette Smith, Wiley India Pvt.Ltd.
5. Personal Development for Life and Work by Masters, Wallace, Cengage.
6. Soft Skills for Managers by Dr. T. KalyanaChakravarthi, Dr. T. LathaChakravarthi, Biztantra.
7. Soft Skills for every one by Jeff Butterfield, Cengage.
8. Behavioural Science by Dr.Abha Singh, Wiley India Pvt.Ltd.
9. An Introduction to Professional English and Soft Skills by Bikram K. Das, KalyaniSamantray, Cambridge University Press New Delhi.
10. Speaking Accurately, K.C. Nambiar, Cambridge University Press New Delhi.
11. Speaking Effectivelyby Jeremy Comfort, Pamela Rogerson, Cambridge University Press New Delhi.
12. Cambridge English for Job Hunting by ColmDownes, Cambridge University Press New Delhi.
13. Body Language by Allen Pease.
14. The Ace of Soft Skills by Gopalswami Ramesh, Mahadevan Ramesh, Pearson Publication, Delhi.
15. Decision Making Skills by Khanka S.S.
16. Business Ethics and Communication by C.S. TejpalSheth.
17. Write Right by Syed AbdurRaheem.

FIRST YEAR ENGINEERING AND TECHNOLOGY

Semester -I and II

Workshop Practice-I

Unit 1: Safety (3)

Concept of accidents, causes of accidents, safety precautions while working in shop, safetyequipments and their use.

Unit 2: Measuring Instruments (3)

Brief introduction to instruments like – Steel rule, Calipers, Vernier Caliper, Micrometer, DialGauge, Vernier height Gauge etc. Least counts, common errors and care while using them, Use ofmarkinggauge, 'V'block and surface plate.

Unit 3: Smithy (4)

Introduction to smithy operations like- bending, forming, upsetting, drawing. Smithy toolshammer,hot & cold chisel flatters, tongs, anvil etc.

Unit 4: Fitting (4)

Study of various tools like- files, drills, taps, dies. Fitting operations.

Term work:

The term work consists of assignment on safety, measuring instruments, Smithy and fitting.
Every student should perform,

1. Smithy
One job in smithy involving upsetting, Drawing, bending such as- Hook, peg, square headedbolt etc.

2. Fitting
One job Male/Female fitting with operations- Marking, cutting, drilling, tapping filing etc.

Reference Books:
1. A Course in Workshop Technology, Vol – I by B. S. Raghuvanshi, Dhanapat Rai and Sons.
2. Elements of Workshop Technology, Vol – I by HajaraChaudhari, Media Promoters.
3. Workshop Technology, Vol – I by Gupta and Kaushik, New Heights.
4. Workshop Technology, Vol – I by Chapman, The English Language Book Society.
5. Workshop Technology, Vol.-I by H.S. Bawa, TMH Publications, New Delhi.

FIRST YEAR ENGINEERING AND TECHNOLOGY

Semester -I and II

EngineeringChemistry

Unit 1: Water **(7)**

Introduction, impurities in natural water, water quality parameters total solids, acidity, alkalinity, chlorides, and dissolved oxygen (definition, causes, significance), hardness of water types of hardness, units of hardness, ill effects of hard water in steam generation in boilers (scale & sludge formation), numerical on hardness, treatment of hard water (ion exchange and reverse osmosis).

Unit 2: Instrumental methods of chemical analysis **(7)**

Introduction, advantages and disadvantages of instrumental methods-----

A)Spectrometry: Introduction, Laws of spectrometry (Lamberts and Beer-Lambert's law),Single beam spectrophotometer (schematic, working and applications).

B)Chromatography: Introduction, types, gas-liquid chromatography (GLC), basic principle, instrumentation and applications.

Unit 3: Advanced materials **(7)**

A)Polymers: Introduction, plastics, thermo softening and thermosetting plastics, industrially important plastics like phenol formaldehyde, urea formaldehyde and epoxy resins, Conducting polymers and Biopolymers(Introduction, examples and applications.)

B)Composite materials: Introduction, Composition, properties and uses of fiber reinforced plastics (FRP) and glass reinforced plastic (GRP).

SECTION II

Unit 4: Fuels(7)

Introduction, classification, calorific value, definition, units (calorie, kcal, joules, kilojoules), characteristics of good fuels, comparison between solid, liquid and gaseous fuels, types of calorific value (higher and lower), Bomb calorimeter and Boy's calorimeter. Numericalproblems on Bomb and Boy's calorimeter.

Unit.5: Corrosion: **(7)**

Introduction, causes, classification, atmospheric corrosion (oxidation corrosion), electrochemical corrosion (hydrogen evolution and oxygen absorption mechanism), factors affecting rate of corrosion. Prevention of corrosion by proper design and material selection,cathodic protection, Protective coatings-hot dipping (galvanizing and tinning,), electroplating.

Unit 6: Metallic materials & Green Chemistry **(7)**

A)Metallic materials: Introduction, Alloy- definition and classification, purposes of making alloys. Ferrous alloys: Plain carbon steels (mild, medium and high), stainless steels. Nonferrous alloys: Copper alloy (Brass), Nickel alloy (Nichrome), Aluminum alloy (Duralumin and Alnico).

B)Green Chemistry: Definition, Twelve principles of Green Chemistry.

Term work:

List of Experiments:

Minimum 8 experiments should be performed from the following list out of which two experiments should be demonstrative on instrumental methods.

1. Determination of acidity of water.
2. Determination of alkalinity of water.
3. Determination of chloride content of water by Mohr's method.

4. Determination of total hardness of water by EDTA method.
5. Determination of moisture, volatile and ash content in a given coal sample by proximate analysis.
6. Preparation of urea-formaldehyde resin.
7. Preparation of phenol-formaldehyde resin.
8. Determination of percentage of copper in brass.
9. Estimation of zinc in brass solution.
10. Determination of rate of corrosion of aluminium in acidic and basic medium.
11. Demonstration of pH meter.
12. Demonstration of photo-colorimeter / spectrophotometer.
13. Demonstration of paper chromatography.

Reference books:

1.Engineering Chemistry by Jain and Jain, DhanpatRai Publishing Company Ltd., New Delhi.
2.A Textbook of Engineering Chemistry by S. S. Dara and S. S. Umare, S. Chand & Company Ltd., New Delhi.
3.A Textbook of Engineering Chemistry by C. P. Murthy, C. V. Agarwal and A. Naidu, BS Publications, Hyderabad.
4.Chatwal and Anand, Instrumental Methods of Chemical Analysis, Himalaya Publishing House, New Delhi.
5.Engineering Chemistry by Dr. A. K. Pahari and Dr. B. S. Chauhan, Laxmi Publications (P) Ltd, New Delhi.
6.A text Book of Engineering Chemistry by ShashiChawla, DhanpatRai& Co. (Pvt.) Ltd, Delhi.
7.Engineering Chemistry by Wiley India.
8.Engineering Chemistry by RenuBapna and Renu Gupta, MacMillan Publishers (India) Ltd, Delhi.

FIRST YEAR ENGINEERING AND TECHNOLOGY
Semester -I and II

Fundamentals of Electronics and Computer

Unit 1: Semiconductor Devices and Applications (7)

(Weightage 12 Marks in Shivaji Uni Exam of 70 marks)

Semiconductor Diode, Half wave, Full wave, Bridge rectifier, Voltage Regulator Using Zener Diode,BJT: characteristics, CE configuration, CE as an amplifier. Load Line, Operating Point, Leakage Currents, Saturation and Cut off Mode of Operations.

Unit 2: Digital Electronics (7)

(Weightage 11 Marks in Shivaji Uni Exam of 70 marks)

Logic Gates, Boolean algebra, Comparison of Specifications of Logic Families, Combinational Logic, Half Adder, Full Adder, Multiplexer, De-Multiplexer.

Unit 3: Applications (7)

(Weightage 12 Marks in Shivaji Uni Exam of 70 marks)

A) Transducers: for Displacement (LVDT), Temperature (RTD), Pressure (Strain Gauge), Speed (Shaft Encoder), Range, Specifications and Limitations.

B) Appliances: Operation of Appliances: Digital Thermometer, Weighing Machine, Washing Machine, Microwave Oven and Tachometer.

SECTION II

Unit 4: Computer Basics and Hardware (5)

(Weightage 12 Marks in Shivaji Uni Exam of 70 marks)

A) Generations & Classification of Computers.

B) Computer System Architecture– CPU, Input Unit, Output Unit, Storage Unit.

C) Applications of Computers.

Unit 5: Data Representation and Computer Software (8)

(Weightage 11 Marks in Shivaji Uni Exam of 70 marks)

A) Data Representation In Computer: Types Of Number System – Binary, Octal, Decimal, Hexadecimal & Their Conversions, Coding Schemes – ASCII, Unicode.

B) Computer Software:

A) Operating System: Types Of Operating System, Functions, Unix/Linux Commands: Listing, Changing, Copying, And Moving Files & Directories (ls, cd, cat, mkdir, rmdir)

B) System Software: Assembler, Interpreter, Compiler.

C) Application Software's: Word Processor, Spreadsheets, Presentation andtheir Applications.

Unit 6: Computer Programming and Networks (8)

(Weightage 12 Marks in Shivaji Uni Exam of 70 marks)

A) Computer Programming: Program Development Cycle, Algorithm, Flowchart, Programming Control Structures – Sequence, Selection, and Repetition.

B) Introduction to Computer Networks: Definition Of Computer Network, Need, Standards: OSI, TCP/IP, Types of Networks: LAN, WAN, MAN, Network Topologies.

Term work: FUNDAMENTAL OF ELECTRONICS

List of Experiments: Minimum 4 experiments should be performed from the following list.

1. Testing of Electronic components- resistors, capacitors, inductor, diode, transistor, LED and Switches using multi-meter &C.R.O.
2. V-I Characteristics of PN junction diode and Zener diode.
3. Study of Half and Full wave rectifiers and their comparison.
4. Study of Frequency response of CE amplifier.
5. Study of truth tables of logic Gates: OR, AND, NOT, NAND, NOR, EXOR.
6. Study of MUX/DEMUX.
7. Measurement of Displacement using LVDT/strain Gauge.
8. Measurement of Temperature using any transducer.

Self-Learning Activities: Different types of Communication systems & Communication Media.

Term work: FUNDAMENTAL OF COMPUTER

List of Experiments: Minimum 4 experiments should be performed from the following list.

1. Study of computer system – Internal Components & peripherals.
2. Use of Unix/Linux commands & create a file using any editor in Linux.
3. Create a document using any word processor (In Linux (open office) /Windows (Microsoft office).
4. Use any spreadsheet application to manipulate numbers, formulae and graphs (In Linux/Windows).
5. Use any power point presentation application and create a professional power point presentation using text, image, animation etc. (In Linux/Windows).
6. An assignment based on use of Internet and Web for searching and downloading Technical information.
7. Study of Tablet and Android Operating System Features and applications.

Text Books:

1. A Text Book of Applied Electronics by R S Sedha, S. Chand
2. Basic Electronics Engineering by Vijay Baru, RajendraKaduskar, S T Gaikwad (Wiley/ DREAMTECH)
3. Digital Principles & Applications by Albert Malvino, Donald Leach, TMGH Publication.
4. Principle of Electronics by V.K. Mehata, S. Chand
5. Electronic Instrumentation by H. S. Kalasi, Tata McGraw Hills Publication

Reference Books:

1) Electronics Devices and Circuit Theory by Robert L. Boylestad and Louis Nashelsky (Pearson Education Publication)
2) Fundamental of Digital Circuits by A. Anand Kumar (PHI- Publication)
3) Fundamental of Electronics Engineering by R.Prasad(CENGAGE- Learning)
4) Introduction to Information Technology, ITL Education Solutions LTD. Pearson Education
5) Fundamentals of Computers by V. Rajaram, PHI Publications.
6) UNIX concepts and applications by Sunitabha Das, TMGH.
7) Computer FundamentalsArchetucture and Organization by B.Ram New Age International Publishers.

FIRST YEAR ENGINEERING AND TECHNOLOGY

Semester -I and II

Applied Mechanics

Unit 1: Fundamentals of Statics (7)

Basic Concepts and Fundamental Laws, Force, Moment and Couple, System of Forces, Resultant, Resolution and Composition of Forces, Varignon's Theorem, Law of Moments.

Unit 2: Equilibrium (7)

Lami s' Theorem, Free Body Diagram, Equilibrium of Forces, Equilibrium conditions, Surface friction for bodies on horizontal and inclined planes.

Beams: Types of Loads, Types of supports, Analysisof Simple beams, Virtual work method for support reactions.

Unit 3: Centroid and Moment of Inertia (7)

Centroid and Center of Gravity, Moment of Inertia of Standard shapes from first principle, Parallel and perpendicular axis theorem, Moment of Inertia of plain and composite figures, Radius of Gyration.

SECTION II

Unit 4: Kinetics of Linear (8)

Introduction to Kinematics of Linear motion (no numerical on kinematics), Kinetics of linear motion, Newton's Laws, D'Alembert's Principle, Work- Energy Principle, Impulse Momentum Principal

Unit 5: Kinetics of Circular Motion (8)

Introduction to Kinematics of Circular motion (no numerical on kinematics), Rotation with constant and variable angular acceleration, centripetal and centrifugal force, condition of skidding and overturning.

Unit 6: Impact and Collision (5)

Impact, Types of Impact, Law of conservation of Momentum, Coefficient of Restitution,Numerical on Direct central Impact.

Term work:

Student can choose either Model 1 or Model 2 for performing practical

Model 1	Model 2
A) Experiments:	
1. Law of polygon of forces	**1.** Law of polygon of forces
2. Jib crane	**2.** Jib crane
3. Bell crank lever	**3.** Bell crank lever
4. Support Reactions of Beam	**4.** Support Reactions of Beam
5.Fleture's Trolley	**5.** Centrifugal force
B) Graphics Statics: (To be solved on A3 sheet)	
1. To find Resultant - 3 problems	1. To find Resultant - 3 problems
2.To find support reactions - 3 problems	**2.**To find support reactions - 3 problems
C) Home Assignments	
At least one assignment on each unit with minimum 5 numericals	At least one assignment on each unit with minimum 5 numericals

Reference Books:

1.Engineering Mechanics by S. S. Bhavikattis, New Age International Pvt. Ltd.
2.Engineering Mechanics by R. K. Bansal and Sanjay Bansal.
3.Vector Mechanics for Engineers Vol.I and II by F. P. Beer and E. R. Johnston, Tata Mc-Graw Hill Publication.
4.Engineering Mechanics by Manoj K Harbola, Cengage Learning
5.Engineering Mechanics by K. I. Kumar, Tata Mc-Graw Hill Publication
6.Engineering Mechanics by S. B. Junnerkar.
7.Engineering Mechanics by Irving H. Shames, Prentice Hall of India, New Delhi.
8.Applied Mechanics by S. N. Saluja, Satya Prakashan, New Delhi.
9.Engineering Mechanics by Statics and Dynamics by Ferdinand Singer, Harper and Row Publications
10.Engineering Mechanics by R. S. Khurmi, S. Chand Publications
11.Fundamentals of Engineering Mechanics by S. Rajasekaran, G. Sankarasubramanian,VikasPublishing House
12) "Applied Mechanics- Dynamics &Statics " by I.B.Prasad, Khanna Publisher, Delhi

FIRST YEAR ENGINEERING AND TECHNOLOGY

Semester -I and II

Basic Mechanical Engineering

Unit1:Thermodynamics(7)

Thermodynamic State, Process, Cycle, Thermodynamic System, Heat, work, Internal Energy,First Law of Thermodynamics, Application of First Law to steady Flow processes,Limitations of First Law (Numerical Treatment) Statements of Second Law of Thermodynamics.(12 marks)

Unit 2: Introduction to I C Engine (7)

Carnot Engine, Construction and Working of C.I. and S.I., Two stroke, Four Stroke Cycles,Air standard cycles- Carnot Cycle, Joule Cycle, Otto Cycle, Air Standard efficiency (DescriptiveTreatment only) (12 marks)

Unit 3: Introduction to Refrigeration and Air Conditioning (6)

Carnot refrigerator, Refrigerant types and properties, Vapour compression and vapourabsorption system, solar refrigeration, Window Air Conditioning, Psychometric properties ofmoistair, Applications of refrigeration and air conditioning (Descriptive Treatment only).(11 marks)

Unit4:EnergySources and power plants (7)

Renewable and nonrenewable, Solar-flat plate collector, concentric collector–Parabolic andcylindrical, Photovoltaic cell, Wind, Hydropower plant, Steam Power plant,Bio-gas, Bio-Diesel (Descriptive Treatment only). (12 marks)

Unit 5: Mechanical Power Transmission and Energy conversion devices(7)

Type of Belt and belt drives, chain drive, Types of gears and gear Trains, (Numerical Treatment on belt drive), Construction, workingand applications of centrifugal Pump, Reciprocating compressor and Peloton wheel Turbine.(12 marks)

Unit 6: Manufacturing Processes (6)

Introduction to manufacturing processes - Casting Process, Steps involved in castingprocesses, and their applications, Metal removing processes (Lathe, milling & drilling operations) Metal JoiningProcesses – Arc welding, soldering and brazing and their applications.(11 marks)

Term Work:

List of experiments: Minimum 8 experiments should be performed from the following list--

1. Demonstration of I.C. engine
2. Demonstration of Two stroke and four stroke engine
3. Demonstration of vapor compression refrigeration system and window airconditioner.
4. Demonstration of Solar water heating system.
5. Demonstration of Steam or Hydroelectric Power Plant
6. Demonstration of Diesel power plant
7. Demonstration of types of Gears and gear trains.
8. Demonstration of pumps and compressor.
9. Demonstration of hydraulic turbine
10. Demonstration of metal joining processes.
11. Demonstration of metal removal processes
12. Industrial visit based on syllabus.

Reference Books:

1. Solar Energy by Dr.S.P. Sukathame,Tata Mc-Graw Hill Publication
2. Non-Conventional Sources of Energy by G.D. Rai, Khanna Publication
3.Engineering Thermodynamics by R.Joel, The English Language Book Society.
4.Engineering Thermodynamics by Achultan, Prentice Hall of India.
5.Thermal Engineering by R.K. Rajput, Laxmi Publication, Delhi.
6.Elements of Heat Engine Vol.I,II,III by Patel and Karamchandani, Acharya Book Depot.
7.Power Plant Engineering by Arora and Domkunwar, Dhanpat Rai and Sons.
8. Manufacturing Technology Volume I and II by P. N. Rao, Tata Mc-Graw Hill Publication
9. Elements of Workshop Technology, Vol.I and II by HajaraChoudhari, Media Promoters
10. Basic Mechanical Engineering by Basant Agrawal & C. M. Agrwal, Wiley India Pvt. Ltd.
11.Energy Technology by S. Rao and Dr.B.B. Parulekar, Khanna Publication.

FIRST YEAR ENGINEERING AND TECHNOLOGY

Semester -II

EngineeringMathematics-II

SECTION-I

Unit 1: Ordinary Differential Equations of First Order and First Degree (7)
(Weightage 10 Marks in Shivaji Uni Exam of 70 marks)
1. Linear differential equations
2. Reducible to Linear differential equations
3. Exact differential equations
4. Reducible to Exact differential equations

Unit 2: Applications of Ordinary Differential Equations of First Order and First Degree (6)
(Weightage 10 Marks in Shivaji Uni Exam of 70 marks)
1.Applications to Orthogonal trajectories (Cartesian and Polar equations)
2. Applications to Simple Electrical Circuits
3. Newton's law of cooling

Unit 3: Numerical Solution of Ordinary Differential Equations of First Orderand First Degree(Weightage 15 Marks in Shivaji Uni Exam of 70 marks)**(8)**
1. Taylor's series method
2. Euler's method
3. Modified Euler's method
4. Runge-Kutta fourth order formula

SECTION-II

Unit 4:Numerical Solutions Of Algebraic and Transcendental Equations (6)(Weightage 10 Marks in Shivaji Uni Exam of 70 marks)
1. Bisection Method
2. Secant Method
3. Newton Raphson Method

Unit 5: Special Functions (7)
(Weightage 10 Marks in Shivaji Uni Exam of 70 marks) 1. Gamma function and its properties
2. Beta function and its properties
3. Error function and its properties

Unit 6: Multiple Integration and its applications: (8)
(Weightage 15 Marks in Shivaji Uni Exam of 70 marks)
1. Double Integrals and evaluation
2. Change of order of integration
3. Change into Polar Coordinates
4. Area enclosed by plane curves
5. Mass of a plane lamina

General Instructions:
1. Batch wise tutorials are to be conducted. The number of students per batch should be asperthe Universitypattern for practical batches.

2. Minimum number of assignments should be 8 covering all topics.

Recommended Books:

1. A text book of Applied Mathematics, Vol.-I by P. N. Wartikar& J. N. Wartikar, PuneVidyarthiGrihaPrakashan, Pune.
2. A text book of Applied Mathematics, Vol.-II by P. N. Wartikar& J. N. Wartikar, PuneVidyarthiGrihaPrakashan, Pune.
3. Dr. B. S. Grewal - Higher Engineering Mathematics by Dr. B. S. Grewal, Khanna Publishers,Delhi.

Reference Books:

1. Higher Engineering Mathematics by B.V.Ramana, Tata McGraw-Hill Publications, NewDelhi
2. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley India Pvt. Ltd.
3. Advanced Engineering Mathematics by H. K. Dass.
4. Mathematical methods of Science and Engineering by Kanti B. Datta, Cengage Learning.
5. A textbook of Engineering Mathematics Volume I by Peter V. O'Neil and Santosh K. Sengar, Cengage Learning.
6. A textbook of Engineering Mathematics by N. P. Bali, Iyengar, Laxmi Publications (P) Ltd.,New Delhi.

FIRST YEAR ENGINEERING AND TECHNOLOGY

Semester -I and II

Workshop Practice-II

Unit 1: Welding (4)

Types of welding – gas welding, arc welding, resistance welding, Welding equipment's,welding of various metals, electrode classification and coding, welding joints.

Unit 2: Carpentry (4)

Introduction, Classifications of wood, common varieties of Indian timber, carpentry toolslike- Marking tools, cutting tools, planes, striking tools, holding tools. Carpentry operations- marking,sawing,chiseling, grooving etc. carpentry joints.

Unit 3: Sheet metal work (4)

Specifications of metal sheets, working tools, sheet metal operations like-cutting, bending,folding, punching, reverting and joining by brazing and soldering.

Unit 4: Air pollution: (2)

Air pollution due to automobiles, causes, PUC testing.

Term work:

The term work consists of assignment on Welding, Carpentry, Sheet metal work, Airpollution.
Every student should perform---

1. Welding: One job on Arc welding- Lap / Butt Joint etc. (For individual student)
OR
Table, Shoe stand, Bag stand etc. (For 4-6 students)

2. Carpentry :One composite job involving dovetail joint, T joint, cross halving joint, pen stand etc.(Forindividual student)
OR
Table, Teapot, Stool etc. (For 4-6 students)

3. Sheet metal Work:

One job on commercial items such as Dust bin, funnel, tray etc.

Reference Books:

1. A Course in Workshop Technology, Vol – I by B. S. Raghuvanshi, Dhanapat Rai and Sons.
2. Elements of Workshop Technology, Vol – I by HajaraChaudhari, Media Promoters.
3. Workshop Technology, Vol – I by Gupta and Kaushik, New Heights.
4. Workshop Technology, Vol – I by Chapman, The English Language Book Society.
5. Workshop technology, Vol.-I by H.S. Bawa, TMH Publications, New Delhi.
6. I.C. Engines by Mathur& Sharma, Dhanpat Rai Publications, New Delhi.

FIRST YEAR ENGINEERING AND TECHNOLOGY

Semester -II

Professional Communication-II

Unit 1: Developing Writing Skills(3)

1. Importance of technical writing
2. Report Writing:

a) Techniques of Report Writing
b) Methods of data collection
c) Types of Report Writing- Survey, Inspection and Investigation

Unit 2: Behavioral Skills(5)

1. Understanding Self (SWOT analysis)
2. Attitude Building/ Developing Positive attitude
3. Decision Making Skills
4. Leadership Skills
5. Stress Management
6. Time Management
7. Team Work

Unit 3: Presentation Skills(2)

1. Importance & techniques
2. Presenting yourself professionally

Unit 4: Career skills (4)

1. Corporate Manners and Etiquettes
2. Planning and Managing Career
3. Job Application and Resume
4. Interview: Techniques& skills
5. Group Discussion
6. Debate

Term Work: Any 8 out of the following should be conducted

1. Group Discussion (lab session/class room activity)
2. Mock Interview
3. Report writing (lab session/class room activity)
4. Paragraph writing on current technical writing
5. Presentation on current affairs
6. Developing Professional Telephonic skills
7. Exercise of Application writing and Resume writing
8. Practice of Case Study
9. Team building activities
10. Report writing (3 types)
11. Introduction and use of modern communication techniques
12. Computer aided presentation of a project report (PPT)

Instructions:

1. Minimum 7 assignments should be covered.
2. Use of language lab is mandatory for both the semesters.

Reference Books:

1. Handbook for Technical Writingby David A. McMurrey, Joanne Buckley, Cengage.
2. A Course in Englishby J.D. O'Connor.
3. Better English Pronunciation by J.D. O'Connor.
4. Communication Skills Handbook: How to succeed in written and oral communication byJane Summers, Brette Smith, Wiley India Pvt.Ltd.
5. Personal Development for Life and Work by Masters, Wallace, Cengage.
6. Soft Skills for Managers by Dr. T. KalyanaChakravarthi, Dr. T. LathaChakravarthi,Biztantra.
7. Soft Skills for every one by Jeff Butterfield, Cengage.
8. Behavioural Science by Dr.Abha Singh, Wiley India Pvt.Ltd.
9. An Introduction to Professional English and Soft Skills by Bikram K. Das, KalyaniSamantray, Cambridge University Press New Delhi.
10. Speaking Accurately, K.C. Nambiar, Cambridge University Press New Delhi.
11. Speaking Effectivelyby Jeremy Comfort, Pamela Rogerson, Cambridge University PressNew Delhi.
12. Cambridge English for Job Hunting by ColmDownes, Cambridge University Press NewDelhi.
13. Body Language by Allen Pease.
14. The Ace of Soft Skills by Gopalswami Ramesh, Mahadevan Ramesh, PearsonPublication, Delhi.
15. Decision Making Skills by Khanka S.S.
16. Business Ethics and Communication by C.S. TejpalSheth.
17. Write Right by Syed AbdurRaheem.

SHIVAJI UNIVERSITY, KOLHAPUR

REVISED STRUCTURE AND SYLLABUS

SECOND YEAR (B. Tech) CBCS

MECHANICAL ENGINEERING

To be introduced from the academic year 2019-20

(i.e. from June 2019) onwards

SECOND YEAR MECHANICAL ENGINEERING– CBCS PATTERN

SEMESTER - III																									
Sr. No	Course (Subject Title)	TEACHING SCHEME									EXAMINATION SCHEME														
		THEORY			TUTORIAL			PRACTICAL			THEORY					PRACTICAL			TERM WORK					
		Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Hours	Mode	Marks	Total Marks	Min	Hours	Max	Min	Hours	Max	Min			
1	BSC-ME201	3	3	3	1	1	1	-	-	-		CIE	30	100	40	As per BOS Guidelines	-	-	2	25	10			
												ESE	70											
2	BSC-ME202	3	3	3	-	-	-	1	2#	2#		CIE	30	100	40				2	25	10			
												ESE	70											
3	PCC-ME203	3	3	3	-	-	-	1	2	2		CIE	30	100	40		25	10	2	25	10			
												ESE	70											
4	PCC-ME204	3	3	3	-	-	-	1	2	2		CIE	30	100	40		25	10	2	25	10			
												ESE	70											
5	PCC-ME205	3	3	3	-	-	-	1	2	2		CIE	30	100	40		25	10	2	25	10			
												ESE	70											
6	PCC-ME206		-	-	-	-	-	1	2	2		-	-	-	-		-	-	2	25	10			
7	PCC-ME207		-	-	-	-	-	1	2	2		-	-	-	-		-	-	-	25	10			
8	PCC-ME208		-	-	-	-	-	1	2#	2#		-	-	-	-		-	-	-	25	10			
9	MC-ME209	3	3	3	-	-	-	-	-	-		CIE	30	100	40		-	-	-	-	-			
												ESE	70											
	TOTAL	**18**	**18**	**18**	**1**	**1**	**1**	**7**	**12**	**12**				**600**			**75**			**200**				
SEMESTER –IV																									
1	PCC-	3	3	3		-	-	-		1	2	2			CIE	30	100	40	As per BOS Guidelines	-	-	2	25	10

	ME210												ESE	70								
2	PCC-ME211	3	3	3	-	-	-	1	2	2			CIE	30	100	40		-	-	2	25	10
													ESE	70								
3	PCC-ME212	3	3	3	-	-	-	1	2	2			CIE	30	100	40		25	10	2	25	10
													ESE	70								
4	PCC-ME213	3	3	3	-	-	-	1	2	2			CIE	30	100	40		-	-	2	25	10
													ESE	70								
5	PCC-ME214	4	4	4	-	-	-	-	-	-			CIE	30	100	40		-	-	-	-	-
													ESE	70								
6	PCC-ME215	-	-	-	-	-	-	1	2	2			-	-	-	-		25	10	2	25	10
7	PCC-ME216	-	-	-	-	-	-	1	2	2			-	-	-	-		-	-	2	25	10
8	PCC-ME217	-	-	-	-	-	-	1	2	2			-	-	-	-		-	-	2	25	10
9	PCC-ME218	-	-	-	-	-	-	1	2	2						-	-	25	10	2	25	10
	TOTAL	**16**	**16**	**16**	-	-	-	**8**	**16**	**16**					**500**			**75**			**200**	
	TOTAL	**34**	**34**	**34**	**1**	**1**	**1**	**16**	**28**	**28**					**1100**			**150**			**400**	

CIE- Continuous Internal Evaluation
ESE – End Semester Examination

• Candidate contact hours per week : 30 Hours (Minimum)	• Total Marks for S.E. Sem III & IV: **1650**
• Theory/Tutorial Duration : 60 Minutes and Practical Duration : 120 Minutes	• Total Credits for S.E. Sem III & IV : **50**
• In theory examination there will be a passing based on separate head of passing for examination of CIE and ESE.	
• There shall be separate passing for theory and practical (term work) courses.	

Note :

1. Basic Science Courses -Mechanical Engineering(BSC-ME) are compulsory.
2. Professional Core Course-MechanicalEngineering (PCC-ME) are compulsory.
3. Mandatory Course (MC-ME)Environmental Studies which is compulsory for theory 70 marks and project work 30 marks.

COURSE CODE AND DEFINITION

Semester III

Sr. No	Code No.	Subject	Credits
1.	BSC-ME201	Engineering Mathematics - III	4
2.	PCC-ME202	*Electrical Technology	4
3.	PCC-ME203	Applied Thermodynamics	4
4.	PCC-ME204	Metallurgy	4
5.	PCC-ME205	Fluid Mechanics	4
6.	PCC-ME206	Machine Drawing	1
7.	PCC-ME207	*Computer Programming Using C++	1
8.	PCC-ME208	Workshop Practice – III	1
9.	MC-ME209	Environmental studies	3
		Total	26

Semester IV

Sr. No	Code No.	Subject	Credits
1.	BSC-ME210	Applied Numerical Methods	4
2.	PCC-ME211	Analysis of Mechanical Elements	4
3.	PCC-ME212	Fluid and Turbo Machinery	4
4.	PCC-ME213	Theory of Machines – I @	4
5.	PCC-ME214	Machine Tools and Processes	4
6.	PCC-ME215	Testing and Measurement	1
7.	PCC-ME216	Computer Aided Drafting	1
8.	PCC-ME217	Computer Graphics	1
9.	PCC-ME218	Workshop Practice – IV	1
		Total	24

S.Y.B. Tech. (MECHANICAL ENGINEERING)- Semester – III

ENGINEERING MATHEMATICS-III BSC-ME201

Teaching Scheme	**Examination Scheme**
Lectures : 3 hours/week	**ESE : 70 marks**
Tutorial : 1 hour/week	**CIE : 30 marks**
Credits : 4	**Term Work : 25 marks**

Course Objectives:

1)To develop mathematical skills and enhance thinking power of students.

2)To give the knowledge to the students of Statistics, Linear Differential Equations ,Vector Differential Calculus ,Laplace transforms ,Fourier series with an emphasis on the application of solving engineering problems

3)To prepare students to formulate a mathematical model using engineering skills & interpret the solution in real world.

Course Outcomes:

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

1) SolveLinear Differential Equations with constant coefficients.
2) Describe the statistical data numerically by using Lines of regression and Curve fittings.
3) Find Laplace transforms of given functions and use it to solve linear differential equations.
4) Applyknowledge of vector differentiation to find directional derivatives, curl and divergence of vector fields.

5) Develop Fourier series expansion of a function over the given interval.

6) Make use ofPartial Differential Equation to solve the Mechanical Engineering problems.

SECTION – I

Unit 1. Linear Differential Equations: **07**

1.1 Linear Differential equations with constant coefficients.
1.2 Rules to find complementary function.
1.3 Methods to find particular Integral (e^{ax}, sinax or cosax, $x^m, e^{ax}x^m, e^{ax}sinax$ or $e^{ax}cosax$)
1.4 Cauchy's homogeneous linear differential equations.

Unit 2. Correlation, Regression & Curve Fitting: 07

2.1 Introduction.
2.2 Karl Pearson's Coefficient of Correlation.
2.3 Lines of regression of bivariate data.
2.4 Fitting of Curves by method of Least-squares:
  2.4.1 Fitting of Straight lines.
  2.4.2 Fitting of exponential curves.
  2.4.3 Fitting of second degree Parabolic curves.

Unit 3. Laplace Transform and its Applications: 07

3.1 Laplace transform of elementary functions.
  3.2 Properties of Laplace transforms(First Shifting , Change of scale property , Multiplication & Division by t).
3.3 Laplace transforms of derivatives and integral.
3.4 Inverse Laplace transforms by partial fractions & convolution theorem.
3.5 Solution of Linear differential equation with constant coefficients using Laplace transform.

SECTION – II

Unit 4. Vector Differential Calculus: 06

4.1 Differentiation of vectors.
4.2 Gradient of scalar point function.
4.3 Directional derivative.
4.4 Divergence of vector point function.
4.5 Curl of a vector point function.
4.6 Irrotational, Solenoidal and Scalar potential function of a vector field.

Unit 5. Fourier Series: **06**

5.1 Introduction
5.2 Definition, Euler's formulae.
5.3 Dirichlet's conditions.
5.4 Change of interval.
5.5 Expansions of odd and even functions.
5.6 Half range series.

Unit 6 Partial Differential Equations and Applications: 09

6.1 Formation of partial differential equation
6.2 Method of separation of variables.

6.3 Wave Equation and its solution
6.4 One dimensional heat flow equation
6.5 Solutions of Laplace equations by the Gauss – Seidel iterative method

Reference Books:

1) Advance Engineering Mathematics by Erwin Kreyszig (Wiley India.)
2) Mathematical Methods of Science and Engineering, by Kanti B. Datta (Cengage Learning.)
3) Advanced Engineering Mathematics, 3e, by Jack Goldberg (Oxford University Press.)
4) Engineering Mathematics by V. Sundaram (Vikas Publication.)
5) Higher Engineering Mathematics, by B. S. Grewal (Khanna Publication Delhi.)
6) Higher Engineering Mathematics, by B. V. Ramana (Tata McGraw-Hill)
7) Advanced Engineering Mathematics, by H. K. Das (S. Chand Publication.)
8) Applied Mathematics by Navneet D. Sangle (Cengage Publication)

General Instructions:

1) For the term work of 25 marks, batch wise tutorials are to be conducted. The number of students per batch per tutorial should be as per University rules.
2) Number of assignments should be at least six (All units should be covered).

S.Y. B. Tech (MECHANICAL ENGINEERING) Semester:III

2.ELECTRICAL TECHNOLOGY

Subject Code:BSC-ME202

TeachingScheme:	**Examination Scheme:**
Lectures: 3 Hrs.perweek	**ESE: 70Marks**
Practical: 2 Hrs. per alternate week	**CIE: 30Marks**
Credit: 04	**TERM WORK:25 Marks**

Pre-requisites: Basic Electrical Engineering

Course Objectives:

1) To understand Essential concepts & applications of Electric motors
2) To Select suitable drives for different mechanical systems.

3) To understand concept of electrical heating.

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

1) Deals the principles of Electrical Engineering
2) Understands the theoretical and practical's concepts of Electric motors
3) Apply Electrical heating methods for Industrial furnaces.
4) Identify and select suitable types of motors and drives
5) Decide complete Electrical drive system for Industrial applications.
6) Design various speed control techniques for Electric motors.

Unit No. 01 : DC motors **[7]**

Construction, Working, Types, Back emf, Speed equation, Torque equation, Speed torque characteristics, Power losses in d.c. Motors. Need of starter, 3 point starter, 4 point starter. Speed control of D.C. Shunt and series motor (numerical treatment on speed control methods). Reversal rotation of D.C motor

Unit No. 02 : Three Phase Induction Motor: **[6]**

Construction, Types, Working, Speed equation, Torque equation, Starting torque, full load torque, Torque speed characteristics, Power stages in motor, Advantages of 3- Phase Induction motor. (Numerical treatment on power stages)

Unit No. 03 : Three Phase Induction Motor Control **[6]**

Need of starter, Star delta starter, DOL starter, Autotransformer starter, Rotor resistance starter. Speed control methods- Pole changing, Voltage control, frequency control, Block diagram of VFD control, Reversal rotation 3- Phase Induction motor.

Unit No. 04 : Fractional Horse Power Motors **[6]**

Construction, Working, characteristics and Applications of Single phase permanent capacitor type Induction motor, AC servo motor, DC servo motor, Stepper motor (VR type and PM type).

Unit No. 05 : Electrical Drives [6]

Advantages of electrical drives, Types – Individual & Group drive, Nature of Mechanical loads With respect to speed–torque variation, 4 quadrant operation of DC motor. Criteria for selection of motors for applications like lathe, Traction, pumps, Conveyors, Lift, etc.

Unit No. 06 : Electric Heating [7]

Construction and Working of - Direct & Indirect resistance Heating, Direct arc furnace, Indirect arc furnace, Horizontal Core type induction furnace, Coreless induction furnace. (Numerical treatment on Electrical to Thermal energy conversion)

TERM WORK/ LIST OF EXPERIMENTS

Minimum six experiments from the following list should be performed.

1. Speed control of d.c. shunt motor by flux control method.
2. Speed control of d.c. shunt motor by armature voltage control.
3. Reversal of rotation of d.c. motor.
4. Load test on d.c. shunt motor.
5. Study of d.c. motor starters.
6. Speed control of 3 phase induction motor
7. Load test on 3 phase induction motor.
8. Reversal of rotation of 3 phase induction motor
9. Study of 3 phase induction motor starter
10. Load test on Single phase Induction motor
11. Study of Servomotors

TEXT BOOKS

1. “Text book of Electrical Technology”, Vol-II ,B. L. Theraja, S. Chand publication, 1st Edition.

REFERANCE BOOKS

1. “Electrical Power”,S. L. Uppal, DBS Publ.
2. “Utilization of Electric Power”, R. K. Rajput, Laxmi publication (p) Ltd., 4th Edition, 2007.

3. “Electrical Technology”, U. A. Bakshi , Technical Publication Pune,4th Edition , 2009.

S.Y. B. Tech (MECHANICAL ENGINEERING) Semester: III

3. APPLIED THERMODYNAMICS

SUBJECT CODE: PCC-ME-203

TeachingScheme:	**Examination Scheme:**
Lectures: 3 Hrs.perweek	**ESE: 70Marks**
Practical: 2 Hrs.perweek	**CIE: 30Marks**
Credit: 04	**Term Work: 25 Marks**
	Practical: 25 Marks

Pre-requisites: Applied Physics, Applied Chemistry

Course Objectives:

1. To introduce student about basic physics and chemistry behind thermodynamics.
2. To study basic concepts of thermodynamics and its applications.

3. To study physical significance of entropy term and its application.
4. To study application of first and second law of thermodynamics to various thermodynamic devices like Steam generator, Condenser, Nozzles andTurbines.
5. To study different types of turbines and corresponding velocity diagrams.

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

1. Remember the fundamental laws of thermodynamics
2. Understand and Solve the introductory problems on Rankine cycle.
3. Classify steam generators and condensers and Steam turbines.
4. Design the steam nozzle.
5. Understand and Solve problems on Steam turbines.
6. Understand the property of lubricants and selection of lubricants.

Unit No. 01 : Review of Laws of Thermodynamics: [08]

Zeroth law, first law and Second law of thermodynamics, Statement of third law of thermodynamics. Corollaries of Second Law, Equivalence of Second law Simple Numerical treatment second law of Thermodynamics (Heat engine, Refrigerator and Heat Pump), Entropy, Clausius theorem, Clausius inequality, Entropy as a property of system, Entropy change in a reversible and irreversible processes, Increase of entropy principle, Calculation of entropy changes of gases,(numerical treatment should be based on single Thermodynamic process),Introduction to Avialablity Definition-Available Energy, Unavilable Energy, Dead State)

Unit No. 02: Properties of Pure Substances and Vapour Power Cycles [06]

Properties of steam, Use of steam table and Mollier chart, Temperature Entropy Diagram Carnot cycle using steam, Limitations of Carnot cycle Rankine cycle, Representation on P-v, T-s and h-s planes, Thermal efficiency, Specific steam consumption. Work ratio, Effect of steam supply pressure and temperature, Condenser pressure on the performance. (Numerical Treatment), Reheat and regenerative steam power cycles.

Unit No. 03: Steam Condensers [06]

Steam Condenser, Functions, Elements of condensing plant, Types of steam condensers, surface and jet condensers, Comparison, Vacuum efficiency, Condenser efficiency, Sources of air leakages, Methods of leak detection, Edward Air Extraction Pump Estimation of cooling water required (Numerical Treatment on Steam Condensers)

Unit No. 04 : Steam Nozzles [06]

Functions, Shapes, Critical pressure ratio, Maximum discharge condition, Effect of faction, Design of throat and exit areas, Nozzle efficiency, Velocity coefficient, Coefficient of discharge, Supersaturated flow, Degree of under-cooling and degree of super saturation, Effects of super saturation(Numerical Treatment on nozzle without friction)

Unit No. 05 : Impulse Turbines [07]

Principles of operation, Classification, Impulse and reaction steam turbine, compounding of steam turbines. Flow through impulse turbine blades, Velocity diagrams, Work done, Efficiencies, End thrust, Blade friction, condition curve and reheat factors.(Numerical Treatment on Single stage impulse turbine)

Unit No 06: Reaction Turbines [07]

Comparison between impulse and reaction, Flow through impulse reaction blades, turbine Velocity diagram, and degree of reaction, Parson's reaction turbine, Governing of steam turbines. Losses in steam turbines, Performance of steam turbines. Function of diaphragm, Glands, Turbine troubles like Erosion, Corrosion, Vibration, Fouling etc. (Numerical Treatment on Single stage impulse reaction turbine)

TERM WORK

1. Study and Demonstration of water tube and fire tube boilers.
2. Study and Demonstration of boiler mountings,Accessories and steam calorimeters
3. Study and Demonstration of condenser and study of cooling towers
4. Significance and relevance of lubrication properties and systems
5. Test on Grease penetrometer and dropping point apparatus
6. Test on Carbon residue, Cloud and Pour point apparatus.

7. Test on Red wood viscometer and Aniline point apparatus.
8. Determination of flash and fire point of a lubricating oil
9. Study / Trial on steam power plant
10. Report on industrial visit to a steam power plant

Instructions for practical examination

1. Four to five experiments shall be selected for practical examination.
2. The number of students for each practical set up would not be more than four students.

TEXT BOOKS:

1. "Thermal Engineering", Kumar and Vasandani,D. S . Publisher Metropolitan Book Co, Delhi, 3rd Edition.
2. "Thermal Engineering", Mathur and Mehta, Jain Bros. Publishers,Delhi,3rd Edition.
3. "Thermal Engineering", BallaneyP.L, Khanna Publishers, New Delhi, 27th Edition.
4. "Engineering Thermodynamics",P.K. Nag., Tata McGraw Hill, New Delhi, 4th Edition.
5. "Engineering Thermodynamics", D.P.Mishra, Cengage learning, 1st Edition
6. "Principles of Engineering Thermodynamics", Moran,Shapiro,Boetnner, Wiley, 8thEdition
7. "Engineering Thermodynamics", Gupta andPrakash, Nemichandand Sons, 2nd edition.
8. "Thermal Engineering",R. K. Rajput, Laxmi Publications, 3rd Edition.
9. "Steam and Gas Turbines",R. Yadav, CPH Allahabad, 2nd Edition , 2005.
10. "Thermal Engineering", M.MRathod, Tata McGraw Hill Education Pvt.Ltd, 1stEdition , 2010

REFERENCE BOOKS:

1. "Fundamentals of Thermodynamics", Claus Borgnakke, Sonntag R. E., John Wiley and Sons.
2. "Thermodynamics",Holman, , McGraw Hill, London.
3. "Principles of Engineering Thermodynamics", Moran,Shapiro,Boetnner, Wiley, 8th Edition.
4. "Thermodynamics: an Engineering Approach",Cengel and Boles, Tata McGraw-Hill, New Delhi ,3rd Edition,.
5. "Applied Themodynamics", Estop Mcconkey ,Pearson Education, 5th Edition
6. "Engineering Thermodynamics" G.Rogers Yon Mayhew, Pearson Education, 4th Edition.

7. “Fundamentals of Thermodynamics”, R.E.Sonntag,C. Borgnakke, V. Wylen, Wiely India Pvt.Ltd, 6th Edition

S.Y. B. Tech (MECHANICAL ENGINEERING) Semester: III

4. METALLURGY

SUBJECT CODE: PCC-204

TeachingScheme:	**Examination Scheme:**
Lectures: 3 Hrs.perweek	**ESE: 70Marks**
Practical: 2 Hrs.perweek	**CIE: 30Marks**
Credit: 04	**Term Work: 25 Marks**
	Practical: 25 Marks

Pre-requisites: Applied Physics, Applied Chemistry, Fundamental knowledge of materials and their basic properties.

Course Objectives:

1. To acquaint students with the basic concepts of Metal Structure

2. To impart fundamental knowledge of Ferrous and Non Ferrous Metal Processing
3. To study applications of different Metals and Alloys
4. To Know Fundamentals of Metallography
5. To develop futuristic insight into Metals

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

1.Understand basic concept of metal structure.

2. Understand fundamental knowledge of Ferrous and Non Ferrous Metal.

3. Selection of Metals and Alloys for different application.

4. Understand need of Heat treatment and various heat treatment processes**.**

Unit No. 01 :Metals and Alloy Systems [07]

Introduction to Metallic and Non-metallic materials and its classification (metals/alloys, polymers and composites)

a) Metals, Metallic bonds, Crystal structure (SC, BCC, FCC, HCP), Imperfections in crystals

b) Alloy formation by crystallization, Nucleation and growth, Cooling curves, Dendritic structure and coring.

c) Solid solutions and intermediate phases

d) Phases and Gibbs phase rule

e) Construction of equilibrium diagrams from cooling curves, Isomorphous system (Solid Solution), Eutectic, Partial solubility Peritectic and Intermetallic Compounds Lever arm principles.

Unit No. 02 :Study of Phase Diagrams [11]

(With respect to typical compositions, Properties and Applications for the following alloys.)

a)Fe- Fe3C equilibrium diagram - Ferrous alloys (Plain carbon steels, cast iron)

b) Alloy steels- Free cutting steels, HSLA high carbon low alloy steels, maraging steels. creep resisting steels, Stainless steels- different types. Tool steels- types,

c) Selection of materials and Specifications based on -IS, BS, SAE, AISI,

d) Copper based alloys brasses Cu- Zn, Bronzes Cu- Sn, , Cu- Be, Cu-Ni.

e) Aluminum based alloys Al- Cu(Duralumin) - Al-Si (Modification),

f) Pb- Sn (Solders and fusible alloys)

Unit No. 03 :Principles of Mechanical Testing: [04]

a) Destructive Testing methods: Tensile, Compressive, Impact, Fatigue, Creep, Hardness (Rockwell, Brinell and Vickers)

b) Non- Destructive Testing: Dye Penetrant, Magnetic, Ultrasonic, Radiography, Eddy Current testing.

Unit No. 04 :Principles of Heat Treatment & heat treatment of Ferrous Alloys [06]

a) Transformation of Pearlite into austenite upon heating,

b) Transformation of austenite into Pearlite, Bainite and Martensite on cooling.

c) TTT –Diagram and CCT - Diagrams - significance, Effect of alloying elements on TTT diagram and its significance.

d) Heat treatment furnaces and equipments, controlled atmosphere

Unit No. 05 :Heat Treatment Processes: [08]

a) Heat Treatment of Steels

I. Annealing – Types-Full, Partial and Sub critical annealing (Various types) and purposes

II. Normalising- Purposes

III. Hardening (Hardening types), Purposes, Austempering and Martempering, Mechanism of quenching and Quenching media, Hardenability- Concept and methods of determination of hardenability- Grossmans critical diameter method and Jominy end quench test.

IV. Tempering Types, Structural transformations during tempering, purposes

sub zero treatment

V. Surface hardening - Flame and Induction

VI. Chemical heat treatments for case hardening - Carburising, Nitriding, Cyniding, Carbonitriding

VII. Annealing- Stress relief, Recrystallization and Process annealing

VIII. Precipitation hardening - Basic requirements, Stages, Common alloys, Variables,theories

IX. Heat treatment defects and remedies

Unit No. 06: Powder Metallurgy: [04]

a) Advantages, Limitations and Applications of Powder Metallurgy

b) Powder manufacturing types- Mechanical, Physical, Chemical and Electro- Chemical

c) Mixing/ Blending.

d) Compaction- types- Conventional, Isostatic, HERF, Powder rolling and extrussion

e) Sintering- Types liquid stage and solid stage sintering

f) Finishing operations: Sizing, Machining, Infiltration and Impregnation

g) Flowcharts for – Self-lubricating bearings.

TERM WORK/ LIST OF EXPERIMENTS

1) Tensile testing of M.S. and C.I.

2) Hardness testing (Rockwell and Brinell)

3) Impact testing (Izod and Charpy) of M.S, Brass and Al Alloy.

4) Demonstration of N.D.T. (Minimum two of different NDT tests)

5) Macroscopic Examinations Spark Test.

6) Examination of microstructure of steels and Cast Irons.

7) Examination of microstructure of Non ferrousalloys (Brass, Duralimin, Babbit)

8) Heat treatment of steels (Annealing, Normalizing, Hardening on medium/ high carbon steels

9) Jominy end - quench test for hardenability

10) Observation of various industrial heat treatments processes during industrial visits.

11) Any five assignments on above units are to be included in journal.

TEXT BOOKS

1. "Introduction to physical metallurgy", S.H.Avner, Mcgraw Hill Book Company Inc, Edition, 2nd , 1974.

2. "Physical metallurgy", Vijendrasingh, Standard Publishers delhi

3. "Material science and engineering",W.D Callister, Wiley India Pvt.Ltd., 5th Edition.

4. "Material science and metallurgy for engineers", V.D.Kodgire, Everest Publishers Pune,12th Edition.

5. "Heat Treatments Principles and Practices", T.V. Rajan / C.P. Sharma, Prentice Hall of India Pvt Ltd, New Delhi,

6. "Material Science and Engineering",VRaghwan., Prentice Hall of India Pvt. Ltd., New Delhi ,3rd Edition, 1995.

REFERANCE BOOKS

1. "Engineering Metallurgy", R.A. Higgins, Viva Books Pvt. Ltd., New Delhi, 1st Edition

,1998

2. “Physical Metallurgy for Engineers ”, D.S.Clark, W. R. Varney, AN East West Press Pvt. Ltd. , New Delhi, 2nd Edition,1962
3. “Heat Treatment of Metals”, J L Smith and SC Bhatia , CBS Publisheres and distibutors, New delhi, 1st edition, 2008.

S.Y. B. Tech (MECHANICAL ENGINEERING) Semester: III

5. FLUIDMECHANICS

SUBJECT CODE:PCC-ME205

TeachingScheme	**Examination Scheme**
Lectures: 3 Hrs.perweek	**ESE: 70Marks**
Practical: 2 Hrs.perweek	**CIE: 30Marks**
Credit: 04	**Term Work: 25 Marks**
	Practical: 25 Marks

Pre-requisites: AppliedPhysics, Applied Chemistry

Course Objectives:

1. To identify various properties of fluids and their SI units.
2. To state and illustrate fundamentals of Fluid Statics, Kinematics and Dynamics.
3. To study the use of Continuity Equation, Bernoulli's Equation and Momentum Equation for various applications.
4. To study the theory of laminar flow and application of Hagen Poiseuille's equation
5. To understand the physics of fluid flow through the pipe and its applications.

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

1. Understand properties of fluids and classification of fluid flows
2. Identify the fluid flow problem and explain the theoretical concepts of fluid statics, fluid kinematics and fluid dynamics
3. Apply fundamental equation of fluid mechanics i.e. Continuity equation, Bernoulli's Equation and momentum equation for different fluid flow applications
4. Make basic analysis of laminar flow to calculate resistance to it through circular pipe and parallel plates
5. Calculate different losses in fluid flow through different arrangements of pipes
6. Apply theory of boundary layer, Drag and lift forces in proper cases

Unit1 FluidPropertiesandFluidStatics: [7]

A) **FluidProperties:**Definitionoffluid,Propertiesoffluid

Mass Density, Weight Density, Specific Volume, Specific Gravity, Dynamic Viscosity, Kinematic Viscosity, Surface Tension, Capillarity and Compressibility,Typesoffluid

B) **FluidStatics:**Statement of Pascal'slaw,Hydrostaticlawofpressure,Definition of TotalPressure,Centreof Pressure,Buoyancy,Metacenter, ConditionofEquilibriumoffloatingandsubmerged bodies (No Numerical Treatment on fluid Statics)

Unit2 FluidKinematics [6]

EulerianandLangragianapproachoffluidflow,Flowvisualization,Typesofflow,Streamlines,Pathlines,streaklines,Stream tube,ContinuityEquationinCartesiancoordinatesinthreedimensional fluid flows.Velocity and Acceleration of fluid particles, Stream function and velocitypotential function.

Unit3 FluidDynamics [7]

Euler's Equationofmotion, IntegrationofEuler'sequationasenergyequation. Kinetic Energycorrection factor,Applications of Bernoulli's equation Venturimeter, orifice meter and Pitot tube,

Definition of Notch, classification and it Applications, Derivation of Flowover triangularandrectangularnotches only, Definition of Orifice, classification and it Applications, Hydraulic Coefficients C_d, C_c and C_v and C_r

Unit4 Momentum Equation and LaminarFlow [7]

A) Derivationofmomentumequation, Applications of momentum equation, momentum correction factor, Analysis of fluid flow through pipe bends.

B) **LaminarFlow**:Laminarflowthroughcircularpipes and derivation of Hagen Poiseuille's equation.Laminarflowthroughparallel plates,Introduction of CFD and its applications.

Unit5 Fluid Pipe through Flow [7]

Different energy losses in flow through pipe, Losses due to friction: Darcy's Weisbach equation and Chezy's equation, Minor Losses due to expansion, contraction, pipe fittings, at entrance, at exit, due to obstruction etc. Flow through Series pipe, Parallel

pipe, Siphon pipes, Branching pipes and equivalent pipes, Hydraulic Gradient line (HGL) and Total Energy Line (TEL).

Unit6 BoundaryLayerTheoryandForces on Immersed Body [6]

A) **Boundary Layer Theory:** Boundary layer thickness, its characteristics, laminar and turbulent boundary layers, Displacement thickness, Momentum thickness, Energy thickness, separation, boundary layer control

B) **Forces on Immersed Bodies:** Lift and Drag, Drag on a flat plate and on aerofoil, Types of drags, Development of lift. (Magnus effect) stalling condition of aerofoil.

TERM WORK

List of Assignments and Experiments

Theterm work shall consist of the report on following assignments and experiments

Assignments on

1. Study and demonstration of Pressure Measuring Devices (Compulsory)
2. Theoretical assignment of Dimensional analysis which may include procedure and Numerical on Rayleigh's method and Buckingham π theorem. (Compulsory)

Experiments List

3. Flow visualization by plotting of streamlines (Heleshaw's apparatus).
4. Reynolds experiment
5. Verification of Bernoulli's equation
6. Calibration of venturimeter
7. Calibration of notches
8. Calibration of orifice under steady and unsteady flow condition
9. Determination of minor losses in pips-fittings
10. Determination of coefficient of friction in pipes of different materials.

TEXTBOOKS:

1. "Fluid Mechanics", K.L.Kumar, S. Chand Publication. New Delhi,2nd Edition ,2000

2. “Theory and Applications of machines”,K.Subramanya,,Tata McGraw Hill, Publication,1993
3. “Fluid Mechanics”, R. K.Bansal,Laxmi publications. New Delhi, 1998.
4. “Fluid Mechanics and HydraulicMachines”, Ramamrutham
5. “Fluid mechanics and Hydraulic Machines”, Modiand Seth,.
6. “Fluid mechanics and Hydraulic Machinery”, R. KRajput,Laxmi publishers.

REFERENCEBOOKS:

1. “Fluid Mechanics”, V.L. Streeter and E.B. Wylie,Tata McGraw Hill PvtLtd., New Delhi,2nd Edition ,1997
2. “Mechanics of Fluid”, Merle C. Potter, Prentis HallofIndia, New Delhi ,2nd Edtion .
3. “Fluid Mechanics”, Foxand McDonald,John Wileyand Sons, New York,8th Edition.
4. “Fluid Mechanics –Fundamentals andApplication”, Y. A. Cengel, J. M. Cimbala, TMI,
5. “Fundamentals of FluidMechanics”,B.R. Munson, D.F. Young, T. H. OkiishiWileyIndia Pvt. Ltd.
6. “Fluid Mechanics and Machinery”, C.S. Ojha, ,Oxford UniversityPress.

S.Y. B. Tech (MECHANICAL ENGINEERING) Semester: III

6: MACHINE DRAWING

SUBJECT CODE: PCC-ME206

TeachingScheme: **Examination Scheme:**

Practical: 2 Hrs.perweek **Term Work: 25 Marks**

Credit: 02

Pre-requisites: Engineering Graphics

Course Objectives:

1. To study BIS conventions used in machine drawing.
2. To find the line/curve of intersection between two solids.
3. To study the function of various machine components.
4. To study the use of production drawings.
5. To study assembly and detail drawings.

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

1. Use BIS conventions in machine drawings.
2. Find line/curve of intersection between two solids.
3. Sketch the various machine components.
4. Read and interpret the given production drawings.
5. Understand significance of assembly and detail drawings.

Study of B.I.S. (Bureau of Indian Standards) Conventions:

Significance and importance of BIS Conventions, Drawings sheet sizes and layout recommended by BIS. Conventional representation of engineering materials, BIS conventions for sectioning, Types of threads profiles, Internal and external threads, Types of springs, Types gears and gearings, Conventional representation of common features (Splined shaft, Serrated shaft, Knurling, Bearings etc.). BIS methods of Linear-and angular dimensioning. Symbolic representation of welds as per BIS for representation of above conventions.

Interpenetration of Solids:

Introduction, interpenetration of Prism with Prism, Prism with cylinder, Prism with cone, prism with pyramid. (Prisms and Pyramids limited up to Rectangular base), Cylinder with Cylinder, Cone with Cylinder.

Sketching of Machine Component:

Importance of sketching and entering proportionate dimensions on sketches. Sketches of nut, Bolts square and Hexagonal Flanged nuts, Lock nuts, Dome nut, Capstan nut, Wing nut, Castle nut, Split pin, Square headed bolt, Cup headed bolt,T-headed bolt, Types of foundation bolts, Stud, Washer, Set screws, Cap screws. Various types of rivets and riveted joints,Various types of keys, Socket and spigot (Cotter joint) , Knuckle (pin) joint, Muff coupling, Protected and unprotected Flanged, Coupling, Universal coupling, solid and bush bearing. Plummer block (pedestal bearing), Foot step bearing. Flat and V-belt pulleys, Fast and loose pulleys, speed cone pulleys, Pipe joint for C.I. Flanged, socket and spigot type pipe joint. Union pipe joint and standard pipe-fittings. Students should know the applications of above machine components.

Auxiliary Projection:

Projection on auxiliary vertical and horizontal plane, Auxiliary nprojection of simple machine components.

Limits, Fits and Tolerances:

Significance of system of limits and fits. Definitions, Types, Recommendations and selections, Tolerances of form and position, surface finish symbols as per BIS, Selection and entering of all these symbols with reference to details and assembly drawings, Tolerancing an individual dimensions of details drawing.

Details and Assembly Drawing:

To prepare detail drawings from given assembly drawing. To prepare assembly drawing from given drawing of details. The number of parts is limited to ten to twelve. Preparation of detail and assembly drawing from the following details such as: - Machine tool parts: Tool post, Tailstock, Machine vice, Chucks etc.- Engine parts: Stuffing box, Crosshead assembly, Piston and connecting rod, etc. - Miscellaneous parts: Valve assembly, Screw jack, Jigs and fixtures, Pipe vice etc. Assembly selected should include different types of sections.

TERM WORK:

Sheet No. 1: Sheet Based on BIS conventions

Sheet No. 2: Sketching (Free hand drawing) of various machine components.

Sheet No. 3: Sheet Based on limits, Fits and tolerances (Production Drawing)

Sheet No. 4: To draw details and assembly drawing of machine component containing 10 to 12 parts.

Sheet No. 5: Sheet based on auxiliary projection **OR**

Sheet No. 5: Sheet based on interpenetration of solids.

TEXT BOOKS:

1. P.S. Gill, Machine Drawing. S. K. Kataria and Sons, Delhi, 7thEdition, 2008

2. N. D. Bhatt, Machine Drawing. Charotor Publication House, Bombay, 42th Edition, 2007

3. N. Sidheshwar . P. Kannaiah and V.V. S. Sastry. Machine Drawing, Tata McGraw Hill, New Delhi.

4. R.K. Dhavan, MachineDrawing, S. Chand and Company, 1stEdition, 1996.

5."Production Drawing", Narayana, Kannaiah and VenkataReddv,New Age International.2nd Edition, 2002.

6. "Machine Drawing", N.D.Junnarkar,Print Pearson Education, 1st Edition.

REFERENCE BOOKS:

1. IS: SP46-Engineering Drawing Practice for Schools and Colleges, B.I.S. Publications.

2. IS: 696-Code of Practice for General Engineering Drawings B.I.S. Publications.

3. IS: 2709-Guide for Selection of Fits, B.I.S. Publications.

4. IS: 919-Recommendation for Limits and Fits for Engineering, B.I.S. Publications

5. IS: 8000-Part I, II. III. TV, Geometrical Tolerencingof Technical Drawings --B.I.S. Publications.

6. “Engineering Drawing, with an Introduction to AutoCAD”, DhananjayA.Jolhe, Tata McGrawHill, 2010

S.Y. B. Tech (MECHANICAL ENGINEERING) Semester: III

8. Computer Programming Using C++

SUBJECT CODE –PCC- ME207

TeachingScheme:	**Examination Scheme:**
Practical: 2 Hrs.peralternate week	**Term Work: 25 Marks**
	Credit: 01

Pre-requisites: Computer Programming in C

Course Objectives:

1. To understand how C++ improves C with object-oriented features.

2. To introduce an object oriented programming language.

3. After the students have successfully completed the course, they shall have sufficient knowledge of the basic computer operations and various programming techniques especially in C++.

4. To develop and enhance the programming skills amongst the students in general aswell as application of it in the field of Mechanical Engineering.

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

1. Write, compile and debug programs in C++ language.
2. Design programs involving decision control statements, loop control statements and case control structures.
3. Develop algorithms for solving problems using object oriented language.
4. Apply their knowledge and programming skills to solve various computing problems in the field of Mechanical Engineering.

1. **Evolution of Programming methodologies,** Introduction to OOP and its basic features, Basic components of a C++, Program and program structure, Compiling and Executing C++ Program. Selection control statements in C++.

2. **Data types, Expression and control statements Iteration** statements in C++, Introduction to Arrays, Multidimensional Arrays, Strings and String related Library Functions.
3. **Functions,** Passing Data to Functions, Scope and Visibility of variables in Functions,
4. **Creating classes and Abstraction:** Classes objects, data members, member functions, this Pointer, Friends, Friend Functions, Friend Classes, Friend Scope, and Static Functions.Structures in C++. **Constructors and Destructors,** Static variables and Functions in class.
5. **Operator Overloading in C++,** Overloading Unary Operators, Overloading binary operators.
6. **Inheritance in C++,** Types of Inheritance, Pointers, Objects and Pointers, Multiple Inheritance.**Virtual Functions,** Polymorphism, Abstract classes.

TERM WORK/ LIST OF EXPERIMENTS

1. One assignment based on Object-Oriented programming: Introduction, Basic concepts, Benefits, Object-oriented languages, Applications.
2. Minimum 2 program on Data types, Expression and control statements Iteration statements in C++, Introduction to Arrays, Multidimensional Arrays, Strings and String related Library Functions.
3. Minimum 2 program on Functions, Passing Data to Functions, Scope and Visibility of variables in Functions, Structures in C++.
4. Minimum 2 program on Creating classes and Abstraction: Classes objects, data members, member functions, this Pointer, Friends, Friend Functions, Friend Classes, Friend Scope, and Static Functions. Constructors and Destructors, Static variables and Functions in class
5. Minimum 2 program on Operator Overloading in C++, Overloading Unary Operators, Overloading binary operators.
6. Minimum 2 program on Inheritance in C++, Types of Inheritance, Pointers, Objects and Pointers, Multiple Inheritance. Virtual Functions, Polymorphism, Abstract classes.

TEXT BOOKS

1. "Object Oriented Programming", E. Balguruswami, Tata McGraw Hill Publication.
2. "Let us C++" ,YashwantKanitkar ,BPB Publication.
3. "C++ Programming",AlstevanswielyIndia,7th Edition.
4. "Object oriented Programming with C++", Sourav Sahay, Oxford University Press.
5. "Object-Oriented Programming in C++", Rajesh K Shukla, Wiley India

REFERANCE BOOKS

1. "Professional C++", Solterwiely India
2. "The C++ Programming Language", Brian W. Kernighan, Dennis M. Ritchie, Prentice Hall
3. "C++: The Complete Reference", Schildt H., Tata Mcgraw Hill.

S.Y. B. Tech. (MECHANICAL ENGINEERING) Semester: III

9. WORKSHOP PRACTICE III

SUBJECT CODE PCC ME 208

TeachingScheme:	**Examination Scheme:**
Practical: 2 Hrs.perweek	**Term Work: 25 Marks**
	Credit: 01

Pre-requisites: Engineering Graphics, Basic Mechanical Engineering

Course Objectives:

1. To study Patterns, Core boxes, Preparation of Pattern for solid casting.
2. To study Sand testing, Size analysis, Moisture percentage, Permeability Test.
3. To study Gating system for metal casting with casting defects.

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

1. Understand types of Patterns, Core boxes and Preparation of Pattern for solid casting.
2. Understand properties of sand by permeability test, moisture percentage test, and green strength.
3. Understand gating system for metal casting with casting defects

Term Work:

1. Study of Patterns – Types, Materials used, Pattern Allowances, Construction and color code.
2. Study of Core boxes: Types, Allowances
3. Preparation of Pattern for solid casting
4. Sand testing for green sand and core sand (Any four)
    a. Preparation of standard specimen
    b. Preparation of green sand mould
    c. Size analysis. Grain fineness Number
    d. Moisture percentage
    e. Permeability Test
    f. Green Compressive strength
    g. Clay content
    h. Mould hardness
5. Foundry visit to study pattern shop, sand making and moulding.

NOTE:

1. The load of Workshop Practice III will be allotted to the Teaching Faculty.
2. Assessment of Journal based on above Term Work and Industrial Visit Report.
3. Term work will consist of Job on Pattern Making Carrying 15 Marks, Journal Assessment along with internal oral 10 marks.

S.Y. B. Tech. (MECHANICAL ENGINEERING) Semester: IV

09. ENVIRONMENTAL STUDIES

SUBJECT CODE: MC ME 209

TeachingScheme:	**Examination Scheme:**
Lectures: 3 Hrs.perweek	**ESE: 70Marks**
Credit: 03	**CIE: 30Marks**

S.Y. B. Tech (MECHANICAL ENGINEERING) **Semester IV**

01. APPLIED NUMERICAL METHODS

SUBJECT CODE: PCC-ME-210

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs. per week	**ESE: 70 Marks**
Practical: 2 Hrs. per week	**CIE: 30 Marks**
Credit: 04	**Term Work: 25 Marks**

Pre-requisites: Engineering Mathematics-I, Engineering Mathematics-II, Engineering Mathematics-III and C++ Programming

Course Objectives:

1. To introduce numerical methods to solve different types of equations.
2. To introduce regression and interpolation techniques.
3. To know various methods of Differentiation & Integration.
4. To apply the knowledge of these methods to solve practical problems.
5. To transform various methods into Computer Programs.

Course Outcomes:

1. Understand and apply various methods to find roots of equations.
2. Learn and Implement different methods to solve simultaneous equations.
3. Understand and apply the methods of Regression and interpolation.
4. Implement various numerical methods for differentiation and Integration.
5. Apply various methods to solve engineering problems with Ordinary differential equations.
6. Understand the methods to solve Partial differential equations involved in Engineering Problems.

Unit 1 **[7]**

a. **Errors**: Introduction, Types of errors, Rules for estimate errors, Error propagation, Error in the approximation of function. **Only an Assignment is to be given on Errors. No weightage in theory examination**.

b. **Roots of Equation**:
    a. Bracketing Method: Bisection Method, False position method
    b. Open method: Newton-Raphson's method for Single root, multiple root, Iterative method for Non-linear equations
    c. Roots of polynomial: Muller's Method, limited to TWO Iterations. Initial guesses not to be given.

Unit 2 **[5]**

Linear Algebraic Equation:

a. Gauss Elimination Method. Pitfalls and improving techniques.
b. LU decomposition method, Gauss-Jacobi and Gauss-Seidel Iteration method

Unit 3 **[8]**

Curve Fitting & Interpolation:

a. Least Square Regression – Linear regression, Parabolic regression

b. Interpolation–Interpolating polynomial, Lagrange's interpolating polynomial, Divided Difference Formula

Unit 4 **[7]**

Numerical Differentiation and Integration

a. Newton-Cote's Integration of equation: Trapezoidal rule, Simpson's rules

b. Integration of Equation: Gauss Quadrature methods.

c. Numerical differentiation: For Equally spaced Data: Forward difference Formula, Central difference Formula, Backward difference Formula,

d. For unequally spaced Data: Divided difference Formula.

Unit 5 **[6]**

Ordinary Differential Equation:

a. Taylor's series method, Picard's Method, Euler's Method, Runge-Kutta 4^{th} Order method

b. Boundary value Problem: Finite Difference Method

c. Eigen value problem: Eigen value problem based on Power method.

Unit 6 **[7]**

Partial Differential Equation:

a. Finite Difference–Elliptical equation, Liebmann's method to Solve Laplace's and Poisson's Equations

b. Finite Difference- Parabolic Equation

c. Implicit Method- Crank-Nicolson method (Derivation Only)

TERM WORK:

Term work should contain **at least SIX assignments** based on SIX Units.

a. At least one problem should be solved based on each method from every Unit.

b. A computer program along with Flowchart on following methods using **C++/MATLAB/SCILAB**or any other suitable software**:**

- Method of false Position,
- Gauss elimination method & Gauss Jacobi method,
- Least Square method for Line fitting,

- Forward difference method for Num. Diff. & Trapezoidal method of Integration,
- Runge-Kutta method of 4^{th} Order,
- Liebmann's method to solve Elliptic equations.

TEXT BOOKS:

1. Higher Engineering Mathematics", Dr. B. S. Grewal, Khanna Publishers, New Delhi, 7th Edition, 2005.

2. "Numerical Methods", Dr. B.S. Grewal, Khanna Publishers, New Delhi, 7th Edition, 2005.

3. "Numerical Methods", E Balguruswamy Tata McGraw-Hill Publication Company Ltd. 8th Edition, 2002.

4. "Numerical Methods", S. Arumugam, A. Thangapandi Isaac and A.Somasundaram, SciTech Publications India Pvt. Ltd. Chennai, 2nd Edition, 2007.

5. "Numerical Methods", Dr. P. Kandasamy, Dr. K. Gunavathi, Dr. K. Thilagavathy. S Chand Publication, New Delhi, 2nd Edition, 2006

6. "Numerical Methods", G. Haribaskaran, Laxmi Publications Pvt. Ltd, New Delhi, 1st Edition, 2006.

REFERENCE BOOKS:

1. "Applied Numerical Methods with MATLAB for Engineers and Scientists", S.C. Chapra, Tata McGraw Hill Education Pvt. Ltd. New Delhi, 3rd Edition, 2012.

2. "Numerical Analysis Theory and Applications", R. L. Burden and J. D. Faires, Cengage Learning India Pvt. Ltd. New Delhi, 1st Edition, 2005.

3. "Applied Numerical Methods Using MATLAB", W. Y. Yang, W. Cao and J. Morris, Wiley India Pvt. Ltd. New Delhi, 1st Edition, 2005.

4. "Numerical Mathematics and Computing", Ward Cheney, Cengage Learning India Pvt. Ltd. New Delhi, 7th Edition.

S.Y. B. Tech (MECHANICAL ENGINEERING) Semester**: IV**

02.ANALYSIS OF MECHANICAL ELEMENTS

SUBJECT CODE: PCC-ME211

TeachingScheme:	**Examination Scheme:**
Lectures: 3 Hrs.perweek	**ESE: 70Marks**
Practical: 2 Hrs.perweek	**CIE: 30Marks**
Credit: 04	**Term Work: 25 Marks**

Pre-requisites: Engineering Mechanics

Course Objectives:

1. To gain knowledge of different types of stresses, strains and deformation induced in mechanical components due to external loads.
2. To study shear force and bending moment distribution for different types of loads and support conditions.
3. To study the distribution of various stresses and deformation in mechanical elements.
4. To study the analytical and graphical method to solve the problems in principal planes and stresses.
5. To study the effect of component dimensions and shape on stresses and deformations.
6. To study the buckling, and strain energy effect in mechanical elements.

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

1. Apply concepts of analysis of mechanical elements to obtain solution to various types of loading and stresses induced in real time engineering problems.
2. Draw shear force and bending moment diagrams for simple beams subjected to various loads and support conditions.
3. Compute and analyze bending and shear stresses in mechanical components.
4. Determine plane stress, principal stress .maximum shear stress and their orientations using analytical method and Mohr's circle.
5. Analyze the effect of deflection in beams**.**
6. Evaluate buckling and strain energy in beams subject to various types of loading.

Unit No. 01 Stresses and Strains: [06]

Concept of Stress and Strain, (Linear, Lateral, Shear and Volumetric), Hooke's Law, Poisson's ratio, Modulus of Elasticity, Modulus of Rigidity, Stress-strain diagram for ductile and brittle material, Factor of safety, Working stress. Normal and shear stresses, Thermal Stresses, Bulk Modulus, Inter-relationship between elastic constants.

Unit No. 02 [08]

A. Torsion: Introduction to Torsion, Basic assumptions, Torsion formula, Hollow and solid circular shafts,Angular deflection.

B. Shear Force and Bending Moment: Concept and definition of shear force and bending moment in determinate beams (Simply supported, cantilever and overhanging) due to concentrated, UDL, UVL and Couple.

Unit No. 03 Stresses in Beams: [07]

A. Bending Stresses: Symmetric pure bending of beams, Flexure formula, moment ofresistance of cross-sections, Simple built-up section, Design of rectangular and circular(solid and hollow) sections; L, I and T sections

B. Shear Stresses: Distribution of shear stresses in beams of various commonly usedsections such as circular. I, T, and angles.

Unit No. 04 Principal Stresses and Strains: [08]

Normal and shear stresses on any oblique planes, Concept of Principal planes, Derivation of expression for Principal stresses and maximum shear stress, Positions of principal planes and planes of maximum shear, Graphical solutions using Mohr's circle of stresses, Combined effect of shear and bending in Beam.

Unit No. 05 Deflection of Beams: [06]

Strain curvature and moment curvature relation, Solution of beam deflection problem by Double integration method, Macaulay's method and Area moment method. (Simply Supported Beam and Cantilever.)

Unit No 06 [05]

A. Columns: Euler's formula for different end connections, Concept of equivalentlength, Eccentric loading, Rankine formula.

B. Energy Methods: Concept of strain energy, Resilience, Proof resilience, Modulus of resilience, derivation for deformation of axially loaded members under gradual, sudden and impact loads (including Numerical).

TERM WORK/ LIST OF EXPERIMENTS

A term work shall consist of report on the assignments given below.

1. Stresses and strains.
2. Torsion (Problems based on industrial applications)
3. Shear force diagram & bending moment diagram.
4. Bending stresses and shear stresses in beams.
5. Principal stresses (both analytical and graphical).
6. Deflection of beams.
7. Columns.
8. Strain Energy.

TEXTBOOKS:

1. "Strength of Materials", S. Ramamruthum, DhanpatRai and Sons, New Delhi.
2. "Strength of Materials", R. K. Bansal, Laxmi Publication, 4th Edition.
3. "Strength of Materials", Khurmi Gupta, S. Chand Publication.
4. "Strength of Materials", R.K. Rajput, S. Chad Publication.
5. "Mechanics of structure", S.BJunnerkar,Charotar Publication House.
6. "Strength of Materials", S. S. Bhavikatti, Vikas Publication House.
7. "Strength of Materials", Timoshenko and Young, CBS Publication.
8. "Mechanics of Materials", S. S. Ratan, Tata McGraw Hill Publication, 2009.
9. "Strength of Materials",B. K. Sarkar, McGraw Hill Publication, 2003
10. "Strength of Materials", L. S. Negi, McGraw Hill Publication, 2008.

REFERANCE BOOKS:

1. "Strength of Materials", Beer and Johnson, CBS Publication.
2. "Strength of Materials", G.H. Rider,Mac Millan India Ltd.
3. "Strength of Materials", Nag and Chanda, Willey India Publication.
4. "Advanced Mechanics of Materials", Boresi, Willey India Publication.
5. "Strength of Materials", Den Hartong, McGraw Hill Publication.
6. "Mechanical analysis and design", H. Burr and John Cheatam, PHI, New Delhi.

S.Y. B. Tech (MECHANICAL ENGINEERING) Semester**: IV**

03. FLUID AND TURBO MACHINERY

SUBJECT CODE- PCC-ME212

TeachingScheme:	**Examination Scheme:**
Lectures: 3 Hrs.perweek	**ESE: 70Marks**
Practical: 2 Hrs.perweek	**CIE: 30Marks**
Credit: 04	**Term Work:25 Marks**
	Practical: 25 Marks

Pre-requisites: Fluid Mechanics, Applied Thermodynamics

Course Objectives:

1. To learn the working principles of Impulse water turbines and also to study its velocity triangles .To study design parameters related to Turbines
2. To learn the working principles of Reaction water turbines and also to study its velocity trianglesstudy design parameters related to Turbines
3. To understand the concept of Centrifugal pumps and its construction. To understand NPSH terms related to centrifugal pumps
4. To illustrate the concept of Reciprocating Air Compressors. To understand various parameters related to Air Compressors.
5. To illustrate the concept of centrifugal compressor, Axial compressors. To understand variousparameters related to rotodynamic air compressors
6. To discuss the working of Gas Turbines, and Jet engine and know its various configurations. To determine the efficiencies of gas turbines

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

1. Classify and understand working principle of rotodynamic machines and Reciprocating compressor.
2. Remember Euler's equation of rotodynamic machines
3. Remember Euler's equation of rotodynamic machines
4. Apply the theoretical knowledge to solve numerical problems, select the machinesfor particular application.
5. Analyze the machines to evaluate the performance.

Unit No. 01 Impulse Water Turbines: [07]

Eulers equation for work done in Rotodynamic Machines classification of water turbines ,Pelton wheel, its construction and working, velocity triangles, types. Pelton wheel design (bucket dimensions, Number of buckets, Jet diameter, Wheel diameter, Jet ratio, Speed ratio, Number of jets,) Calculation of efficiency, Power, Discharge etc. Governing of Pelton wheel.

Unit No. 02 Reaction Water Turbines: [07]

Principle of operation, Construction and working of Francis and Kaplan Turbine, Draft tube, Cavitation calculation of various efficiencies, Power, Discharge, Blade angles, Runner dimensions etc. Governing of Francis and Kaplan turbine. Draft tube-types and analysis.

Unit No. 03 Centrifugal Pumps: **[06]**

Working principles, Construction, Types, Various heads, Multistage pumps, Velocity triangles, Minimum starting speed, Cavitation, Net positive suction head (NPSH). efficiencies, Discharge, Blade angles, Head, Power required, Impeller dimensions etc.

Unit No. 04 Reciprocating Air Compressors: **[08]**

Application of compressed air, classification of compressor, Reciprocating compressors, construction , Work input, Necessity of cooling , Isothermal efficiency, Heat rejected, Effect of clearance volume, Volumetric efficiency, Necessity of multistaging, construction, Optimum intermediate pressure for minimum work required, After cooler.

Unit No. 05 Rotodyanamic Air Compressors: **[07]**

Centrifugal compressor, velocity diagram. Theory of operation, losses, Adiabatic efficiency, Effect of compressibility, Diffuser, Prewhirl, Pressure coefficient, Slip factor, performance., Surging, Chocking, Stalling, Performance, Comparison with centrifugal. Introduction to Axial flow compressors, Roots blower and vane blower (Descriptive treatment)

Unit No. 06 Gas Turbines: **[05]**

Working principles, Applications, Open, Closed cycle and their comparison. Cycle modified to Regeneration, Reheat, Intercooling performance. Calculation of gas turbine work ratio, Efficiency etc. Types of fuels for gas Turbine Introduction to Jet engine.

TERM WORK/ LIST OF EXPERIMENTS

1. Study and demonstration of Model & Testing, Unit quantities of turbine & pump.
2. Trial on Pelton wheel with characteristics curve.
3. Trial on Francis/ Kaplan turbine with characteristics curve.
4. Trial on Centrifugal pump with characteristics curve.
5. Trial on reciprocating compressor
6. Study & Trial on centrifugal blower
7. Study of hydraulic devices- Intensifier, Accumulator, Hydraulic jacks, Press, Crane. hydraulic

ram.

8. Study of other types of pumps- Reciprocating pump, Gear pump, Jet pump, Submersible pump, Air lift pump.
9. Industrial visit to Pump/Turbine Manufacturing Industry or Hydro Power Plant.

TEXT BOOKS:

1. "Hydraulic Machines", V.P. Vasantdani, Khanna Publishers, 1996.
2. "Fluid flow machines", N.S. Govindrao, Tata McGraw-Hill,1983.
3. "Steam and gas Turbines", R. Yadav, Central Publishing House, Allahabad, 6th Edition , 1997 4. "Gas Turbines", V. Ganeshan, Published by TMH Education Pvt. Ltd. ,3rdEdition.
5. "Thermal Engg.", Kumar vasantdani, Khanna publisher
6. "Thermal Engg.",P.L. Balleny, Khannapublisher. , 20th Edition
7. "Gas turbines and Compressor", Cohen and Rogers, Saravanamutto Publisher
8. "Thermodynamics and Heat Engines", R. Yadav, Vol-II, Central Publishing House.
9. "Fluid mechanics and hydraulic machines", Modi and Seth, Sstandard Book House, 2004
10. "Thermal Engineering", R K Rajput, Laxmi Publication.
11. "Fluid Mechanics and Hydraulic Machines", S.C. Gupta , Pearson Education, 1stEdition
12. "Fluid Mechanics and hydraulic machines",R. K. Rajput , S. Chand Publication.
13. "Fluid Mechanics and hydraulic machines",R. K. Bansal, L.P. Pub. House.
14. "Turbo machines", Pai, Willey India

REFERENCES BOOKS:

1. "Turbo machines", S.M. Yahya , Tata Mc Graw Hill , 2005
2. "Fans, compressor and turbine", S. M. Yahya,Tata Mc Graw Hill , 2005

S.Y. B. Tech (MECHANICAL ENGINEERING) Semester: IV

04. THEORY OF MACHINES-I (*)

SUBJECT CODE: PCC-ME-213

TeachingScheme:	**Examination Scheme:**
Lectures: 3 Hrs.perweek	**ESE: 70*Marks**
Practical: 2 Hrs.perweek	**CIE: 30Marks**
Credit: 04	**Term Work: 25 Marks**

Course Objectives:

1. To represent kinematic behavior of different machine elements and mechanisms.
2. To select various Power transmitting devices.

3. To explain types of Cam with followers and select according to their applications.
4. To compare types of Governing mechanisms.
5. To analyze effect of friction in Mechanisms and machines

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

1. Understand different types of mechanisms and their applications
2. Analyze kinematic theories of mechanism,
3. Design cam with follower for different applications
4. Select different power transmitting elements according to application
5. Select different governing mechanisms according to application.

Unit No. 01 Basic Concept of Mechanisms: [05]

Links, kinematic pair (lower and higher), Kinematic chain, Mechanism, inversion, Types of constraints, Grubbler□s criterion, Inversions of slider crank chain, Double slider crank chain, Four bar, Steering gear mechanisms, Hooke's joint (only theoretical treatment).

Unit No. 02 Velocity and Acceleration in Mechanisms: [10]

Graphical analysis of Velocity and acceleration for different mechanisms using relative velocity and acceleration method, Klein's construction for slider crank mechanism, Velocity analysis by Instantaneous center method.

Unit No. 03 Friction: [05]

Introduction to friction, Friction in pivot bearings, Inclined plane theory, Friction in screws

Unit No. 04 Cams: [08]

Types of cams and followers, Profiles of cams for specified motion of different followers, Spring load on the follower, Jumping of follower.

Unit No. 05 Belts and Dynamometers: [06]

Types of belt drives, Calculation of power transmitted, Belt tension ratio, Actual tension in a running belt, Centrifugal and initial tension in belt, Slip and creep of belt.

Unit No. 06 Governors: [06]

Types of governors, Porter and Hartnell governor, Controlling force and stability of governor, Hunting, Sensitivity, Isochronism, Governor effort and power, Insensitiveness of governors.

TERM WORK/ LIST OF EXPERIMENTS

1. Study of basic mechanisms. (Demonstration of models, Actual mechanisms, etc.)
2. One A3 size sheet of Velocity problems by relative velocity method. (Minimum 4 problems)
3. One A3 size sheet of Velocity problems by Klien's construction and Instantaneous center method. (Minimum 4 problems)
4. One A3 size sheet of Acceleration problems (including Coriolis component) by relative acceleration method. (Minimum 4 problems)
5. Verification of ratio of angular velocities of shafts connected by Hooks joint.
6. One A3 size sheet of Problems on cam profile. (Minimum 4 problems)
7. Experiment on Governor characteristics for Porter or Hartnell governor.
8. Experiment on Cam Profile
9. Experiment on belt drives.
10. Experiment on Dynamometer

Note: Minimum 8 experiment

TEXT BOOKS

1. "Theory of Machines", RatanS.S, Tata McGraw Hill New Delhi, 2nd Edition.
2. "Theory of Machines", P.L.Ballany, Khanna Publication, New Delhi, 2nd Edition.
3. "Theory of Machines", V.P. Singh, DhanpatRai and Sons.
4. "Theory of Machines", H.G.Phakatkar, Nirali Publication. Pune
5. "Theory of Machines", Dr. R.K.Bansal, Laxmi Publication.
6. "Theory of Machines", Thomas Bevan, CBS Publishers, New Delhi.
7. "Theory of Machines and Mechanism", G.S. Rao and R.V. Dukipatti, "New Age Int.Publications Ltd., New Delhi.
8. "Theory of Machines", Shah and Jadhawani, DhanpatRaiand Sons

REFERANCE BOOKS

1. “Theory of Machines and Mechanism”, Shigley, McGraw Hill, New York
2. “Theory of Machines”, Abdullah Shariff, McGraw Hill, New Delhi.

Note: (*) Indicates Theory Paper of Three Hours Duration.

S.Y. B. Tech (MECHANICAL ENGINEERING) Semester: IV

05.MACHINE TOOLS AND PROCESSES

Subject Code: PCC-ME214

TeachingScheme:	**Examination Scheme:**
Lectures: 4 Hrs.perweek	**ESE: 70Marks**
Credit: 03	**CIE: 30Marks**

Pre-requisites: Basic Mechanical Engineering

Course Objectives:

1. To introduce different methods of Molding and Casting.

2. To introduce forming and Plastic Shaping processes.

3. To study various Metal Removal Processes and Machine tools.

4. To study Nonconventional Machining.

5. To study gear manufacturing processes.

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

1. Identify various kinds of machine tools of previous and present era tools.

2. Describe construction and working of basic machine tools.

3. Demonstrate their understanding of plastic processing, injection moulding, extrusion and thermoforming.

4. Analyze the concept, mechanism of material removal with respect different processes.

5. In position to appreciate the merits of non-traditional machining and its applications in industries.

Unit No. 01 Casting Processes: **[11]**

Importance of casting as manufacturing process, advantages and limitations of casting processes, foundry layouts and mechanization, Moulding types such as Green sand moulding, Shell moulding, CO_2moulding, investment casting, Sand reclamation, Components of gating system, functions and importance of runners and risers, solidification control devices: chills, ceramics bricks, directional solidification, Introduction to permanent mould casting process such as continuous casting, Gravity die casting, pressure die casting, centrifugal casting, Melting practices and Metallurgical control in Cupola furnace, oil/gas fired furnaces, Induction and Arc Furnace, Solidification of castings, casting defects, metal pouring equipments, Cleaning-fettling and inspection of casting.

Unit No. 02 Forming Processes: [**11]**

a) **Rolling:** Introduction, Hot and cold rolling, Rolling Mill Classification, Defects in rolling.

b) **Forging:** Introduction, Forging Machines (board Hammer, Air and Steam, Hydraulic Hammer), Open and Closed die Forging, Defects in forging.

c) **Extrusion:** Introduction, Direct, Indirect, Tube, Impact and Hydraulic Extrusion, Defects in extrusion.

d) **Drawing:** Introduction and Types of Wire, rod and pipe drawing, defects in drawing.

Unit No. 03 Plastic Shaping: [**04]**

Thermosetting and thermoplastic materials, their properties and applications, Introduction to blow moulding, injection moulding, extrusion, calendaring and thermo forming.

Unit No. 04 Machine Tools for Metal Cutting I: [11]

a) **Lathe**: Introduction, Working principle, types, specifications, principle parts, accessories, attachments, and various lathe operations, Calculations of Change gears for thread cutting.

b) **Capstan, turret lathe**: Principle parts, Working, Turret indexing mechanism, bar feeding mechanism, Comparison with centre lathe.

c) **Drilling & Boring Machines:** Classification of drilling machines, Construction and working of radial drilling machine, Various accessories and various operations. Introduction to boring machines, Types of boring machine, different operations.

Unit No. 05 Machine Tools for Metal Cutting II: [11]

a) **Shaping & Planning Machine:** Construction & working of shaper and Planer machine, Comparison between planer and shaper machine.

b) **Milling Machine:** Types- Horizontal, Vertical milling machines, Milling cutters, construction and working of column and knee type, milling operations, simple and compound indexing.

c) **Gear Manufacturing processes:** Study of various processes like gear shaping, gear hobbing, Gear finishing processes –Gear shaving, Gear burnishing and gear rolling.

Unit No. 06 Nonconventional Machining: [04]

Fundamental principle, machining unit, tool material, advantages, limitations and applications of Abrasive Jet Machining, Electrical Discharge machining, Electro- Chemical machining, Laser beam machining, Ultrasonic machining, Water jet machining.

Note:

The Workshop practice IV should cover the practical based on this syllabus, the load of

which shall be allotted to teaching staff.

TEXT BOOKS:

1. "Manufacturing Technology- Foundry, Forming and Welding, Vol. I", P. N. Rao, Tata McGraw-Hill, New Delhi,3rd edition, 2009.
2. "Principles of Foundry Technology", P.L. Jain, Tata McGraw-Hill, NewDelhi, 2nd Edition.
3. "A Textbook of Production Technology (Manufacturing Processes)", P.C. Sharma, S. Chand and Company Pvt.Ltd, New Delhi.7thEdition,2010.
4. "Foundry technology", O. P. Khanna, Dhanapat Rai Publications Pvt.Ltd, New Delhi.17th Edition, 2013.
5. "Workshop Technology vol. II", B.S. Raghuvanshi, Dhanapat Rai Publications Pvt.Ltd, New Delhi.10th Edition, 2000.
6. "Workshop Technology vol. II", W. A. J. Chapman, Viva Books Pvt.Ltd,NewDelhi,1stEdition,2001.
7. "Elements of Workshop Technology vol. II", S.K.Hajra Choudhury and A.K. Hajra Choudhury , Media promoters and Publishers Pvt.Ltd,NewDelhi,13thEdition,2012.
8. "Production technology", R. K. Jain, Khanna Publishers, Delhi, 15th Edition,2000.
9. "A Textbook of Manufacturing Technology (Manufacturing Processes)", R.K. Rajput, Laxmi Publications Pvt.Ltd, New Delhi. Edition,2007

REFERANCE BOOKS:

1. "Principles of metal casting", Haineand Rosenthal, Tata McGraw-Hill Book, Company. New Delhi.
2. ASTM Volumes on Welding, casting, forming and material selection.
3. ASM Handbook," Volume- 15, 1988, Casting.
4. "Workshop Technology", W.A.J.Chapman, CBS Publishing and Distributors, N.DelhiVol.I [ISBN-13:9788123904016]2001, Vol.II [9788123904115] 2007 andVol.III [9788123904122] 1995.
5. "Machine Tools and Manufacturing Technology" , Steve F. Krar, Mario Rapisarda,Albert F. Check.

S.Y. B. Tech (MECHANICAL ENGINEERING) Semester: IV

06. Testing and Measurement

SUBJECT CODE: PCC-ME 215

TeachingScheme:	**Examination Scheme:**
Practical: 2 Hrs.perweek	**Term Work: 25 Marks**
Credit: 01	**Practical: 25Marks**

Pre-requisites: Applied Thermodynamics, Fluid Mechanics, Applied Physics

Course Objectives:

1. to gain knowledge of different types of measuring instruments for mechanical engineering

2. to study and calibration of various measuring instruments

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

1. Understand basic constriction of working of various instruments
2. Select the various of types of instruments for the measurement system

TERM WORK/ LIST OF EXPERIMENTS

1. Study and assignment on generalized measurement system and characteristics of instruments.
2. Study and assignment on sensing elements and transducers.
3. Testing of mechanical pressure gauge by using dead weight pressure gauge tester
4. Study and Measurement of fluid flow by using Rota meter/ Anemometer/ Turbine meter/ Target Meter.
5. Study and Measurement of Angular speed by using Magnetic Pickup and Photoelectric Pickup/ Stroboscope.
6. Study and Measurement of Temperature by using Thermocouple, RTD, Thermister/ Pyrometer.
7. Study and Measurement of Displacement by using LVDT.
8. Study and Measurement of Force and Torque by using Strain Gauges.
9. Study and Measurement of Vacumm by using Mc-lead guage/ Pirani gauge
10. Study of Vibrations testing by using Vibrometer.
11. Case study on measuring system for Pressure, flow, temperature etc.

TEXT BOOKS

1. “Mechanical Measurement”, Beckwith and Buck, Pearson Education Asia,5thEdition,2001.
2. “Mechanical Measurement and Control” D.S. Kumar, Metropolitan Book Co.Pvt.Ltd.,NewDelhi,4thEdition,2007.
3. “Mechanical Measurements”, Shirohi and Radha Krishnan H.C., New Age International, New Delhi, 3rd Edition,2007.
4. Engineering Practices Laboratory Kannaiah, Scitech Publication.

REFERANCE BOOKS

1. “Measurement Systems”, DoebelinEmesto, McGraw Hill International Publication Co. New York, 4th Edition, 1990
2. “Mechanical Measurement and Control” ,A.K. Sawhney and P. Sawhney, Dhanpat Rai and Company Pvt.Ltd.,New Delhi, 12th Edition,2010.
3. “Theory and design for mechanical measurements”, Richard S. Figliola, Donald E. Beasley, Wiley India Edition.

S.Y. B. Tech (MECHANICAL ENGINEERING) Semester : IV

07. COMPUTER AIDED DRAFTING

SUBJECT CODE: PCC-ME216

TeachingScheme:

Practical: 2 Hrs.perweek

Credit: 01

Examination Scheme:

Term Work: 25 Marks

Pre-requisites:

1. Fundamentals of Engineering Graphics
2. Fundamentals of Machine Drawing and Engineering Drawing

Course Objectives:

1. To understand importance of CAD tool
2. To Develop an ability to create 2-D drawings
3. To Create 3-D models of machine components
4. To Create assembly of simple machine components with industrial approach.

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

1. Draw 2D drawings and 3D models of simple components.
2. Analyze and interpret production Drawing
3. Use modern engineering techniques, tools and skills for engineering practice.
4. Develop the skills for drafting using CAD software and get the knowledge to enhance the CAD utilities.

1. Introduction to CAD: [03]

Basic commands to draw 2D objects like, point, line, circle, ellipse, polygon etc. Editing commands like, Erase, extension, break, trim, fillet, scale etc. Viewing commands like Zoom, pan, mirror, rotate, move, block, offsetting, Draw& Modify toolbars of any advance CAD Software.

2.Use of layers: [02]

Use of layers in 2D drawing, Annotation and Layers toolbars any advance CAD Software.

3.Geometric Dimensioning and Tolerancing: [02]

Geometric Dimensioning and Tolerancing For 2-D Objects: Straightness, Flatness, Perpendicularity, Angularity, Roundness, Concentricity, Cylindricity, Run out, Profile, Parallelism etc. Entering limits, fits, tolerances surface finish symbols and Machining Symbols on drawings.

4.Detail and Assembly Drawings: [02]

Preparing detail and assembly drawings in 2D. Preparing of bill of material (BOM). Maximum no. of parts to be limited to twelve only. Entering limits, fits, tolerances and surface finish symbols on detail and assembly drawings.

5.Production Drawing: [02]

Production drawing including production note, removed cross section, detail views, Cross sectional views, dimensions and tolerances etc.

6.Introduction 3D: [02]

Extrude, Cut, Revolve, Union, Rib, Fillet, Chamfer, UCS etc. using any advance CAD software.

TERM WORK/ LIST OF EXPERIMENTS:

1) Computer aided drafting of two simple components and print out of the same on A4 size sheet.
2) Drawing details and assembly with limit, fit, tolerances & Bill of material of assembly containing 6-8 major components .Print out of the same on A3 size sheet.
3) 3-D drawing of one simple components and plotting its 2-D views along with 3-D object drawing. Print out of the same on A4 size sheet.

Note: Latest drafting software like Auto cad and any advance 3-D modeling software are to be used.

TEXT BOOKS

1. Ajeet Sing, "Working with AutoCAD 2000", Tata McGraw Hill
2. "Machine drawing", N.D. Bhat and V.M. Panchal, Charotar Publication House, Anand, 42nd Edition,2007 .
3. "Machine drawing", Basudeb Bhattacharyya, Oxford university press.

REFERANCE BOOKS

1. "Auto cad 2014 for Engineers and Designers", Sham Tickoo, Dreamtech press, New Delhi,2014.
2. "Auto Cad 2014", Ellen Finkelsten, Wiley India Manuals and Tutorials of referred software"

S.Y. B. Tech (MECHANICAL ENGINEERING) Semester: III

7: Computer Graphics

SUBJECT CODE: PCC-ME 217

TeachingScheme:	**Examination Scheme:**
Practical: 2 Hrs.perweek	**Term Work: 25 Marks**
	Credit: 01

Course Objectives:

1) To introduce student about computer graphics leading to the ability to understand contemporary.
2) To study basic concepts of computer graphics techniques, focusing on 3D modeling, Image synthesis.
3) To study physical significance of Curves and Surfaces.

Course Learning Outcomes:

1) To acquire the knowledge of basics of computer graphics.
2) To Apply basic programming in C for line, rectangle, circle etc for different shapes.
3) To recognize the importance of using three dimensional transformations like translation, scaling and rotating.
4) To Analyzing the hidden unwanted parts in graphics and do the program on animation
5) To choose the different of curves and surfaces

Unit 1:-

Introduction and background of Computer Graphics, Need of Computer Graphics, Importance of Computer Graphics in the area of CAD/CAM/CAE,

Display devices: Refresh Cathode ray Tubes, Random Scan and Raster Scan monitors, Colour CRT Monitors, Direct view Storage Tubes, Continuous Refresh and Storage display, LED and LCD Monitors.

Unit 2:-

Graphics programming, Initializing the graphics, C Graphical functions, simple programs

Graphic primitives: Points & Lines, Line drawing Algorithm, DDA and Bresenham's Algorithm. Fill Algorithm: Scan-Line Polygon Fill algorithm, Boundary Fill Algorithm, Flood Fill Algorithm, Area Filling. Generation of circles.

Unit 3:-

Two Dimensional Transformations and Clipping and Windowing

What is transformation?, Matrix representation of points, Basic transformation, Need for Clipping and Windowing, Line Clipping Algorithms, The midpoint subdivision Method, Sutherland – Hodgeman Algorithm, Viewing Transformations

Unit 4:-

Need for 3-Dimensional Imaging, Techniques for 3-Dimesional displaying, Parallel Projections, Perspective projection, Intensity cues, Stereoscope effect, Kinetic depth effect, Shading.

Unit 5:-

Curves and Surfaces

Shape description requirements, parametric functions, Bezier methods, Bezier curves, Bezier surfaces, B-Spline methods, Need for hidden surface removal, The Depth - Buffer Algorithm, Scan Line coherence algorithm, Span – Coherence algorithm,

Unit 6:-

Solid Area Scan Conversion and Three Dimensional Transformations

Solid Area Scan Conversion, Scan Conversion of Polygons, Algorithm Singularity, Three Dimensional transformation, Translations, Scaling, Rotation, Viewing Transformation, The Perspective, Algorithms, Three Dimensional Clipping, Perspective view of Cube.

TERM WORK:

Should contain at least 6 assignments (one per unit) covering thesyllabus.

PRACTICAL:

Should contain following programs developed using C++. Some Sample practical are listedbelow.

1. Write a program with menu option to input the line coordinates from the user to generate a line using Bresenham□s method and DDA algorithm. Compare the lines for their valueson theline.
2. Develop a program to generate a complete circle basedon

   Bresenham□s CircleAlgorithm

   Midpoint CircleAlgorithm

3. ImplementtheBresenham□s/DDAalgorithmfordrawingline(programmerisexpectedto shift the origin to the center of the screen and divide the screen into requiredquadrants).
4. Write program to perform the following 2D and 3D transformations on the given input figure

   Rotatethrough degree

   Reflection

   Scaling

   Translation.
5. Develop a program to clip a line using Cohen-Sutherland line clipping algorithm between (x1,y1)(x2, y2) against a window (xmin, ymin)(xmax, ymax).
6. Write a program to implement polygon filling.
7. Write a program to draw Bezier and B-Spline Curves with interactive user inputs for control polygon defining the shape of the curve.
8. Write a program to generate a 2D/3D fractal figures (Sierpinski triangle, Cantor set, Tree etc).

TEXT BOOKS:

1. "CGraphics and Projects" , B M Havaldar , Anmol publication.
2. "Computer Graphics", Hearn and Baker, Published by Dorling Kindersleypvt.Ltd., 2nd Edition
3. "Computer Graphics for Scientists and Engineers", Asthana and Sinha, New Age International(P) Ltd. Publishers, New Delhi, 2nd RevisedEdition
4. Computer Graphics-Donald hearn and M.Pauline Baker-Prentice Hall of India Pvt Ltd.
5. Introduction to Computer Graphics – N. Krishnamurhy - TMH Publication.

REFERENCE BOOKS:

1. "Principles of Interactive Computer Graphics", Newman and Sproull, Mc GrawHill Education.
2. Computer Graphics –Harrington S. – TMH Publication.
3. Computer Graphics - Schaum's Outline –TMH Publication

S.Y. B. Tech. (MECHANICAL ENGINEERING) Semester: IV

08. WORKSHOP PRACTICE IV

SUBJECT CODE:PCC ME 218

TeachingScheme:	**Examination Scheme:**
Practical: 2 Hrs.perweek	**Term Work: 25 Marks**
Credit: 01	**Practical Exam: 25Marks**

Pre-requisites: Engineering Graphics, Basic Mechanical Engineering

Course Objectives:

1) To study Machine layout, installation of Machine Tools, selection of Tools.
2) To study Lathe Machine, Drilling Machine, Milling Machine.
3) To study machining operations and prepare Job with its process sheet on Lathe machine.
4) To study basics of CNC and VMC Machine

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

1) Understand Machine layout, method of Machine Tool installation, selection of Tools for various machining operation.
2) Understand Construction, Mechanism and Application of Lathe Machine, Drilling Machine, and Milling Machine.
3) Understand machining operations and prepare Job with plain turning, taper turning, external threading and knurling operation along with its process sheet
4) Understand basics of CNC and VMC Machine

Term Work:

1) Machine layout, existing machine specifications, Installation procedure of Machine Tools
2) Selection of tools for metal cutting based on work piece materials
3) Study of Construction, Mechanism and Application of following machines (any two)
    a. Lathe Machine
    b. Drilling Machine
    c. Milling Machine
4) One Job of MS material; plain turning, taper turning, external threading and knurling operation with its process sheet.
5) Introduction to CNC and VMC Machine (Construction working theoretical treatment only)
6) Industrial visit to study Plastic Shaping, Forming, Conventional Machine Shop and gear manufacturing processes

NOTE:

1) The load of Workshop Practice IV will be allotted to the Teaching Faculty.
2) Assessment of Journal based on above Term Work and Industrial Visit Report.
3) Term work will consist of Job Carrying 15 Marks, Journal Assessment along with

internal oral 10 marks.

4) Practical Examination is on basis of Job done (25 Marks)

SHIVAJI UNIVERSITY KOLHAPUR

REVISED SYLLABUS AND STRUCTURE

THIRD YEAR (B. Tech.)

MECHANICAL ENGINEERING

To be introduced from the academic year 2020-21 (i.e. from June 2020) onwards

First Year ENGINEERING – CBCS PATTERN

Sr. No	Course	TEACHING SCHEME									EXAMINATION SCHEME							
		THEORY			TUTORIAL			PRACTICAL			THEORY					PRACTICAL (Term wok)		
		Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Hours	Mode	Marks	Total Marks	%Min	Hours	Max	%Min
SEMESTER - I																		
1	BSC-P / BSC-C	3	3	3	-	-	-	1	2	2		CIE / ESE	30 / 70	100	40%	As per BOS Guidelines	25	40%
2	BSC-M-I	3	3	3	1	1	1	-	-	-		CIE / ESE	30 / 70	100	40%		25	40%
3	ESC	3	3	3	-	-	-	1	2	2		CIE / ESE	30 / 70	100	40%		25	40%
4	ESC	3	3	3	-	-	-	1	2	2		CIE / ESE	30 / 70	100	40%		25	40%
5	ESC	3	3	3	-	-	-	1	2	2		CIE / ESE	30 / 70	100	40%		25	40%
6	HM-I	1	1	1	-	-	-	1	2	2		-	-	-	-		25	40%
7	ESC-W-I	1	1	1	-	-	-	1	2	2		-	-	-	-		50	40%
	TOTAL	**17**	**17**	**17**	**1**	**1**	**1**	**6**	**12**	**12**				**500**			**200**	
SEMESTER –II																		
1	BSC-P / BSC-C	3	3	3	-	-	-	1	2	2		CIE / ESE	30 / 70	100	40%	As per BOS Guidelines	25	40%
2	BSC-M-II	3	3	3	1	1	1	-	-	-		CIE / ESE	30 / 70	100	40%		25	40%
3	ESC	3	3	3	-	-	-	1	2	2		CIE / ESE	30 / 70	100	40%		25	40%
4	ESC	3	3	3	-	-	-	1	2	2		CIE / ESE	30 / 70	100	40%		25	40%
5	ESC	3	3	3	-	-	-	1	2	2		CIE / ESE	30 / 70	100	40%		25	40%
6	HM-II	1	1	1	-	-	-	1	2	2		-	-	-	-		25	40%
7	ESC-W-II	1	1	1	-	-	-	1	2	2		-	-	-	-		50	40%
	TOTAL	**17**	**17**	**17**	**1**	**1**	**1**	**6**	**12**	**12**				**500**			**200**	
	TOTAL	**34**	**34**	**34**	**2**	**2**	**2**	**12**	**24**	**24**				**1000**			**400**	

CIE – Continuous Internal Evaluation
ESE – End Semester Examination

Note :

• Candidate contact hours per week : 30 Hours (Minimum)	• Total Marks for B.E. Sem I & II : **1400**
• Theory and Practical Lectures : 60 Minutes Each	• Total Credits for B.E.-I (Semester I & II) : **48**
• In theory examination there will be a passing based on separate head of passing for examination of CIE and ESE.	
• There shall be separate passing for theory and practical (term work) courses.	
A) Non-Credit Self Study Course : Compulsory Civic Courses (CCC) **For Sem I: CCC – I :** Democracy, Elections and Good Governance **(B) Non-Credit Self Study Course : Skill Development Courses (SDC)** **For Sem II: SDC – I :** Any one from following (i) to (v) i) Business Communication & Presentation ii) Event management iii) Personality Development, iv) Yoga & Physical Management v) Resume, Report & proposal writing	

1. **BSC** : Basic Science Courses are compulsory.
2. **HM :**Humanities and Management are compulsory.
3. **ESC :** Engineering Science Course **: ESC – P** courses (subjects) are mandatory for **Physics** group, while**ESC – C** courses (subjects) are mandatory for **Chemistry** group.
4. There will be two groups for Sem I & II Physics and Chemistry. The Candidate's those opting Physics group in Sem I shall appear for Chemistry group in Sem II and Vice-versa.
5. **ESC-W:** Engineering Science Course-Workshops are compulsory.

SECOND YEAR MECHANICAL ENGINEERING– CBCS PATTERN

Sr. No	Course (Subject Title)	TEACHING SCHEME									EXAMINATION SCHEME											
		THEORY			TUTORIAL			PRACTICAL			THEORY					PRACTICAL			TERM WORK		
		Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Hours	Mode	Marks	Total Marks	Min	Hours	Max	Min	Hours	Max	Min
SEMESTER - III																						
1	BSC-ME201	3	3	3	1	1	1	-	-	-		CIE	30	100	40	As per BOS Guidelines	-	-	2	25	10
												ESE	70								
2	BSC-ME202	3	3	3	-	-	-	1	2#	2#		CIE	30	100	40				2	25	10
												ESE	70								
3	PCC-ME203	3	3	3	-	-	-	1	2	2		CIE	30	100	40		25	10	2	25	10
												ESE	70								
4	PCC-ME204	3	3	3	-	-	-	1	2	2		CIE	30	100	40		25	10	2	25	10
												ESE	70								
5	PCC-ME205	3	3	3	-	-	-	1	2	2		CIE	30	100	40		25	10	2	25	10
												ESE	70								
6	PCC-ME206	-	-	-	-	-	-	1	2	2		-	-	-	-		-	-	2	25	10
7	PCC-ME207	-	-	-	-	-	-	1	2	2		-	-	-	-		-	-	-	25	10
8	PCC-ME208	-	-	-	-	-	-	1	2#	2#		-	-	-	-		-	-	-	25	10
9	MC-ME209	3	3	3	-	-	-	-	-	-		CIE	30	100	40		-	-	-	-	-
												ESE	70								
	TOTAL	**18**	**18**	**18**	**1**	**1**	**1**	**7**	**12**	**12**				**600**			**75**			**200**	
SEMESTER –IV																						
1	PCC-ME210	3	3	3	-	-	-	1	2	2		CIE	30	100	40	As per BOS Guidelines	-	-	2	25	10
												ESE	70								
2	PCC-ME211	3	3	3	-	-	-	1	2	2		CIE	30	100	40		-	-	2	25	10
												ESE	70								
3	PCC-ME212	3	3	3	-	-	-	1	2	2		CIE	30	100	40		25	10	2	25	10
												ESE	70								
4	PCC-ME213	3	3	3	-	-	-	1	2	2		CIE	30	100	40		-	-	2	25	10
												ESE	70								
5	PCC-ME214	4	4	4	-	-	-	-	-	-		CIE	30	100	40		-	-	-	-	-
												ESE	70								
6	PCC-ME215	-	-	-	-	-	-	1	2	2		-	-	-	-		25	10	2	25	10
7	PCC-	-	-	-	-	-	-	1	2	2		-	-	-	-		-	-	2	25	10

	ME216																							
8	PCC-ME217	-	-	-		-	-	-		1	2	2			-	-	-	-		-	-	2	25	10
9	PCC-ME218	-	-	-		-	-	-		1	2	2						-	-	25	10	2	25	10
	TOTAL	**16**	**16**	**16**		-	-	-		**8**	**16**	**16**					**500**			**75**			**200**	
	TOTAL	**34**	**34**	**34**		**1**	**1**	**1**		**16**	**28**	**28**					**1100**			**150**			**400**	

CIE- Continuous Internal Evaluation

ESE – End Semester Examination

• Candidate contact hours per week : 30 Hours (Minimum)	• Total Marks for S.E. Sem III & IV: **1650**
• Theory/Tutorial Duration : 60 Minutes and Practical Duration : 120 Minutes	• Total Credits for S.E. Sem III & IV : **50**
• In theory examination there will be a passing based on separate head of passing for examination of CIE and ESE.	
• There shall be separate passing for theory and practical (term work) courses.	

Note :

1. Basic Science Courses -Mechanical Engineering (BSC-ME) are compulsory.
2. Professional Core Courses-Mechanical Engineering (PCC-ME) are compulsory.
3. Mandatory Course (MC-ME)Environmental Studies which is compulsory for theory 70 marks and project work 30 marks.

COURSE CODE AND DEFINITION

Semester III

Sr. No	Code No.	Subject	Credits
1.	BSC-ME201	Engineering Mathematics - III	4
2.	PCC-ME202	*Electrical Technology	4
3.	PCC-ME203	Applied Thermodynamics	4
4.	PCC-ME204	Metallurgy	4
5.	PCC-ME205	Fluid Mechanics	4
6.	PCC-ME206	Machine Drawing	1
7.	PCC-ME207	*Computer Programming Using C++	1
8.	PCC-ME208	Workshop Practice – III	1
9.	MC-ME209	Environmental studies	3
		Total	26

Semester IV

Sr. No	Code No.	Subject	Credits
1.	BSC-ME210	Applied Numerical Methods	4
2.	PCC-ME211	Analysis of Mechanical Elements	4
3.	PCC-ME212	Fluid and Turbo Machinery	4
4.	PCC-ME213	Theory of Machines – I @	4
5.	PCC-ME214	Machine Tools and Processes	4
6.	PCC-ME215	Testing and Measurement	1
7.	PCC-ME216	Computer Aided Drafting	1
8.	PCC-ME217	Computer Graphics	1
9.	PCC-ME218	Workshop Practice – IV	1
		Total	24

THIRD YEAR MECHANICAL ENGINEERING – CBCS PATTERN

SEMESTER – V

Sr. No	Course (Subject Title)	TEACHING SCHEME									EXAMINATION SCHEME											
		THEORY			TUTORIAL			PRACTICAL			THEORY					PRACTICAL			TERM WORK		
		Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Hours	Mode	Marks	Total Marks	Min	Hours	Max	Min	Hours	Max	Min
1	PCC-ME	3	3	3	-	-	-	1	2	2		CIE ESE	30 70	100	40	As per BOS Guidelines			2	25	10
2	PCC-ME	3	3	3	-	-	-	1	2	2		CIE ESE	30 70	100	40		25	10	2	25	10
3	PCC-ME	3	3	3	-	-	-	1	2	2		CIE ESE	30 70	100	40		25	10	2	25	10
4	PCC-ME	3	3	3	1	1	1					CIE ESE	30 70	100	40				2	25	10
5	PCC-ME	3	3	3	-	-	-	1	2	2		CIE ESE	30 70	100	40				2	25	10
6	OEC-ME	3	3	3	-	-	-					CIE ESE	30 70	100	40				--	--	--
7	PCC-ME	-	-	-	-	-	-	1	2	2									2	25	10
8	PCC-ME	-	-	-	-	-	-	1	2	2									2	25	10
	TOTAL	**18**	**18**	**18**	**1**	**1**	**1**	**6**	**12**	**12**				**600**			**50**			**175**	

SEMESTER –VI

1	PCC-ME	3	3	3	1	1	1	-	-	-		CIE ESE	30 70	100	40	As per BOS Guidelines	-	-	2	25	10
2	PCC-ME	3	3	3	-	-	-	1	2	2		CIE ESE	30 70	100	40		-	-	2	25	10
3	PCC-ME	3	3	3	-	-	-	1	2	2		CIE ESE	30 70	100	40		-	-	2	25	10
4	PCC-ME	3	3	3	-	-	-	1	2	2		CIE ESE	30 70	100	40		25	10	2	25	10
5	PCC-ME	3	3	3	-	-	-	1	2	2		CIE ESE	30 70	100	40		25	10	2	25	10
6	OEC-ME	3	3	3	- -	- -	- -	-	-	-		CIE ESE	30 70	100	40		-	--	--	--	--
7	PCC-ME	-	-	-	-	-	-	1	2	2		-	-	-	-		-	-	2	25	10
8	PCC-ME	-	-	-	-	-	-	1	2	2		-	-	-	-	-	-	-	2	25	10
9	PCC-ME** (Audit Course)	-	1	1	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-

	TOTAL	**18**	**19**	**19**	**1**	**1**	**1**	**6**	**12**	**12**		**600**		**50**		**175**	
	TOTAL	**36**	**37**	**37**	**2**	**2**	**2**	**12**	**24**	**24**		**1200**		**100**		**350**	

CIE- Continuous Internal Evaluation

ESE – End Semester Examination

• Candidate contact hours per week : 30 Hours (Minimum)	• Total Marks for T.E. Sem V& VI:**1650**
• Theory/Tutorial Duration : 60 Minutes and Practical Duration : 120 Minutes	• Total Credits for T.E. Sem V & VI : **50**
• In theory examination there will be a passing based on separate head of passing for examination of CIE and ESE.	
• There shall be separate passing for theory and practical (term work) courses.	
• **Sem V &SemVI** :- Open Elective Course has 3 credits for one course. Each department / branch has to run at least one Open Elective Course in Sem-V and Sem-VI from the list of Elective Course. It is compulsory.	

Note :

1. Professional Core Courses-Mechanical Engineering (PCC-ME) are compulsory.
2. Open Elective Course- Mechanical Engineering (OEC-ME) is compulsory.
3. **PCC-ME**(Audit Course):- Students has to complete audit course as compulsory.**

Semester V

Sr. No	**Code No.**	**Subject**	**Credits**
1.	PCC-ME 301	Control Engineering	4
2.	PCC-ME 302	Theory of Machines – II	4
3.	PCC-ME 303	Heat and Mass Transfer	4
4.	PCC-ME 304	Machine Design – I	4
5.	PCC-ME 305	Manufacturing Engineering @	4
6.	OEC-ME 306	Open Elective-I	3
7.	PCC-ME 307	CAD/CAM Laboratory	1
8.	PCC-ME308	Workshop Practice – V	1
		Total	25

Semester VI

Sr. No	Code No.	Subject	Credits
1.	PCC-ME 311	Industrial Management and Operations Research	4
2.	PCC-ME 312	Industrial Fluid Power	4
3.	PCC-ME 313	Metrology and Quality Control	4
4.	PCC-ME 314	Machine Design – II	4
5.	PCC-ME 315	Internal Combustion Engines	4
6.	OEC-ME 316	Open Elective-II	3
7.	PCC-ME 317	Computer Integrated Manufacturing Lab	1
8.	PCC-ME318	Workshop Practice –VI	1
9.	**PCC-ME319** (Audit Course)**	**Professional Skill Development****	**--**
		Total	**25**

FINAL YEAR MECHANICAL ENGINEERING – CBCS PATTERN

Sr. No	Course (Subject Title)	TEACHING SCHEME									EXAMINATION SCHEME											
		THEORY			TUTORIAL			PRACTICAL			THEORY					PRACTICAL			TERM WORK		
		Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Hours	Mode	Marks	Total Marks	Min	Hours	Max	Min	Hours	Max	Min
SEMESTER –VII																					
1	PCC ME	3	3	3	-	-	-	1	2	2		CIE ESE	30 70	100	40	As per BOS Guidelines	25	10	2	25	10
2	PCC ME	3	3	3	-	-	-	1	2	2		CIE ESE	30 70	100	40		-	-		25	10
3	PCC ME	3	3		-	-	-	1	2	2		CIE ESE	30 70	100	40		25	10	2	25	10
4	PCE ME	3	3	3	-		-	1	2	2		CIE ESE	30 70	100	40				2	25	10
5	PCE ME	3	3	3	-	-	-	1	2	2		CIE ESE	30 70	100	40		-	-	2	25	10
6	PCC ME	-	-	-	-	-	-	1	2	2									2	25	10
7	SI ME	-	-	-				1	-	-		-	-	-	-		-	-	2	25	10
8	PW ME	-	-	-				3	6	6		-	-	-	-		25	10		25	10
	TOTAL	**15**	**15**	**15**				**10**	**18**	**18**				**500**			**75**			**200**	
SEMESTER –VIII																					
1	PCC ME	3	3	3	-	-	-	1	2	2		CIE ESE	30 70	100	40	As per BOS Guidelines	25	10	2	25	10
2	PCC ME	3	3	3	-	-	-	1	2	2		CIE ESE	30 70	100	40		25	10	2	25	10
3	PCC ME	3	3	3	-	-	-	1	2	2		CIE ESE	30 70	100	40		-	-	2	25	10
4	PCE ME	3	3	3	-	-	-	1	2	2		CIE ESE	30 70	100	40		-	-	2	25	10
5	PCE ME	3	3	3	-	-	-	1	2	2		CIE ESE	30 70	100	40		-	-	2	25	10
6	PCC ME***	2	-	-	-	-	-	-	-	-		-	-	-					2	25	10
8	PW ME	-	-	-	-	-	-	3	6	6		-	-	-	-		25	10	6	50	20
	TOTAL	**17**	**15**	**15**				**8**	**16**	**16**				**500**			**75**			**200**	
	TOTAL	**32**	**30**	**30**				**18**	**34**	**34**				**1000**			**150**			**400**	

CIE- Continuous Internal Evaluation

ESE – End Semester Examination

• Candidate contact hours per week : 30 Hours (Minimum)	• Total Marks for B.E. Sem VII & VIII : **1550**
• Theory/Tutorial Duration : 60 Minutes and Practical Duration : 120 Minutes	• Total Credits for B.E. Sem VII & VIII : **50**
• In theory examination there will be a passing based on separate head of passing for examination of CIE and ESE.	
• There shall be separate passing for theory and practical (term work) courses.	

Note :

1. Professional Core Courses-Mechanical Engineering(PCC-ME) are compulsory.
2. Professional Core Electives -MechanicalEngineering (PCE-ME) are compulsory.
3. Summer Internship -Mechanical Engineering (SI-ME) is compulsory.
4. Project Work Mechanical Engineering (PW-ME) is compulsory.
5. **PCC-ME***- Online Certificate Course based on Project topic.**

Semester VII

Sr. No	Code No.	Subject	Credits
1.	PCC ME 401	Refrigeration and Air Conditioning	4
2.	PCC ME 402	Mechanical System Design	4
3.	PCC ME 403	Finite Element Analysis	4
4.	PCE ME 404	Elective I	4
5.	PCE ME 405	Elective II	4
6.	PCC ME 406	Seminar	1
7.	SI ME 406	Summer Internship @	1
8.	PW ME 407	Project Phase -I	3
		Total	25

Semester VIII

Sr. No	Code No.	Subject	Credits
1.	PCC ME 408	Mechatronics	4
2.	PCC ME 409	Energy and Power Engineering	4
3.	PCC ME 410	Noise and Vibration	4
4.	PCE ME 411	Elective III	4
5.	PCE ME 412	Elective IV	4
6.	**PCE ME413*** **	**Online Certificate Course**	**2**
7.	PW ME 414	Project Phase –II	3
		Total	25

SUBJECT NAME: Control Engineering

SUBJECT CODE: PCC-ME 301

Teaching Scheme:	**Examination Scheme:**
Lectures: 03Hrs.perweek	**ESE: 70Marks**
Practical: 02Hrs.perweek	**CIE: 30Marks**
Credit: 04	**Term Work: 25 Marks**

Pre-requisites: Electrical Technology, Engg. Mathematics

Course Objectives:

1.	Student should be able to understand control system, its types andapplications.
2.	Student should be able to model physicalsystem.
3.	Student should be able to determine system stability and systemresponse.
4.	Student should be able to use MATLAB software to analyze controlsystem

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

1.	To understand control system, its type andapplications
2.	To model physicalsystem.
3.	To determine system stability and systemresponse.
4.	To understand various controlactions.
5.	To use MATLAB software to analyze controlsystem

Unit 1	Introduction to Automatic Control	[6]
	Generalized feedback Control System, Types, Mathematical Model of Control System, Mechanical Translational Systems, Rotational System, Grounded Chair Representation, Electrical Elements, Analogous Systems, Force – Voltage Analog, Force – Current Analog,	

Unit 2	Representation of control system	[7]
	Linearization of non linear functions, Linearization of operating curves, Block Diagram Algebra, Rules for Reduction of Block Diagram.	

Unit 3	Transient Response	[7]
	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

Unit 4	Stability and Root Locus Technique:	[8]
	Routh's Stability Criteria, Significance of Root Locus, Construction of Root Loci, General Procedure, Effect of Poles and Zeros on the System Stability.	

Unit 5	Frequency Response Analysis	[7]
	Frequency Response Log Magnitude Plots and Phase angle Plots, Gain Margin, Phase Margin, Evaluation of Gain 'K'.	

Unit 6	State Space Analysis	[5]
	System Representation, Direct, Parallel, Series and General Programming.	

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

1. Mathematical Model of Liquid Level System, Thermal System, Gear Train.
2. Study of Control System Components – Tachometer, Hydraulic Servomotor, Stepper Motor, Jet – Pipe Amplifier, Pneumatic Amplifier.
3. One numerical assignment on each unit.
4. Assignment based on use of Software 'MATLAB' on Unit 3,4,5,6.

REFERENCE BOOKS:

	Write Title of Book, Authors Name, Publication & Edition
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

SUBJECT NAME: Theory of Machines - II

SUBJECT CODE: PCC-ME 302

Teaching Scheme:	**Examination Scheme:**
Lectures: 3Hrs.perweek	**ESE: 70Marks**
Practical: 2Hrs.perweek	**CIE: 30Marks**
Credit: 04	**Term Work: 25 Marks**
	Practical/Oral : 25 Marks

Course Objectives:

1.	understand the basic theory on gears.
2.	analyze the various types of gear trains used for transmission of motion and power.
3.	study the gyroscopic effect on different vehicles, aero plane and ship.
4.	study and analyze the problems on balancing of rotary masses.
5.	study the force analysis of simple mechanisms.
6.	study turning moment diagram.

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

1.	Identify 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 gear, Interference in Involute tooth gears and methods for its prevention, Path of contact, Contact ratio.	

Unit 2	**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, Torque in epicyclic gear train, Differential gear box.	

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 masses. Number of masses rotating in single plane and different planes.	

Unit 6	**Flywheel**	**[06]**
	Turning moment diagrams, Fluctuation of energy, Coefficient of fluctuation of speed, Rimmed flywheel	

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

Any nine of following

1. Generation of involute profile using rack cutter method.
2. Experiment on Torque Measurement in epicyclical 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

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.

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.

SUBJECT NAME: Heat & Mass Transfer

SUBJECT CODE: PCC-ME 303

Teaching Scheme:	**Examination Scheme:**
Lectures: 03 Hrs. per week	**ESE: 70 Marks**
Practical: 02 Hrs. per week	**CIE: 30 Marks**
Credit: 04	**Term Work: 25 Marks**
	Practical/Oral: 25 Marks

Pre-requisites: Fluid Mechanics, Basic Thermodynamics, Engineering Mathematics

Course Objectives:

1.	Studentswilllearnaboutwhatisheattransfer, what are the modes of heat transfer and their basic laws, and analysis of heat transfer problems in conduction, convection, radiation and combined modes.
2.	Theywillalsolearngeneral ordifferential equations for conduction and radiation as well as governing equations of convection so that students can solve real time heat transfer problem.
3.	Studentswilllearnabout design and analysis of heat exchanger devices by using LMTD and NTU approach.

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

1.	Formulate basic equations for heat transferproblems.
2.	Applyheattransferprinciplestodesignandevaluateperformanceofthermal systems.
3.	Calculate the effectiveness and ratingof heat exchangers.
4.	Calculate heat transfer byradiation between objects withsimple geometries.
5.	Calculateandevaluatetheimpactofboundary conditionsonthesolutionsof heat transfer problems.
6.	Evaluate the relative contributions of different modes of heat transfer.

Unit 1	**IntroductiontoHeatandMassTransfer**	**[10]**
	Basic concepts: Modesofheattransfer,Basiclawsofheattransfer,Introductiontocombinedmodesofheat transfer,Thermalconductivityanditsvariationwithtemperatureforvarious Engg.Materials (Descriptiononly),Introductiontomasstransfer,Modesofmasstransfer, Analogy betweenheat,massandmomentumtransfer,Fick'slawofdiffusion, Derivation ofGeneralized differential equation of heat conduction in Cartesian co-ordinates, itsreductiontoFourier,LaplaceandPoisson'sequations,GeneralizedHeatconduction equationin cylindricaland spherical coordinates (noderivation). **One dimensional steady state heat conduction without heat generation:**ReductionofGeneralizeddifferentialequationofHeatConductiontoonedimension(1D), Heatconductionthroughplanewall;cylinder;sphere,electricalanalogy,conceptofthermal resistance andconductance,compositeslab,compositecylinderandcompositesphere,critical radiusof insulation for cylinderand sphere.	

Unit 2	**HeatConductionwithHeatGenerationandUnsteadyStateHeatConduction**	**[06]**
	Onedimensionalsteadystateheatconductionwithheatgeneration: Onedimensionalsteadystateheatconductionwithuniformheatgenerationforplanewall; cylinder; and sphere (with numerical on plane wall and cylinder) **Onedimensionalunsteadystateheatconduction:** LumpedHeatcapacity Analysis,BiotandFouriernumberandtheirsignificance,(Numerical basedonLumpedHeatcapacityAnalysis)	

Unit 3	**ExtendedSurfaces**	**[06]**
	Typesandapplicationsoffins,Heattransferfromrectangularandpinfins.Fineffectiveness and efficiency, Analysis of fin with insulated end and infinite long fin, Error estimation intemperaturemeasurement inthermo well (No numerical on error estimation).	

Unit 4	**Convection**	**[06]**
	Mechanismofnaturalandforcedconvection.ConceptofHydrodynamicandthermal boundarylayer,Localandaverageconvectivecoefficientforlaminarandturbulentflowfor flat plate and pipe. **Natural convection:** Dimensionalanalysis,Physicalsignificanceofdimensionlessnumbers,correlationsfor natural convectionover vertical plate,cylinder, & sphereandflow patterns. **Forced convection:** Dimensional analysis, Physicalsignificance ofdimensionless numbers, Reynoldsanalogy for laminar flow, Correlations for forced convection overflat plateand closedconduits.	

Unit 5	**Radiation**	**[06]**
	Natureofthermalradiation,absorptivity,reflectivity,transmissivity,emissivepowerand emissivity, spectral and total concept,blackbody,graybody,andwhitebodyKirchhoff'slaw, Wein'slawandPlanck'slaw,anddeductionofStefanBoltzmannlaw.Lambertcosinerule, Intensityofradiation. Energyexchangebyradiationbetweentwoblacksurfaceswithnon-absorbingmediuminbetweenandinabsenceofreradiatingsurfaces.Shapefactorandits characteristics. Energ yexchangebyradiationbetweentwograysurfaceswithoutabsorbing medium, conceptofradiosityandirradiation.Radiationnetworkmethod,networkfortwo surfaces which seeeachother and nothingelse, radiation shields.	

Unit 6	**HeatExchangers & Phase change phenomenon**	**[06]**
	Heat Exchangers: Classificationandtypesof heatexchangers,Foulingfactor,andOverallheattransfer coefficient,HeatExchangeranalysisusingLMTDandNTUmethodsforparalleland counterflow,DesignconsiderationofHeatexchangersandintroductiontodesignstandards like TEMA, **Boiling & Condensation:**	

Typesofboiling,Poolboilingandforcedconvectionboiling,Film wise and drop wise condensation.

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

Any8 Experiments based on followinglist.

1. Determination of thermalconductivityofinsulatingpowder.
2. Determination of thermalconductivityof aMetalrod
3. DeterminationofthermalresistanceandtemperaturedistributioninaComposite wall.
4. Determination of thermal conductivityofinsulatingmaterial inLagged pipe.
5. DeterminationoflocalandaverageheattransfercoefficientinNaturalconvection heattransferfromavertical cylinder.
6. DeterminationofHeatTransferCoefficientunderforcedconvectiontoairthrough pipe.
7. Determination of emissivityof aNonblack surface.
8. Determination of Stefan Boltzmann Constant.
9. DeterminationofoverallheattransfercoefficientandeffectivenessinaParallel Flow and Counter flow Heat Exchanger.
10. Studyand Demonstration of Heat Pipe
11. Determination of heat transfer coefficient in dropwise and film-wise condensation.
12. Determination of Critical Heat Flux.

TEXT BOOKS:

1.	"HeatandMassTransfer",R.K.Rajput,S.ChandandCompanyLtd.,NewDelhi., 5th Edition
2.	"HeatTransfer",J.P.Holman,TataMcGrawHillBookCompany,New York,2nd Edition
3.	"Fundamentals of Heat and Mass Transfer",R.C.Sachdeva, WilleyEasternLtd., New York, 2nd Edition
4.	"Heat and Mass transfer", M.M.Rathod, Laxmi Publications

REFERENCE BOOKS:

1.	. “Heat Transfer– A Practical approach”,Yunus. A .Cengel, Tata McGraw Hill
2.	“Heat Transfer” Chapman A.J., Tata McGraw HillBook Company, NewYork
3.	“FundamentalsofHeatandMassTransfer”,FrankP.Incropera,DavidP.Dewitt,WisleyIndia. 5^{th}Edition
4.	“ATextBookonHeatTransfer”,Dr.S.P.Sukhatme,OrientLongmanPublication Hyderabad
5.	“HeatandMassTransfer”,S.C.AroraandS.Domkundwar,DhanpatRaiandSons, Delhi

SUBJECT NAME: Machine Design-I

SUBJECT CODE:PCC-ME304

Teaching Scheme:	**Examination Scheme:**
Lectures: 03Hrs.perweek	**ESE: 70Marks**
Tutorial: 01Hrs.perweek	**CIE: 30Marks**
Credit: 04	**Term Work: 25 Marks**
	Practical/Oral : 00 Marks

Pre-requisites:

Elementary knowledge of Mechanics, Mathematics and Science.

Course Objectives:

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: At the end of this course, 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, Theories of failure(Maximum Principle stress, Maximum shear stress and Maximum Distortion Energy), Phases 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 Mechanical Elements**	**[09]**
	a) Design of machine elements under static loading- Knuckle joint, Turn buckle and bell crank Lever. (Numerical on Knuckle Joint and Bell crank Lever). b) Forms of threads, Terminology of threads, Trapezoidal and Acme thread, Design of power screw and nuts, Introduction to Recirculating ball Screw. (Numerical on Power Screw with Square thread).	

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, Rigid Coupling, flexible bushed pin type flanged coupling.	

Unit 4	**Design of Joints**	**[08]**
	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. Riveted Joint (Theoretical treatment only).	

Unit 5	**Design of springs**	**[06]**
	Types of springs and their applications, Styles of end, Design of Helical Compression Spring subjected to static loading.	

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 /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

1) Case study of components (include selection of materials for various components 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) Case study each joint.

5) Design of helical compression spring subjected to static load.

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 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.	"A Text Book of Machine Design", R.S. Khurmi and J.K.Gupta.
3.	"Machine Design A Basic Approach", Dr. S.S.wadhwa S S Jolly Dhanapat Rai and Sons.
4.	"Machine Design", U.C.Jindal, Pearson Education.
5.	"Machine Design", Pandya Shah, Charotar Publication.

REFERENCE BOOKS:

1.	"Design of Machine Element", J.F. Shigley, Tata McGraw Hill Publication.
2.	"Design of Machine Element" M.F.Spotts, Pearson Education Publication, 6th Edition.
3.	PSG Design data Book.
4.	"Machine Component Design",Robert C. Juvniall, Willey Ltd, 5th Edition.

SUBJECT NAME: Manufacturing Engineering

SUBJECT CODE:PCC-ME305

Teaching Scheme:	**Examination Scheme:**
Lectures: 03Hrs.perweek	**ESE: 70Marks**
Practical: 02Hrs.perweek	**CIE: 30Marks**
Credit: 04	**Term Work: 25 Marks**

Pre-requisites: Machine Tools Processes

Course Objectives:

1.	Study of metal cutting technology including the process, measurements.
2.	Design and selection of various cutting tools and their industrial specifications
3.	Study of Geometry of various cutting tools.
4.	Introduce the students to design practices of toolings (Jigs and Fixtures)
5.	Study of various press working tools
6.	Study of various aspects of CNC machine technology and its tooling.

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

1.	Understand various metal cutting technology including the process and measurement etc.
2.	Identify and select proper cutting tool with respect to work piece materials
3.	Identify parameters of single and multipoint cutting tools.
4.	Design and Draw Jig and Fixture.
5.	Select and design dies for press working operations.
6.	Understand and apply CNC Technology

Unit 1	**Theory of Metal Cutting**	**[06]**
	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.	

Unit 2	**Tool Life and Tool geometry**	**[06]**
	Cutting tool materials and their properties, Advanced cutting tools. Machinability of Metals- Factors affecting, improvement and machinability index. Tool life - Types of wear, relationship with cutting parameters, Taylor's equation, improvement measures. Surface finish- Factors affecting, effect of cutting parameters, improvements. Heat generation in machining, its effect on cutting force, tool life and surface finish, types and selection criteria of cutting fluids.	

Unit 3	Tool geometry	**[04]**
	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 4	**Drilling Jigs and Milling Fixtures**	**[12]**
	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.	

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). Problems on Blanking and Piercing operations	

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 /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

1) Study of Theory of metal Cutting
2) Study of cutting Tools (Tool Life, Tool Materials etc.)
3) Study of Tool Geometry (Single and Multipoint cutting Tools)
4) Design and drawing of any one Drilling jig.
5) Design and drawing of any one Milling fixture.
6) Assignment on Press Tools (Numerical Based)
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.	"Jigs and Fixtures", Kempster ,ELBS.
9.	"Metal Cutting and Machine Tools", Thirupati Reddy, Scitech Publication, 1st Edition.

SUBJECT NAME: Enterprise Resource Planning

SUBJECT CODE:OEC-ME 306

Teaching Scheme:	**Examination Scheme:**
Lectures: 03 Hrs.perweek	**ESE: 70Marks**
Practical: --	**CIE: 30Marks**
Credit: 03	

Pre-requisites:

Course Objectives:

1.	Know the basics, evolution , importance of ERP
2.	Correlate ERP and related technology
3.	Understand manufacturing perspectives of ERP
4.	Know business modules of ERP
5.	Understand the key implementation issues and some popular products in ERP
6.	Understand implementation of ERP package

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

1.	Understand the structure of an ERP system and know how process chains in Materialsmanagement, production, controlling and sales are implemented in an ERP system
2.	Implementation and customize an ERP system using the appropriate modeling methods,that are Entity Relationship Modeling (ERM) and Event-Driven Process Chains (EPC)
3.	Understand the customization of an ERP system and customize essential parts of materials management, production, controlling and sales in SAP ECC
4.	Understand software design issues in state-of-the-art business software and realize theimportance of project management in an ERP implementation project
5.	Understand what to expect, and not to expect, from a consultant implementing an ERPsystem
6.	Understand the importance of IT governance in long-term relationships with a

softwarevendor, such as SAP

Unit 1	**Introduction to ERP**	**[05]**
	Introduction, Evolution, Reasons for the growth of ERP market, Advantages, Reasons for failure of ERP. Benefits of ERP-Reduction of lead time, On time shipment, Reduction in cycle time, Improved resource utilization, Better customer satisfaction, Input supplier performance,Increased flexibility.	

Unit 2	**ERP and Related Technologies**	**[06]**
	Data warehousing, Data mining, OLAP, Business Process Reengineering (BPR), Management Information System (MIS), Supply Chain Management (SCM), Decision Support System (DSS),Executive Information System (EIS),Customer relationship management (CRM)	

Unit 3	**A Manufacturing Perspective**	**[03]**
	CAD/CAM, MRP, MRP II, Distribution Requirement Planning (DRP), Product Data Management (PDM).	

Unit 4	**ERP Modules**	**[05]**
	Introduction and study of Business modules like Finance, Mfg. and Production, HR, Plantmaintenance, Quality and Material Management, Sales and Distribution.	

Unit 5	**ERP Implementation Life Cycle**	**[05]**
	Introduction, Pre-evaluation Screening, Package evaluation, Project planning, Gap Analysis, Reengineering, Configuration, Team training, Testing, End user training and Post-implementation phases, Expanding ERP boundaries, Service oriented architecture, Enterprises application integration.	

Unit 6	**ERP Market and Case Studies**	**[04]**
	Brief account of ERP market, various ERP packages like SAPAG, Oracle, PeopleSoft, etc. Indian scenario for ERP implementation, Case studies based on implementation of ERP for various areas in mfg., Marketing and other businesses, E-commerce, cloud based ERP system.	

TEXT BOOKS:

1.	"Enterprise Resource Planning", Alexis Leon, Tata McGraw Hill Publication, ISBN 0-07-463712-6.
2.	"Enterprise Resource Planning", Bret Wagner, Delmar Learning, International Edition, ISBN 10: 1439081085, ISBN–13: 978-1439081082.
3.	"Enterprises Resource Planning", Venkateshswara, Scitech Publication.
4.	"Entrepreneurship",Chris Boulton, Patric Turner, Willey India.
5.	"Management Information System",S. Sadagopan, PHI, New Delhi, 2nd Edition.

REFERENCE BOOKS:

1.	"Modern ERP: Select Implement and Use", Marianne Bradford, Hand M Books, ISBN: 978-0-557-01291-6.
2.	"Enterprises Resource Planning", E.F. Monk, B.J. Wagner, Cengage Learning.
3.	"Enterprises Resource Planning", A. R Singla, Cengage Learning.
4.	"Enterprises Resource Planning-Concepts and Practices", Vinod Kumar Garg and Venkitakrishnan N. K. , PHI, New Delhi.

SUBJECT NAME: Optimization Techniques

SUBJECT CODE: OEC-ME 306

Teaching Scheme:	**Examination Scheme:**
Lectures: 03Hrs.perweek	**ESE: 70Marks**
Practical: 00Hrs.perweek	**CIE: 30Marks**
Credit: 03	**Term Work: --**

Pre-requisites: Engg. Mathematics

Course Objectives:

1.	To Provide students with the basic mathematical concepts of optimization. .
2.	To Provide students with the modeling skills necessary to describe and formulate optimization problems
3.	To Provide students with the skills necessary to solve and interpret optimization problems in engineering
4.	To Enhance students' skills related to optimization in engineering, open-ended problem solving, critical thinking and life-long learning

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

1.	To understand importance of optimization of industrial process management
2.	To apply basic concepts of mathematics to formulate an optimization problem
3.	To analyse and appreciate variety of performance measures for various optimization problems
4.	To recognition of the need for, and an ability to engage in life-long learning

Unit 1	Introduction	04
	Concept of optimization – classification of optimization – problems.	

Unit 2	Linear Programming	09
	Examples of linear programming problems –formulation simplex methods variable with upper bounds –principle-duality -dual simplex method -sensitivity analysis – revised simplex procedure –solution of the transportation problem –assignment – network minimization –shortest route problem –maximal two problem –L.P. representation of networks.	

Unit 3	Queuing Theory	07
	Queuing Model, poison and exponential distributions -Queues with combined arrivals and departures-random and series queues.	

Unit 4	Unconstrained Optimization	07
	Maximization and minimization of convex functions. Necessary and sufficient conditions for local minima – speed and order of convegence – unibariate search – steepest and desent methods- metcher reeves method -conjugate gradient method.	

Unit 5	Constrained Optimization	07
	Necessary and sufficient condition – equality constraints, inequality constraints - kuhu – tucker conditions – gradient projection method – penalty function methods – cutting plane methods of sibel directions.	

Unit 6	Dynamic Programming	06
	Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution – examples illustrating the tabular method of solution.	

TEXT BOOK(S)

1.	Rao S.S,"Optimization – Theory and applications", Wiley Easter Ltd., 1979.
2.	Operations Research by NVR Naidu, G Rajendra, T Krishna Rao, I K International Publishing house, New Delhi.
3.	Operations Research: An Introduction by H A Taha, 5th Edition, Macmillan, New York

REFERENCE BOOKS:

1.	David G.Luerbeggan, "Introduction to Linear and Non Linear Programming", Addison Wesley Publishing Co. 1973.
2.	Hadley G. "Nonlinear and – dynamic programming" Addison Wesley Publishing Co. 1964.
3.	Cordan C.C. Beveridge and Robert S. Schedther, "Optimization, Theory and Practice" McGraw Hill Co.1970.
4.	D. Bertsekas Nonlinear programming, 2nd Edition, Athena Scientific, 1999, Nashua.
5.	A. Ruszczynski, Nonlinear optimization, 2006, Princeton University Press, Princeton

SUBJECT NAME:CAD CAM Laboratory

SUBJECT CODE:PCC-ME307

Teaching Scheme:	**Examination Scheme:**
Practical: 02Hrsperweek	**Term Work: 25Marks**
Credit: 01	

Course Objectives:The course aims to:

5.	UnderstandParametric Modeling Fundamentals and Procedure
6.	Developan ability to create constrained 2-D Sketches.
7.	Create Solid Models of machine components.
8.	Create assembly model with drafting.
9.	Create solid models using surfacing technique.
10	UnderstandComputer Aided Manufacturing.

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

6.	Understand and read engineering Drawings.
7.	Prepare solid and surface models from 2D drawings.
8.	Prepare assemblies and BOM.
9.	Conversion of 3D Models into orthographic views.
10	Know the process of CAD data exchange between the software.
11	Understand the basics of Computer Aided Manufacturing.

Unit 1	**Introduction to CAD**	**04**
	1. Introduction to CAD 2. Introduction to graphical user interface (GUI) 3. Application and modification of contents and dimensions 4. Introduction to different CAD software	

Unit 2	**3D and Surface Modeling**	**10**
	1. Generation of 2D and 3D models with the help of various toolbars and	

	commands for industrial based product. 2. Introduction to commands in surface modeling.

Unit 3	Assembly and drafting	08
	1. Introduction to Assembly modeling. 2. Top down and Bottom up method of assembly. 3. Creation of exploded view, ballooning & BOM. 4. Drafting and GD & T	

Unit 4	Introduction to CAM	02
	1. Introduction to CAM 2. Various CAM Software to generate Tool path	

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

1. Solid Modeling- Four exercises (Print outs on A4 size sheet)
2. Surface modeling-Two exercises (Print outs on A4 size sheet)
3. Drafting-Two exercises (Print outs on A4 size sheet)
4. Assembly (with Minimum 5 components) (Print outs on A3 size sheet)

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.	CAD/CAM by M.P.Grover. and E.W.Zimmer, Prentice Hall of India Pvt. Ltd.
2.	CATIA V5R20 for Engineers and Designers, Prof.ShyamTickoo andDeepak Maini,DreamTech Press.

3.	CAD/CAM/CIM, Radhakrishnan, Subramanyam, Raju (2nd Ed.), New Age International Publishers.
4.	Respective Software manuals.
5.	CAD/CAM/CAE Chougule N.K SCITECH PUBLICATION.

SUBJECT NAME: WORKSHOP PRACTICE – V

SUBJECT CODE: PCC-ME308

Teaching Scheme:	**Examination Scheme:**
Lectures: 00Hrs. per week	**ESE: 00 Marks**
Practical: 02 Hrs. per week	**CIE: 00 Marks**
Credit: 01	**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: At the end of this course, 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

	Syllabus 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) Facing iii) Step turning iv) taper turning v)knurling vi)threading vii) Drilling **C**. A visit report based on the industrial visit to study the following machining processes i) Broaching, ii) Slotting iii) Grinding iv) Milling	-

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

Assignments

Write any three assignments out of following.

1. Study and demonstration of Lathe machine.
2. Study and demonstration of grinding machine.
3. Study and demonstration of drilling machine.
4. Study of Broaching machine. (Theoretical treatment only.)

TEXT BOOKS:

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

REFERENCE BOOKS:

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

T.Y.B.TECH (MECHANICAL ENGINEERING) Semester-VI

SUBJECT NAME: Industrial Management and Operations Research

SUBJECT CODE: PCC-ME 311

Teaching Scheme:	**Examination Scheme:**
Lectures: 03Hrs.perweek	**ESE: 70Marks**
Tutorial: 01Hrs.perweek	**CIE: 30Marks**
Credit: 04	**Term Work: 25 Marks**

Pre-requisites:

Course Objectives:

1	State various functions of management.
2	Know Production and marketing functional area of management.
3	Aware about norms of SSI, Industrial safety, MIS.
4	Apply Various Models of Operation Research Such as Linear Programming Model, Assignment Model, Transportation Model, Network Model and Sequencing Model.

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

1	Apply the concepts of Industrial management and operations research approaches. Know various functional areas of management.
2	They will analyses issues in Managing operations and projects and various approaches to resolve those issues.
3	Formulate and solve a wide variety of applications and problems that can be addressed using Operations Research techniques as Linear programming problems.
4	Formulate and solve a wide variety of applications and problems that can be addressed using Operations Research techniques as Transportation and Assignment problems.
5	Apply the various techniques of Project Management such as Network Model and Sequencing Model.

Unit 1	Functions of Management	[8]
	Definition of Management, Planning –Objectives, Steps in Planning, elements of planning, Organizing – Process of Organizing importance and principle of organizing, departmentation, Span of control. Staffing – Nature, Purpose, Scope, Human resource management, Policies, Recruitment procedure, training and development, appraisal methods. Leading – Leadership style, Communication process, Barriers, remedies, Motivation, importance Herzberg's theory, Maslow's theory, McGregor's theory . Controlling–Process, Requirement for control management	

Unit 2	Functional areas of Management	[7]
	Production Management-Product mix, line balancing, break even analysis, Material Handling Equipments, TPM, Problem solving Techniques. Marketing Management –Principles & Functions, Types of Market, Market Research, Market Segmentation, Marketing Mix, Advertisement, Channel Of Distribution.	

Unit 3	Entrepreneurship Development	[5]
	Types of small scale industries (SSI), stages in starting SSI, Qualities required to be Entrepreneur, Government policies for SSI, Problems of SSI, Feasibility Report writing, Industrial Safety, Management Information System.	

Unit 4	Introduction to Operations Research and Linear Programming Problems	[6]
	History and development of OR, Applications, OR models and their Applications, Formulation of LPP problem, Graphical solution of LPP, Simplex procedure for maximization, Simplex procedure for minimization, Duality concept.	

Unit 5	Assignment Model and transportation model	[7]
	Assignment Model- Mathematical statement, Methods to solve balanced assignment problems, Unbalanced assignment problems, Maximization problems, Assignment with restrictions. Transportation model- Mathematical formulation, methods to obtain initial basic feasible solution (IBFS)- NWCR ,LCM and VAM, Conditions for testing optimality, MODI method for testing optimality of solution of balanced problems and unbalanced problems	

Unit 6	Network model and sequencing	[7]
	CPM-Construction of network, Critical path, forward and backward Path, Floats and their significance. PERT- construction of networks, Time estimates, Probability of completing project by given date. Sequencing-Sequencing of n jobs & 2 machines, Sequencing of n jobs & 3 machines	

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

Term Work: case studies on:
1) Recruitment procedure
2) Market Research/Market Segmentation
3) MIS
4) Office communication
5) Line Balancing.

Content Assessment Tool
1. Case studies on above topic

2. Case studies on above topic
3. Case studies on above topic
4. Formulation of LPP and Graphical Solution, Assignment on Maximization and Minimization problems using Simplex Method.
5. Assignment on Assignment Problems, Assignment on Transportation Problems.
6. Assignment on Sequencing Problems, Development of PERT/CPM Network for any live project involving at least seven activities

TEXT BOOKS:

1.	"Industrial Engineering and Management", Vishwanath ,Scitech Publication,1st Edition.
2.	"Industrial Management and Operation Research", NandkumarHukeri, Electrotech Publication.
3.	"Operations Research", J. K. Sharma, McMillan India Publication New Delhi,5th Edition
4.	"Operations Research", Hira and Gupta, S.Chand and Co. New Delhi.
5.	"Operation Research an Introduction", Hamdy A. Taha, Pearson,10 th Edition

REFERENCE BOOKS:

1.	"Management, Today – Principles and Practice", Gene Burton and Manab Thakur, Tata McGraw Hill Publishing Company, New Delhi.
2.	"Essentials of Management", Koontz and H.Weinrich, Tata McGraw Hill Publication, 12th Edition.
3.	"Business Management", J.P.Bose, S. Talukdar, New Central Agencies (P) Ltd.,
4.	"Production and Operation Management", Tripathy, Scitech Publication, 2nd Edition.
5.	"Management", James A.F. Stoner, R. Edward Freeman, Prentice Hall of India New Delhi.
6.	"Introduction to Operation Research", Paneer-Selvam, Prentice Hall of India publication, 2nd Edition.
7.	"Operation Research", Pradeep J. Jha, Tata McGraw Hill Publication.
8.	"Operation Research", Mariappan, Pearson Education.
9.	"Operation Research – Principle and Applications", G.Shriniwasan, Prentice Hall of India Publication, 3rd Edition.

SUBJECT NAME: Industrial Fluid Power

SUBJECT CODE: PCC-ME 312

Teaching Scheme:	**Examination Scheme:**
Lectures: 03Hrs.perweek	**ESE: 70Marks**
Practical: 02Hrs.perweek	**CIE: 30Marks**
Credit: 04	**Term Work: 25 Marks**

Pre-requisites:
Basic Mechanical Engineering,Fluid power, Manufacturing Processes.

Course Objectives:

1.	To impart knowledge about the fundamentals ofHydraulic and pneumatic system
2.	To prepare the students to study different pumps and compressors in hydraulic and pneumatic system.
3.	To educate the students about hydraulic fluidsandcharacteristics of fluids.
4.	To impart knowledge about various control valves and its functions
5.	To enable the students to design components of Hydraulic and pneumatic system

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

1.	Do analysis of performance of Hydraulic and pneumatic system
2.	Demonstrate Hydraulic and pneumatic system
3.	Apply Hydraulic and pneumatic system fundamentals to industrial applications
4.	Demonstrate knowledge about the fundamentals of Hydraulic and pneumatic system

Unit 1	**Introduction to Fluid Power**	**[08]**
	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**	**[08]**
	a) Classification, types of seals, sealing material, pipes, hoses, compatibility of seal withfluid, 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. forvarious applications. c) Actuators-linear and rotary, hydraulic motors, types of hydraulic cylinders and theirmountings. d) Accumulators, intensifier and their applications.	

Unit 3	**Control of Fluid Power Elements**	**[08]**
	a) Requirements of Pressure control, direction control and flow control valves. b) Principle of pressure control valves, directly operated and pilot operated pressurerelief 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. e) Hydraulic servo system for linear and rotary motion.	

Unit 4	**Elements of Pneumatic System**	**[08]**
	a) Air compressor- Types, selection criteria, capacity control, piping layout, fitting andconnectors, Pneumatic controls, Direction control valves (two way, three way, fourway), check valves, flow control valves, pressure control valves, speed regulators,quick exhaust valves, time delay valve, shuttle valve and twin pressure valve. Solenoidoperated, pilot operated valves, Pneumatic actuators, Rotary and reciprocatingcylinders–types and their mountings, Air motor – types, Comparison with hydraulicand electric motor. b) Serving of compressed air – types of filters, regulators, lubricators (FRL unit), mufflers, dryers. c) Maintenance ,troubleshooting and safety of hydraulic and pneumatic system.	

Unit 5	**Hydraulic Circuits and its Application**	**[04]**
	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.	

Unit 6	**Pneumatic Circuits and its Application**.	**[04]**
	i. Speed control circuits ii. Impulse operation circuit. iii. Sequence circuits. iv. Time delay circuit.	

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

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. 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.

REFERENCE BOOKS:

1.	"Industrial Fluid Power", S.S. Kuber, NiraliPrakashan, 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.

SUBJECT NAME: Metrology and Quality Control

SUBJECT CODE: PCC-ME 313

Teaching Scheme:	**Examination Scheme:**
Lectures: 03 Hrs.perweek	**ESE: 70 Marks**
Practical: 02 Hrs.perweek	**CIE: 30 Marks**
Credit: 04	**Term Work: 25 Marks**

Pre-requisites: Machine Drawing.

Course Objectives:

1.	Understand the use of standards in measurement, gauges and tolerances
2.	Understand the principle/s, construction, working and use of comparators and angle measuring instruments.
3.	Study the advanced methods in metrology and measurement of surface roughness
4.	Study the methods used for the measurement of screw threads and gears.
5.	Understand the concept of quality control and SQC techniques.
6.	Apply knowledge of measuring instruments in actual industry practice.

Course Outcomes: At the end of this course, 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.	Learn advanced techniques of metrology in various industrial applications.
4.	Prepare and understand drawings with general dimensions, tolerances and surface finish.

Unit 1	**Linear measurement and Limits fits and tolerances.**	**[08]**
	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 gauges (Numerical treatment).	

Unit 2	**Compactors and Angle Measurement**	**[06]**
	Classification of Comparator, Mechanical comparator (dial indicator, Sigma and Johansson mikrokator. Pneumatic comparator (Solex and differential), Bevel	

	protractor, sine bar, sine center,clinometers. Use of angle dekkor, auto collimator for straightness and flatness measurement.

Unit 3	**Advancements in Metrology and surface roughness**	**[07]**
	Introduction & applications of: Coordinate Measuring Machine, use of Laser in Metrology, machine vision system. 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 (Tomlinson and Talysurf surface testers).	

Unit 4	**Metrology 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.	

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 (Numerical treatment on X Bar, R, P and C charts), their constructions and applications, process capability. Basic concept of sampling inspection, Single and double sampling plans, Operating characteristic curves.	

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

Minimum eight experiments/assignments from the following list including quality control should be performed.

1) Study and use of Linear Measuring Instruments.
2) Study and Use of Comparators (practical use of pneumatic/Mechanical comparator).
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) Assignment on Control Charts.
10) Industrial case study on geometric features by using industrial component drawing.

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.

SUBJECT NAME: Machine Design-II

SUBJECT CODE: PCC-ME314

Teaching Scheme:	**Examination Scheme:**
Lectures:03Hrs.perweek	**ESE: 70Marks**
Practical:02Hrs.perweek	**CIE: 30Marks**
Credit: 04	**Term Work: 25 Marks**
	Practical/Oral: 25 Marks

Pre-requisites:

Elementary knowledge of Mechanics, Mathematics and science, Machine Design-I

Course Objectives:

1.	Design machine elements subjected to fluctuating loading.
2.	Study effect of wear considerations and their relevance to design.
3.	Study and select rolling contact bearings used for mechanical systems.
4.	Design hydrodynamic bearing using Raimondi and Boyd's method and heat balance.
5.	Design various types of gears using strength and wear considerations.

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

1.	Design machine elements subjected to fluctuating loading
2.	Understand effect of tribological considerations on design
3.	Select rolling contact bearings from manufacturer's catalogue.
4.	Design sliding contact bearings used in various mechanical systems
5.	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, Goodman diagram, Modified Goodman diagram, Fatigue design for components under combined stresses such as shafts, Thin pressure vessels, Beams subjected to point loads etc.	

Unit 2	**Design of Rolling Contact Bearings**	**[07]**

	Rolling Contact Bearing: Types, Static and dynamic load capacities, Steinbeck's equation**(No Derivation),** 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.

Unit 3	**Design of Sliding Contact Bearings**	**[06]**
	i. Introduction to Tribological consideration in design Friction, Wear, Lubrication. ii. Sliding Contact Bearing: Bearing material and their properties: Sintered bearing materials, bearing types and their construction details. iii. Hydro-Dynamic Lubrication: Basic theory, Thick and thin film lubrication, Reynolds's equation (**No Derivation)**, Sommerfield Number, Design consideration in hydrodynamic bearings, Raimondi and Boyd method relating bearing variables, Heat balance in journal bearings, Temperature rise	

Unit 4	**Design of Spur Gear**	**[07]**
	a) Introduction to Gears: Gear terminology, Material selection, Types of gear failure. **b) Spur 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.	

Unit 5	**Design of Helical and Bevel Gears**	**[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.	

Unit 6	**Design of Worm Gears**	**[05]**
	Terminology and geometrical relations. Standard dimensions and recommendation of worm gearing, Force analysis, Friction, Efficiency of worm gear drive, Design of	

worm drive as per IS 7443-1974 based on beam strength and wear strength rating, Thermal consideration in worm drive

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

Note: Reference to Design Data Book is mandatory

Term Work:

A) Total two design project

A detail design report and two sheets containing working drawing of details and assembly

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 (Optional).
- Construction of gears such as hub, web, arm, rim type etc.Design considerations of gear box.

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 A Basic Approach", Dr. S.S.wadhwa S S Jolly Dhanapat Rai and Sons.
4.	"Machine Design", U.C.Jindal, Pearson Education.
5.	"A Text Book of Machine Design", R.S. Khurmi and J.K.Gupta.

REFERENCE BOOKS:

1.	"Design of Machine Element", J.F. Shigley, Tata McGraw Hill Publication.
2.	"Design of Machine Element" M.F.Spotts, Pearson Education Publication, 6th Edition.
3.	PSG Design data Book
4.	"Machine Component Design",Robert C. Juvniall, Willey Ltd, 5th Edition.
5.	"Machine Design", Black and Adams ,Tata McGraw Hill International.
6.	PSG Design Data Book
7.	Bearing Manufacturers Catalogue.

SUBJECT NAME: Internal Combustion Engines

SUBJECT CODE:PCC-ME315

Teaching Scheme:	**Examination Scheme:**
Lectures:03 Hrs Per Week	**ESE: 70Marks**
Practical:02Hrs.perweek	**CIE: 30Marks**
Credit: 04	**Term Work: 25Marks**
	Practical/Oral : 25 Marks

Pre-requisites: Basic Mechanical Engineering,Applied Thermodynamics, Heat & Mass Transfer

Course Objectives: The course aims to

1.	Study constructional details and various types of internal combustionengine.
2.	Understand and analyze thermodynamic cycles of ICengines.
3.	Understand combustion phenomenon in SI engine and CIengines.
4.	Impart knowledge about various systems on the ICengines.
5.	Impart knowledge about various engine performance characteristics and itstesting.

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

1.	Demonstrate engine construction, function of various parts of theengine and classify I.C.Engines.
2.	Demonstrate combustionmechanism.
3.	Demonstrate importance and functions of various systems on theengine.
4.	Demonstrate need and methods of enginetesting.
5.	Understand the impact of vehicular pollution and ways to reduce or control thepollution.

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 (Carnot, Otto, Diesel), Only numericals on Air standard cycles (Otto and Diesel cycles only), Deviation of actual cycles from air standard cycles, Valve timing diagram for high and low speed engine, Port timing diagram.	

Unit 2	**Fuel Systems for SI and CI Engines**	**08**
	Engine fuel requirements, complete carburetor, Derivation for calculation of A/F ratio, Calculation of main dimensions of carburetors (Only Approximate analysis numericals), 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, Electronic diesel injection system. Calculations of main dimension of fuel injection system of diesel engine.	

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 itstypes.	

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, 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.	

Unit 6	**Engine Emission and Control**	**08**
	Introduction to Supercharging and Turbo-charging, 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.	

Practicals:

Study group:-

1. Constructional detail of I.C. engines, dismantling andassembly.

2. Study and Demonstration of Engine systems: Air intake, Exhaust, Cooling, Lubrication systems.
3. Study and Demonstration of Ignition systems, startingsystems.
4. Study and Demonstration of Carburetor and Petrol injectionsystem
5. Study and Demonstration of fuel injection system of dieselengine.

Test group:- (Any Five)

1. Test on four stroke DieselEngine.
2. Test on four stroke PetrolEngine.
3. Test on two stroke Petrol Engine. (Variable SpeedTest)
4. Morse Test on Multi CylinderEngine
5. Visit to an engine manufacturing company / repairingunit
6. Test on computer controlled I.C. Engine
7. Test on variable compression ratio engine
8. Visit PUC centre and submit PUC certificate photocopy of your own vehicle.
9. Visit to Fuel Injection Pump testing unit for calibration of FIP and submit report.

TEXT BOOKS:

1.	Ganesan. V. , "Internal Combustion Engines", Tata McGraw Hill
2.	Mathur & Sharma, "A Course in Internal Combustion Engines", R. P. Dhanapat Rai Publications.
3.	"Internal Combustion Engines", Domkundwar, Dhanpat RaiPublication.
4.	"Internal Combustion Engines",Ramlingam, SciTech Publication.

REFERENCE BOOKS:

1.	"Internal Combustion Engines",Maleev, CBS Publication andDistributors.
2.	"Internal Combustion Engines", J. B. Heywood,Tata McGraw Hill Publication.
3.	"Internal Combustion Engines",Gills and Smith , Oxford and IBH PublishingCompany
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 , PearsonEducation
7.	Crouse W.H., "Automotive Mechanics", McGraw Hill

SUBJECT NAME: Computer Aided Design and Manufacturing

SUBJECT CODE: OEC-ME 316

Teaching Scheme:	**Examination Scheme:**
Lectures: 03Hrs.perweek	**ESE: 70Marks**
Practical: 00Hrs.perweek	**CIE: 30Marks**
Credit: 03	**Term Work: --**

Pre-requisites: NA

Course Objectives:

1.	To Provide basic foundation in computer aided design / manufacturing
2.	To Understand the fundamentals used to create and manipulate geometric models
3.	To Get acquainted with the basic CAD software designed for geometric modeling
4.	To Learn working principles of NC machines CNC control and part programming

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

1.	To Compare and Represent 2-D and 3-D entities
2.	To Apply transform techniques on 2-D and 3-D entities
3.	To Examine CNC program for production of components
4.	To Express the principles and methods of Rapid Prototyping

Unit 1	**Fundamentals of CAD/CAM**	04
	Product cycle and scope of CAD/CAM/CIM in product cycle, Features of CAD/CAM Hardware and software, selection of software. CAD workstation configurations	

Unit 2	**Representation of Curves and surfaces**	08
	Introduction to Analytic Curves, Synthetic Curves: Hermite Cubic Spline, Bezier Curve, B-Spline curve. Surface Representation: Synthetic Surfaces	

Unit 3	**Solid Modeling**	08

	2D Vs 3D modeling, Comparison of Wireframe, surface and solid modeling techniques, Geometry Vs Topology, Requirements of Solid Modeling, Solid Modeling Methods: Constructive Solid Geometry (CSG), Boundary Representation (B-rep), etc.

Unit 4	**Geometric Transformation**	06
	2D geometric transformations, Homogeneous co-ordinate representation, Composite transformations, 3D transformations, Inverse transformations, geometric mapping	

Unit 5	**Computer Numerical Control and Part Programming**	09
	Introduction to NC/CNC/DNC machines, Classification of NC systems, Axis nomenclature, Interpolation, features of CNC controllers, Types of CNC machines,Construction features of CNC machines, Manual Part Programming, , NC word format, Details of G and M codes, Canned cycles, subroutines and Do loops, Tool radius and length compensations	

Unit 6	**Rapid Prototyping and Manufacturing**	05
	Introduction to Rapid Prototyping, rapid tooling and rapid manufacturing. Process of rapid prototyping. Different techniques of Rapid prototyping and their applications	

Text Books:

1.	IbrahimZeid ,CAD/CAM Theory and Practice, Tata McGraw-Hill Publishing Company Ltd., New Delhi,2012
2.	Dacid F. Rogers, J Alan Adams, Mathematical Elements for Computer Graphics, McGraw-Hill publishing Company Ltd.,2001
3.	Chougule N.K., CAD/CAM/CAE, Scitech Publications Ltd, 2017

Reference Books:

1.	M.E. Mortenson, Geometric Modelling , Wiley, 2016
2.	Bedworth, Wolfe & Henderson Computer Aided Design & Manufacturing, McGraw Hill 2003

SUBJECT NAME: Electric Vehicle

SUBJECT CODE: OEC-ME 316

Teaching Scheme:	**Examination Scheme:**
Lectures: 03Hrs.perweek	**ESE: 70Marks**
Practical: 00Hrs.perweek	**CIE: 30Marks**
Credit: 03	**Term Work: --**

Pre-requisites: NA

Course Objectives:

1.	To impart the basic knowledge of Electric Vehicle Technology
2.	To make the student conversant with power sources of todays and future EV
3.	To prepare the students for a career in the drastically changing automotive industry
4.	To acquaint the student with prerequisite for higher studies in Electric Vehicle
5.	To make the students aware with different areas of research in the field of Electric Vehicle

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

1.	To Understand the basic knowledge of electric vehicle technology.
2.	To Select power sources for electric vehicles
3.	To Choose various configurations of an electric vehicle.
4.	To Configure power transmission system in electric vehicle

Unit 1	**Introduction to Electric Vehicles**	05
	Energy crises, Need of future transportation, Introduction and overview of Electric Drive Technologies and Configurations, Traction power requirement for vehicle propulsion under different road and speed condition, EV – Indian strategies, policies, R&D and Collaboration, Introduction to Energy Storage.	

Unit 2	**Batteries for Electric Vehicles**	07
	Electrochemical Batteries – Reactions and Thermodynamic, Voltage, Specific power and Energy, Working of Pb-Acid batteries, Ni-Fe, Ni- Cd, Ni-MH Batteries, Li-Polymer, Li-ion, Battery selection for Electric Vehicle, Regenerative Braking for battery charging, Effects of Current Density and Heat on Battery Cycle and Life. Battery Storage, Battery Pack Design	

Unit 3	**Battery Charging Technology for Electric Vehicles**	07
	Types of battery charging, Normal charging, Opportunity charging, Fast charging, Battery swapping. Battery Charging algorithms, Improve the charging efficiency, Reduce the charging time, enhancing the battery life, Protect the battery, Constant current and constant voltage Charging, Multistage charging (MSC), Pulse Charging, Trickle Charging (TC), Wire and Wireless charging, Charging station infrastructure,	

Unit 4	**Electric Motors in Electric Vehicles**	07
	Electric Motors used in electric vehicles, DC motors, Induction motors, Permanent Magnet motors, Switched Reluctance motors., Torque –speed characteristics of above mentioned motors, Comparison and its layout in EV, Selection of motor for EV, Motor location and drive from motor to wheels,	

Unit 5	**Motor control in Electric Vehicles**	07
	Power conversion required in EV. Principle of operation of power electronics devices like: SCR, TRIAC, DIAC, GTO, MOSFET, IGBT and power BJT, Battery to Motor with speed control, Regenerative Braking requirements, Bi-directional and multiple input to single output power conversion in EV. Power conversion required for DC charging and AC charging on board and off board.	

Unit 6	**Safety, Norms and Testing of Electric Vehicles**	07
	Type approval procedure for electric and hybrid electric vehicles, Government scheme, Electric vehicle conductive AC charging system, DC charging system, V2X technology like V2 home, V2Grid, Self-driving from level 1 to level 5, Autonomous driving	

Recommended Books

1.	James Larmine and John Lowry, *Electrical Vehicle Technology Explained*,John Wiely and Sons Ltd.,2nd Edition WSE 2015.
2.	Iqbal Husain, *Electric and Hybrid Vehicles: Design Fundamental.* CRC Press, 2nd Edition, e-library 2011
3.	C.C. Chan, K.T. Chau, *Modern Electric Vehicle Technology*, Oxford Publication, New York, 1st edition 2001

SUBJECT NAME: Computer Integrated Manufacturing

SUBJECT CODE: PCC-ME 317

Teaching Scheme:	**Examination Scheme:**
Lectures : 00 Hrs. per week	**ESE : 00 Marks**
Practical : 02 Hrs. per week	**CIE : 00 Marks**
Credit : 01	**Term Work : 25 Marks**

Pre-requisites: Computer Integrated Manufacturing

Course Objectives:

1.	Study role of CAD/CAM in CIM and CIM implementation issues
2.	Apply various classification and coding system in group technology.
3.	Study concepts of Computer Aided Production Planning and Control
4.	To expose the students to the tequinics of CNC programming and cutting tool path generation through CNC simulation software by using G and M codes

Course Outcomes: At the end of this course, 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
3.	Apply classification and coding in Group Technology.
4.	Elaborate Computer Aided Production Planning and Control.
5.	Generate CNC lathe part programming for turning ,facing,stepturning,taper turning.

Unit 1	Assignment on Introduction to CIM.	(1)
	Meaning, Scope, Evolution, Architecture, Elements, Benefits, Limitations, Social Aspects, etc.	

Unit 2	Assignment on Role of CAD/CAM in CIM.	(1)
	Role of Computers in design and manufacturing, integration.	

Unit 3	Exercise on Group Technology, Part Classification and Coding System. OPITZ and MICLASS : one exercise on each.	(2)

Unit 4	Part Programming	(8)
	Introduction to manual Part programming buse of G and M Codes to generate part product on CNC,VMC,HMC etc.generation model on milling/turnning/Drilling using suitable CAM Software	

Unit 5	Presentations (by group of minimum 2 and maximum 4 students).	(2)
	I. Computer Aided Process Planning II. Shop Floor Control III. Manufacturing Resource Planning (MRP-II) IV. CIM Planning and Implementation Issues	

Unit 6	Industrial Visit	
	exploring CMM, Material Handling and Storage System, Robotics/ Automation covering, CIM major parts.	

TEXT BOOKS:

1.	"CAD/CAM Computer Aided Design and Manufacturing", M. Groover, E. Zimmers, Pearson Publications, ISBN 9788177584165.
2.	"Automation, Production systems and Computer Integrated Manufacturing", M.P. Groover ,Prentice Hall of India.
3.	"Computer Aided Manufacturing",P.N. Rao, N.K. Tewari and T.K. Kundra, Tata McGraw Hill, ISBN 9780074631034.

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.

SUBJECT NAME: Workshop Practice–VI

SUBJECT CODE:PCC-ME318

Teaching Scheme:	**Examination Scheme:**
Lectures: 00Hrs. per week	**ESE: 00 Marks**
Practical: 02 Hrs. per week	**CIE: 00 Marks**
Credit: 01	**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: At the end of this course, student will be able to

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

Syllabus

A. 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 vi) Boring vii) Slotting

B. To carry out assembly of all components.

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

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

Assignments

Write any **three** assignments out of following.

1. Study and demonstration of Milling machine.

2. Study and demonstration of Shaping machine.

3. Study and demonstration of CNC machine.

4. Study of Slotting machine. (Theoretical treatment only.)

TEXT BOOKS:

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

REFERENCE BOOKS:

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

SUBJECT NAME: Professional Skill Development**

SUBJECT CODE: PCC-ME319**

(Audit Course)

Teaching Scheme:	**Examination Scheme:**
Lectures: 01Hrs.perweek	**ESE: 00 Marks**
Practical: 00Hrs.perweek	**CIE: 00 Marks**
Credit: 00	**Term Work: 00 Marks**

Pre-requisites: NA

Course Objectives:

1.	Enable students to imbibe all those skills that are needed to be successful in their professional life
2.	Develop behavioral competencies amongst students
3.	Develop effective communication skills in business situations
4.	Develop effective writing and presentation skills in business situations
5.	Enhance team building and time management skills
6.	Develop interpersonal skills

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

1.	Effectively use techniques for self-awareness and self-development to increase confidence in abilities
2.	Strengthen soft skills to achieve success in professional career
3.	Smoothly transit from student life to professional life
4.	Create professional documents using MS office tools

Unit 1	**Technical Writing and Business Communication**	**[02]**
	Informal and formal letter writing,quotations, purchase orders, enquiry letter, invitation and acceptance letter, notice of meeting,circular, agenda and minutes of meeting.	

Unit 2	**Report and Proposal Writing**	**[02]**

	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.

Unit 3	**The e-English**	**[02]**
	Writing email to an unknown person, guidelines for continuing the conversation on emails, the top ten Do's, Business emails, marketing emails.	

Unit 4	**Team Building and Time Management**	**[02]**
	Interpersonal skills, what is needed to form smart team. Different approaches to team building. Techniques of a time management: ABC analysis, Pareto analysis.	

Unit 5	**Corporate Etiquettes**	**[02]**
	Business dress and grooming, office etiquettes, telephone etiquettes, dining etiquettes, meeting etiquettes, travel etiquettes.	

Unit 6	**Working with Professional Documents**	**[04]**
	Creating professional quality documents using MS Office applications. MS Word: Create, store, organize. Font & paragraph formatting, inserting tables, smart art, page breaks. MS Excel: Creating, editing, saving and printing spreadsheets, functions & formulas, charts & graphs, filtering data. MS Power Point: Creating slides, applying auto layouts, adding animation, slide transitions, graphically representing data.	

TERM WORK / LIST OF ASSIGNMENTS:

1. Quotation and Purchase order for the Engineering goods.
2. Agenda, notice, and minutes of a meeting.
3. One report based on the literature review or comparison.
4. One page biodata.
5. Power Point presentation based on hobby or favorite topic.

TEXT BOOKS:

1.	"Soft skills for managers",Dr. T. KalyanaChatravarthi, Dr. T. LathaChatravarthi 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 PubliishersChennai , (2010).

SHIVAJI UNIVERSITY, KOLHAPUR

REVISED SYLLABUS AND STRUCTURE
FINAL YEAR (B. Tech.)

MECHANICAL ENGINEERING

To be introduced from the academic year 2021-22
(i.e. from June 2021) onwards

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

FINAL YEAR MECHANICAL ENGINEERING – CBCS PATTERN

SEMESTER –VII

Sr. No	Course (Subject Title)	TEACHING SCHEME									EXAMINATION SCHEME											
		THEORY			TUTORIAL			PRACTICAL			THEORY					PRACTICAL			TERM WORK		
		Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Hours	Mode	Marks	Total Marks	Min	Hours	Max	Min	Hours	Max	Min
1	PCC ME401	3	3	3	-	-	-	1	2	2		CIE ESE	30 70	100	40	As per BOS Guidelines	25	10	2	25	10
2	PCC ME402	3	3	3	-	-	-	1	2	2		CIE ESE	30 70	100	40		25	10	2	25	10
3	PCC ME403	3	3	3	-	-	-	1	2	2		CIE ESE	30 70	100	40				2	25	10
4	PCE ME404	3	3	3	-		-	1	2	2		CIE ESE	30 70	100	40				2	25	10
5	PCE ME405	3	3	3	-	-	-	1	2	2		CIE ESE	30 70	100	40		-	-	2	25	10
6	PCC ME406	-	-	-	-	-	-	1	2	2									2	25	10
7	SI ME407	-	-	-				1	-	-		-	-	-	-		-	-	-	25	10
8	PW ME408	-	-	-				3	6	6		-	-	-	-		25	10		25	10
	TOTAL	**15**	**15**	**15**				**10**	**18**	**18**				**500**			**75**			**200**	

SEMESTER –VIII

1	PCC ME409	3	3	3	-	-	-	1	2	2		CIE ESE	30 70	100	40	As per BOS Guidelines	25	10	2	25	10
2	PCC ME410	3	3	3	-	-	-	1	2	2				100	40				2	25	10
3	PCC ME411	3	3	3	-	-	-	1	2	2		ESE	70	100	40		25	10	2	25	10
4	PCE ME412	3	3	3	-	-	-	1	2	2				100	40		-	-	2	25	10
5	PCE ME413	3	3	3	-	-	-	1	2	2		ESE	70	100	40		-	-	2	25	10
6	PCC ME***414	2	-	-	-	-	-	-	-	-		-	-	-					2	25	10
8	PW ME415	-	-	-	-	-	-	3	6	6		-	-	-	-		25	10	6	50	20
	TOTAL	**17**	**15**	**15**				**8**	**16**	**16**				**500**			**75**			**200**	

	TOTAL	**32**	**30**	**30**				**18**	**34**	**34**		**1000**		**150**		**400**	

CIE- Continuous Internal EvaluationESE – End Semester Examination

• Candidate contact hours per week : 30 Hours(Minimum)	• Total Marks for B.E. Sem VII & VIII :**1550**
• Theory/Tutorial Duration:60 Minutes and Practical Duration:120 Minutes	• Total Credits for B.E. Sem VII & VIII :**50**
• In theory examination there will be a passing based on separate head of passing for examination of CIE and ESE.	
• There shall be separate passing for theory and practical (term work)courses.	

Note:

1. Professional Core Courses-Mechanical Engineering (PCC-ME) are compulsory.
2. Professional Core Electives –Mechanical Engineering (PCE-ME) are compulsory.
3. Summer Internship -Mechanical Engineering (SI-ME) is compulsory.
4. Project Work Mechanical Engineering (PW-ME) is compulsory.
5. **PCC-ME***- Online Certificate Course.**

The Student should register the online course with Moodle/Swayam/MOOC/NPTEL. etc. of his interest in Recent Advances in Mechanical Engineering at a Start of his/her final year (i.e. at Semester VII.) and Same is intimated to Head of Department or Coordinator. For Term Work, Student has to Submit Completion Certificate of Course to the Department till end of Semester VIII. Term Work will be given at the end of Semester VIII. The Head of Department has to assign a Coordinator or Supervisor for Online Certificate Course.

Semester VII

Sr. No	Code No.	Subject	Credits
1.	PCC ME 401	Refrigeration and Air Conditioning	4
2.	PCC ME 402	Mechanical System Design	4
3.	PCC ME 403	Finite Element Analysis	4
4.	PCE ME 404	Elective I	4
5.	PCE ME 405	Elective II	4
6.	PCC ME 406	Seminar	1
7.	SI ME 407	Summer Internship @	1
8.	PW ME 408	Project Phase -I	3
		Total	25

Semester VIII

Sr. No	Code No.	Subject	Credits
1.	PCC ME 409	Mechatronics	4
2.	PCC ME 410	Energy and Power Engineering	4
3.	PCC ME 411	Noise and Vibration	4
4.	PCE ME 412	Elective III	4
5.	PCE ME 413	Elective IV	4
6.	**PCE ME414*** **	**Online Certificate Course**	**2**
7.	PW ME 415	Project Phase –II	3
		Total	25

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech (Mechanical Engineering) **CBCS PATTERN Semester VII**

REFRIGERATION AND AIR CONDITIONING

SUBJECT CODE: PCC ME401

Teaching Scheme:	**Examination Scheme:**
Lectures: 3Hrs/Week	ESE: 70Marks
Practical: 2Hrs/Week	CIE: 30Marks
Credits:4	Term Work: 25Marks
	Oral Exam: 25 Marks

Pre-requisites: Applied Thermodynamics, Heat and Mass Transfer

Course Objectives:

The course aims to:

1. Study basic refrigeration cycles and Psychometric.
2. Performance Evaluation of Refrigeration and Air Conditioning Systems
3. Enable thestudentstoanalyzeandsolverefrigerationrelatedproblems byapplying principles of mathematics, science and engineering

Course Outcomes:

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

1. Demonstrate an understanding of the need and importance of HVAC technology, the typical and some advanced and innovative schematic designs, and the goals of HVAC engineering andHVACsystems.
2. Demonstrate an understanding thermal comfort conditions with respect to temperature and humidity and human clothing and activities and its impact on human comfort, productivity,andhealth.
3. Demonstrate an understanding of psychometrics and its application in HVAC engineering and design and will practice or observe psychometric measurements.
4. Demonstrate an understanding of heat transfer in buildings with a given architectural design and its application to heating and cooling load estimation especially including thermal lag effects by conducting a detailed annual load analysis for a representative building and present the results of this analysis in a formal report possibly including recommendations forenergyconservation.
5. Demonstrate an understanding of the engineering and operation of vapour compression and possibly heat-driven refrigeration systems and evaporative cooling systems and understand contemporary issues of ozone depletion and global warming potential with respect torefrigerationsystems.

Unit 1

Application of Second Law of Thermodynamics [03]

A Refrigerating Machine – The Second Law Interpretation,Introduction to Heat pump, Heat Engine and Refrigerator (with Numerical treatment), Energy Ratios (EER), BEE star rating COP, Power Consumption of a Refrigerating Machine, Refrigeration Cycle, vapour as a Refrigerant Reversed Carnot Cycle Limitations of Carnot Cycle with Gas as a Refrigerant, Reversed Brayton or Jouleor Bell Coleman Cycle, Introduction to aero-plane air conditioning cycles (Only Theory)

Unit 2

Vapour Compression System [08]

Limitations of Reversed Carnot Cycle with vapour as a Refrigerant, Dry versus Wet Compression, Throttling versus Isentropic Expansion, Introduction to Vapour Compression Cycleand Vapour Absorption cycle.Pressure Enthalpy Diagram and Calculations (Numerical on VCR Cycle) and effect of Operating Conditions, effect of Evaporator Pressure Effect of Condenser Pressure, effect of Suction Vapour Superheat, effect of Liquid Sub cooling, Using Liquid- Vapour Regenerative Heat Exchanger, Actual Vapour Compression Cycle.Removal of flash gas, Flash intercooling, Introduction to cryogenic Engineering and applications,

Unit 3

Refrigerants and Refrigeration Equipment [09]

Classification, Desirable Properties like Thermodynamic, physical, and chemical.Comparison among commonly used refrigerants, Selection of Refrigerants, Effect on Ozone depletion and global warming, Alternative Refrigerants. Environmental Protection protocol and India's commitment. Introduction to role of ASHRAE &ISHRAE in refrigeration and air conditioning area, ASHRA Nomenclatures. Insulation, types and different applications, properties of ideal insulations.Introduction to Equipment such as Compressor, Condenser, Evaporator, Expansion devices. Applications of Refrigeration in Dairy plant, Ice-plant, Cold storage.

Unit 4

Psychrometry and Human Comfort [09]

Moist air as a working substance, Psychrometric properties of air, Use of Psychrometric tables and charts, Processes, Combinations and Calculations (Numerical on Psychrometry), ADP, Coil Condition lime, Sensible heat factor, Bypass factor, Air washer and itsapplications. Thermal exchange between human body and environment, factors affecting comfort, effective temperature comfort chart, ventilation requirements.

Unit 5

Heating andCooling load calculations [05]

Design of air conditioning systems, different Heat sources,- Adiabatic mixing of two air streams, sensible heat factor, RSHF, GSHF, ERSHF, Room apparatus dew point and coil apparatus dew point, Ventilation and infiltration, Inside and Outside Design condition. Cooling Load estimation, Introduction to, Variable Refrigerant Flow systems, VAV control systems, Inverter Units. Introduction to Inverter technology and its use in power failure, Introduction to Phase change material used for temperature retention inrefrigerator.

Unit 6

Air Distribution System [06]

Re-circulated air, Ventilation air, Duct work, Use of friction loss and rectangular equivalent of round duct chart, duct system, principle of duct sizing, and air distribution it's norms, diffusers, dampers, layout, duct systems for theaters, auditorium, hospitals, assembly shop etc. Energy Conservations and Green Buildings, Freeze drying, Pharmaceutical and hospital air conditioning, textile, car air conditioning (plant layout, system components and design conditioning)

TermWork:

1. Study of various conventional and Nonconventional methodsofrefrigeration.
2. Studyanddemonstrationofrefrigerationsystem.(Water cooler, refrigerators,chiller,ice plant andcoldstorage).
3. Trial on Electrolux-RefrigerationTestRig.
4. Trial on heat pumptestrig.
5. Study and trial on vapourabsorptionsystem
6. Trial two stagecascadesystem.
7. Trial on ice planttestrig
8. Trial on window air conditioner or Air ConditioningTestRig
9. Study and demonstration on air conditioningsystems. (Unitary viz Room/Split and Packaged Air Conditionersand central air conditioning/system)
10. Study and demonstration on Compressor, Condenser, Evaporator, Expansion, devices, Types, selection. Component balancing, safety devices and refrigeration controls
11. Study anddemonstration of dehydration, charging leak testing and testing of refrigeration system with trouble shooting.
12. Study and demonstration of controls and safety devices in refrigeration and air conditioning.
13. Visit to central air conditioning or cold storage or dairy plant to ice plant related with refrigeration and air conditioning system.
14. Market survey of various refrigeration and air conditioning systems which include the equipment's with related specifications, manufacturers, cost and comparison with respect to tonnage, coat and presentation of report inthelaboratory.

(Three trials and market survey report is compulsory.Total 10 are compulsory)

Reference Books:

1. "Basic Refrigeration And Air Conditioning", PNAnanthanarayanTataMcGrawHillPublishing Company Ltd., New Delhi, 3rd Edition,(1981).
2. "Principles of Refrigeration" RoyJ. Dossat, Pearson Education, 4thEdition.
3. "Refrigeration andAir Conditioning", Stoker.
4. "Refrigeration and Air Conditioning", Arora Domkundwar, Pearson Education,3rd Edition.
5. "Refrigeration and Air Conditioning",V.K.Jain.
6. Air Conditioning Principles and Systems",Pita,PrenticeHall of India Publisher, 4thEdition.
7. "Air Conditioning Applications and Design",W. P. Jones, Elsevier,2ndEdition.
8. "Air Conditioning Engineering", W. P. Jones,Elsevier,5thEdition.
9. "Thermal Environmental Engineering", Tnerellaild Prentice Hall of India Publisher,3rdEdition.

Text Book:

1. "RefrigerationandAir Conditioning",C. P.Arora,TataMcGraw-HillPublishingCompany Ltd., New Delhi,1981,2ndEdition.
2. "Refrigeration and Air Conditioning", by Er.R.K.Rajput.(3rdEdition,Katsonbook.)

SHIVAJI UNIVERSITY, KOLHAPUR,
Final Year B.Tech (Mechanical Engineering) CBCS PATTERN Semester VII

Mechanical System Design

SUBJECT CODE:PCC-ME402

Teaching Scheme:	Examination Scheme:
Lectures: 3Hrs/ Week	ESE: 70 Marks
Practical: 2Hrs/Week	CIE: 30Marks
Credits:4	Term Work: 25 Marks
	Oral Exam: 25 Marks

Pre-requisites: Applied Mechanics, Analysis of Mechanical Elements, Theory of Machines (I&II), Machine Design (I&II),

Course Objectives:

The course aims to

1. Enable student to develop competency for new system by involving Industrial engineering aspects.
2. Acquaint student about the use of IS Codes during the design of pressure vessels.
3. Introduce student to design the mechanical Systems. Like Clutch and Braking.
4. Familiarize student about design machine tool gearbox, design internal combustion(IC) engine components and material handling systems.

Course Outcomes:

On completion of the course, students will be able to

1. Understand the role of aesthetics, ergonomics and creativity in design.
2. Understand theories and principles used in design of pressure vessels. IC Engine and material handling equipments.
3. Analyze and select suitable materials and design parameters during the design of pressure vessels, IC engine components, machine tool gear box and material handling systems as per industrial and societal requirement.
4. Evaluate the load carrying capacity, stress bearing capacity in various mechanical systems like unfired pressure vessels, IC engine components.
5. Design various mechanical systems like pressure vessels, machine tool gear boxes, material handling systems, etc. as per industrial and societal requirement.
6. Create the competency in mechanical system design by applying industrial design aspect

Unit 01

Aesthetic and Ergonomic Consideration in Design: [6]

Basic types of product forms, Designing for appearance, shape, Design features, Materials, Finishes, proportions, Symmetry, Contrast etc. Morgon's colour code. Ergonomic considérations- Relation between man, machine and environmental factors. Design of displays and controls. Practical examples of products or equipment's using ergonomic and aesthetic design principles. Creativity concept in designing. Theoretical treatment of optimum design and adequate design.

Unit 02

Pressure Vessel Design [7]

Thin and thick cylinders; Failure criteria of vessels; Lame's equation; Clavarino's and Birnie's equation; Autofrettage and compound cylinders; Types of pressure vessels-Horizontal and vertical; Classification of pressure vessel as per IS2825, 1969, Introduction to design of pressure vessels as per IS Codes. Shell and end closures. Effect of opening and nozzles in shell and covers. Types of pressure vessel support.

Unit 03
Design of Braking and Clutch System [7]

Brakes: Design consideration in brakes, Band, Internal expanding shoe, External contracting shoe. Thermal consideration and rating of brakes.

Clutches: Design requirement of friction clutches, Selection criteria, Torque transmitting capacity of single plate, Multi disc clutch, Cone clutch and Centrifugal clutch.

Unit 04
Design of Gear boxes for machine tool applications [7]

Determination of variable speed range- Graphical representation of speeds- Structure diagram- Deviation diagram- Ray diagram- Selection of optimum ray diagram- Difference between number of teeth of successive gears in a change gear box- Analysis of twelve speed gear box- Compound ray diagram

Unit 05
Design of I. C. Engine Components [7]

Introduction to selection of material for I. C. engine components, Design of cylinder and cylinder head, Design of cylinder liners, Design of piston and piston-pins, Piston rings, Design of connecting rod, Design of crank-shaft and crank-pin.

Unit 06
Design of Material Handling System [6]

Design of belt and chain conveyors – Power requirement, Selection of belt and chain, Design of tension take up unit, Idler pulley.

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

1. A detail design report and A2 size sheet containing working drawing of detail and assembly of
   a) Design of Machine Tool Gear Box.(Three Stage, Twelve speed gear Box)
   b) Pressure vessel design/ Brake design or Clutch design.
2. Assignment based on
   a) Aesthetic and Ergonomic design considerations –case study.
   b) Problems on Material Handling System.
   c) Minimum four Problems on Design of IC Engine components. such as connecting rod, crank shaft, piston with piston rings and pins, cylinder and cylinder head.

TEXT BOOKS:

1. "Design of Machine Elements", V.B.Bhandari, Tata Mc- Graw Hill Publication, 3rdEdition.
2. "Mechanical Engineering Design", Shigley and C.R.Miscke, Tata Mc- Graw Hill Publication.
3. "Mechanical Design Analysis", M.F.Spotts, Prentice Hall Publication.
4. "Design of Machine Tools", S.k. Basu and D.K. Pal Oxford and IBH Publication, 6thEdition.
5. "Machine Tools Design",N.K. Mehta, Tata Mc- Graw Hill Publication, 5th Edition.
6. "Design Data Book",P.S.Gill (PSG) 3rd Edition.
7. I.S.:2825 Code for Unfired Pressure Vessels.

REFERENCE BOOKS:

1. "Handbook of Gear Design",JitinMaitra,TataMc-Graw Hill Publication.
2. "Machine Design", Black P.H.and O.Eugene Adams, Tata Mc- Graw Hill Publication.
3. "Mechanical Design Synthesis with Optimisation Applications",Johnson R.C.,Von-Nostrand-Reynold Publicaion.
4. "Engineering Design",Dieter G.E., Tata Mc- Graw Hill Publication, 4th Edition.
5. "Mechanical System Design",S.P.Patil, Jaico Publication House,New Delhi,2nd Edition.
6. "Product Design and Process Engineering",Benjamin W. Niebel , Alan B. Draper, TataMc-Graw Hill Publication.
7. "Design of Pressure Vessel", Harve, CBS Publishers and Distributors Van Nostrand Reinhold.
8. "Engineering Optimization Theories and Practice", S.S.Rao, New Age Publication, 3rdEdition.
9. "Process Equipment Design", M.V.Joshi ,Macmillal Publication, 3rd Edition.
10. "Machine Design", Robert L.Norton, Tata Mc- Graw Hill Publication.
11. "Machine Design", P. Kannaiah, Scitech Publication, 2nd Edition.
12. "Fundamentals of Machine Component Design",Junvinall Wiley India, 5th Edition.
13. "Mechanical System Design", Anurag Dixit, SCITECH Publication.
14. "Principles of Machine Tool", Sen. Bhattacharya, New Central Book Agency.
15. Material Handling Equipments by N. Rudenko, Peace Publication.
16. Material Handling Equipments by Alexandrov, Mir Publication.

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech(Mechanical Engineering) **CBSE PATTERN Semester VII**

FINITE ELEMENT ANALYSIS

SUBJECT CODE: PCC ME 403

Teaching Scheme:	**Examination Scheme:**
Lectures : 03 Hrs. per week	ESE : 70 Marks
Practical : 02 Hrs. per week	CIE : 30 Marks
Credits: 04	Term Work : 25 Marks

Pre-requisites: Matrices, Partial differentiation, Strength of materials.

Course Objectives:

1. To define the basic finite element formulation techniques
2. To derive the finite element equations for 1D, 2D Elements.
3. To formulate and solve basic problems in Solid Mechanics & heat transfer.
4. To use commercial software to solve Basic Engineering problems in Solid Mechanics & heat transfer.

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

1. Elaborate the fundamental concepts of Finite Element method.
2. Understand the key concepts like Shape function, element stiffness and boundary conditions by finite element formulations for 1D problem.
3. Apply the finite element formulations for two dimensional problems using constant strain triangle.
4. Demonstrate the modeling aspects of axisymmetric solids subjected to axisymmetric loading.
5. Apply the finite element formulations for Planer Trusses using 1D element.
6. Solve Scalar field problems by Finite element formulation.

Unit 1 FUNDAMENTAL CONCEPTS 04

Introduction to FEA, Brief History, General FEM procedure, Simplification of problem through Symmetry, Various terminologies associated with FEA (Discretization, nodes and element) Stiffness matrix and its properties.) Application of FEM in various fields.Advantages and Disadvantages of FEA

Unit 2 ONE DIMENSIONAL ELEMENT 07

Introduction to One dimensional element, Types of One dimensional element, Derivation of Stiffness matrix and Shape function for one dimensional Linear and Quadratic element. Stress analysis of a Stepped bar, Thermal analysis of a Composite Wall and Torsion analysis of a shaft using 1 D element. Treatment of Boundary conditions by Elimination approach and Penalty approach

Unit 3 TWO-DIMENSIONAL ELEMENT 08

Introduction to two-dimensional element, Derivation of Stiffness matrix and Shape function for two dimensional linear element. Numericals on Two-Dimensional analysis using 2Delements (Constant Strain Triangle

Unit 4 ANALYSIS OF AXISYMMETRIC SOLIDS 06

Introduction & applications of Axisymmetric elements, axisymmetric formulation, finiteelement modeling, triangular element and stress calculations

Unit 5 ANALYSIS OF TRUSS 08

Trusses:-Plane trusses, Local and Global coordinate systems, Derivation of Global stiffness matrix, Formulae for calculating L and M, element stiffness matrix, Stress Calculations,Assembly of global stiffness matrix.

Unit 6 SCALAR FIELD PROBLEMS 07

Introduction, Steady state heat transfer, one dimensional heat transfer in thin fins, Twodimensional steady state heat conduction, Two dimensional fins.

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

1. Assignment on Discretization – types of elements, choice of element and type of meshing – automatic, mapped, meshing in criticalareas.

2. Finite Element Analysis of Stepped bar (Two or Three Steps only)using,
a) Finite Element Approach(Theory)
b) Finite Element Software (ANSYS / HYPERWORKSetc.)
Compare the results obtained by abovemethods.

3. Finite element analysis of Composite wall (Minimum threeslabs)

a) Finite Element Approach(Theory)
b) Finite Element Software (ANSYS / HYPERWORKSetc.) Compare the results obtained by abovemethods.

4. Use of any ONE Standard software package like ANSYS / HYPER WORKS etc. for solving following problems: **(ANY FIVE)**

- □ Static Analysis of Truss
- □ Static Analysis of Beam
- □ Static Analysis of Plate with a circular hole
- □ Thermal analysis of Composite wall under Convection &Conduction.
- □ Torsional Analysis of ashaft.
- □ Analysis of Wallbracket.
- □ Analysis of 1Dfin.
- □ Introduction to Ansys Work bench
- □ Importing external geometry file into ANSYSClassic.
- □ Analysis of a machine element using ANSYS / HYPER WORKS etc.

5. Finite element analysis of STEPPED BAR in ANSYS using**APDL.**

TEXT BOOKS:

1. "Introduction to Finite Elements in Engineering"; Chandrupatala-Belgundu, PHI.
2. "Finite Element Method with Application in Engineering" Y. M. Desai, T. I. Eldho, A. H. Shah, Pearson.
3. "Textbook of Finite Elements Analysis", P. Sheshu, Prentice-Hall of India Private Limited, New Delhi.
4. "An Introduction to Finite Element Method"; J. N. Reddy; 2/e, McGraw Hill International Editions, ISBN 0-07-112799-2
5. Finite Element Analysis – Theory and Practice"; M.J. Fagan, Longman Scientific &Technical.
6. "Finite Element Analysis", UdaiBorker, Nandu Printers & Publishers Pvt. Ltd.Mumbai.

REFERENCE BOOKS:

1. "Practical Finite Element Analysis", N.S. Gokhale, S.S. Deshpande, S.V. Bedekar, A.N.Thite,Finite to Infinite Publication.
2. "Concepts of Finite Element Methods",ManickaSelvam, SCITECH publication
3. "Finite Elements Analysis – Theory and Application with ANSYS, Sawed Mouveni, Prentice HallInc.
4. "Applied Finite Elements Analysis", Larry J. Segerlind, BSP Books Pvt Ltd.

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech (Mechanical Engineering) **CBCS PATTERN Semester VII**

Experimental Mechanics (Elective- I)

SUBJECT CODE: PCE ME404

TeachingScheme:	**ExaminationScheme:**
Lectures: 3Hrs/Week	ESE: 70 Marks
Practical: 2Hrs/Week	CIE: 30Marks
Credits:4	Term Work: 25Marks

Pre-requisites: Analysis of mechanical elements, material science

Course Objectives:

1. Introducetheconceptofexperimentalstressanalysis
2. Prepare mechanical engineering students for advanced graduate studies in various experimental stress analysis techniques like photo elasticity, strain gauge etc.
3. Supply qualified personnel to meet the requirement in experimentalstress analysis

Course Outcomes:

1. To analyze photo elastic technique for stressanalysis
2. To explain the concept of strain gages and itsapplications
3. To elaborate the concept of coatingmethods.
4. To applythe knowledge of Moiré fringe method for stressanalysis

Unit 01 Principles ofExperimentalApproach- [03]

Introduction to Experimental Mechanics, advantages scope of Experimental Mechanics in design, various experimental methods of stress analysis and their relative merits and demerits

Unit 02 Two DimensionalPhoto elasticity- [11]

- □ Stress optics law, material fringe value in terms of stress and strain, significance of material fringevalue
- □ Nature of light, Wave theory of light - opticalinterference

- □ Photoelastic Materials - Criteria for selection, common photoelastic materials and their properties, Photoelastic sheet casting and model making, calibration of photoelastic material, calibration methods using circulardisc
- □ polariscope, its scope in photo elasticity, various configurations of polariscope
- □ effect of stressed model in plane and circular polariscope, isoclinics, isochromatics, their significance in photoelastic stressanalysis
- □ Properties of 2D photoelastic model materials, Materials for 2Dphotoelasticity
- □ Methods for fractional fringe measurement , Tardy's method of compensation (Derivation)

Unit 03 Analysis of Photo elastic Data– [06]

Principle of photoelasticity, methods of photoelastic stress analysis, temporary and permanent double refraction

Determination of direction of principal stresses at a given point, shear difference method, oblique incidence method and electrical analogymethod.

Unit 04 Strain Measurement Using Strain Gauges– [07]

Concept, meaning of strain gauges, desirable properties of strain gauges, types of strain gauges, Strain measurement using electrical resistance strain gauge, Selection and mounting of strain gauge, criteria for selection, mounting of gauge and checking its installation

Unit 05 Strain Gauge Circuitry– [07]

Wheatstone bridge circuit, its role in measurement of resistance change, condition for bridge balance, different configurations of Wheatstone bridge, output voltage of Wheatstone bridge, relationship between output voltage and strain, commercial strain indicators, potentiometer circuit.

Introduction to strain gauge rosettes, two, three and four element rosettes, different configurations of rosettes and their comparison, determination of magnitudes and direction of principal stresses when principal stress directions are specified and notspecified.

Unit 06 Coating Methods and Moire Fringemethod– [06]

Introduction, Brittle coating, coating stresses, crack patterns, crack detection techniques, selection of brittle coating, advantages, Birefringent coating:- Limitations and applications, Introduction to Birefringent coating, Birefringence coating stresses, Effects of coating thickness: Reinforcing effects, Poisson's effect , reflection polar scope

Introduction to Moiré fringe method of stress analysis – Mechanism of fringe formation, approaches to moiré fringe analysis, advantages, limitations and applications

TERM WORK :

Any eight out ofthe following list

1. Bonding of strain gauge and checking itsinstallation.
2. Determination of gauge factor for one arm sensitive and two armsensitive configuration.
3. Determination of gauge factor for four arm sensitive and four arm sensitive two linear and two lateralconfiguration.
4. Transducer applications of strain gauge- determination of unknown weight using load cell.
5. Study of photo elastic stress analysis – use of diffused light transmissionpolariscope.
6. Determination of fractional fringe order using Tardy's method.
7. Calibration of photoelastic materials - determination of material fringevalue.
8. Study of Moiré Fringe Technique.
9. Study of Brittle Coating Method.
10. Study of photo elastic materials.

TEXT BOOKS:

1. "Experimental Stress Analysis", Dr. Sadhu Singh; Khanna Publishers, 5 thEdition.
2. "Experimental Stress Analysis", U.C. Jindal, Pearson Publications, 1 stEdition.
3. "Experimental Stress Analysis", Abdul Muben; DhanpatRaiandCo., 1 stEdition.
4. "Experimental Stress Analysis", Vazirani, KhannaPublications.
5. "Stress Analysis and Experimental Techniques an Introduction", J. Srinivas,Narosa Publications.

REFERENCE BOOKS:

1. "Experimental Stress Analysis",J.W. Dally and W.F.Riley, Tata McGraw Hill Book Company, 3rdEdition.
2. "PrinciplesofExperimentalStressAnalysis",byAmericanSocietyforMetals,6thEdition.
3. "Experimental Stress Analysis", L.S.Srinath., Tata McGrawHill.
4. "Experimental Stress Analysis", Dove and Adams Merrill, 1 stEdition.
5. "The Strain Gauge Primer", Perry Listner McGraw Hill Book Company2 ndEdition.
6. "Moiré Fringes", Theocoris., Pergamon Press limited.
7. "Experimental Stress Analysis Principles and Method", by Holister G.S., Cambridge Engineering Services.

SHIVAJI UNIVERSITY, KOLHAPUR

Final Year B.Tech(Mechanical Engineering) **CBCS PATTERN Semester VII**

HUMAN AND PROFESSIONAL ETHICS (Elective-I)

SUBJECT CODE: PCE ME 404

Teaching Scheme:	**Examination Scheme:**
Lectures : 03 Hrs. per week	ESE: 70Marks
Practical : 02 Hrs. per week	CIE: 30Marks
Credit:04	Term Work: 25Marks

Pre-requisites:NA

CourseObjectives:

1. The objective of the course is an exploration of human values which go into making a good human being, a good human society and a good life. The context is the work life and the personal life of modern Indian professionals.
2. The movement to identify and remote the values shared by societies around the world is relatively new.
3. It is only in recent years as globalization extended its reach to even remote corners of the earth that he need to refocus and build upon what we as a human society have in common, has become apparent.
4. Increased contact between peoples and nations enhances awareness of our kinship and the shared code of ethics and conduct that underlies all civilization.
5. It's the Human values that we must now promote to create a common vision and means for moving forward toward a more peaceful and sustainable world.
6. The course also aims to have students appreciate the vastness of the Universe and the

wonder of its parts, and the philosophical significance of this for improving the quality of human life through value clarification.

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

1. Understand the role of cognitive and moral values in world views, by discussing and writing about the ethical implications of modern scientific and technological results
2. Recognize the difference between matters of fact and matters of value, while understanding the important ways in which facts influence value assessments and how value judgments shape our vision of "the facts"
3. Understand ethical methodologies and competency in ethical deliberation on rationally applying these methodologies to contemporary ethical questions related to scientific progress and technological power
4. Understand why ethics plays an important role in science and technology
5. To help students apply this understanding to make their living better at different levels- individual, family, society and nature
6. To facilitate the students in applying this understanding in their profession and lead an ethical life

Unit 1 Human Values [8]

The value, crisis in the contemporary Indian Society, The Indian system of values in the Indian constitution, Aesthetic values: perception and enjoyment of beauty, Relative and absolute values, Morals Values and Ethics, Integrity Service Work Ethic Service Learning Civic Virtue, Respect for Others, Respect for the Environment, Quest for Living Peacefully and happily, Attitude of Nonviolence Innate dignity for human life, Bring out the best in oneself caring Sharing Honesty Courage, Valuing Time, Co-operation, Commitment, Empathy, Self-Confidence Character, Spirituality

Unit 2 Harmony in the Human Being [6]

1. Human Being is more than just the Body 2. Harmony of the Self (I) with the Body 3. Understanding Myself as Co-existence of the Self and the Body 4. Understanding Needs of the Self and the Needs of the Body

Unit 3 Harmony in the Family and Society and Harmony in the Nature [6]

1. Family as a basic unit of Human Interaction and Values in Relationships 2. TheBasics for respect and todays Crisis: Affection, Care, Guidance, Reverence, Glory,Gratitude and Love 3. Comprehensive Human Goal : The Five dimensions of Human Endeavour

Unit 4 Safety [5]

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk – The Government Regulator's Approach to Risk- the three mile island, Chernobyl and Bhopal case studies. Collegiality and loyalty - respect for authority - collective bargaining - confidentiality -conflicts of interest - occupational crime

Unit 5 Responsibilities and Rights [5]

Engineers responsibility, Professional rights - Employee rights - Intellectual Property Rights(IPR) - Discrimination

Unit 6 Experimentation and Global Issues [10]

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

Multinational corporations - Business Ethics -Environmental ethics –Role in Technological Development- computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -Honesty-moral leadership-sample codes of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE), India, etc.

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

The term work should be carried out with the methodology of Lectures, group discussions (based on case studies), movies, field visits, essays, and student self-investigation sessions.

1. TEN modules based on the topics mentioned above and including –

• Group Discussions based on Case Studies with Report/Essays.

• Undergoing the Art of Living's ***YES+ / Happiness Programme*** on the Awareness of Human Values conducted by VyaktiVikas Kendra ,Bangalore in assistancewith

INTERNATIONAL ASSOCIATION OF HUMAN VALUES.(IAHV).

• Visits (with report writing) to Public Institutes like MunicipalCorporation,ZP,Co-op organizations, social clubs like charitable trusts, Waste Water/Air Pollution Control Plant, Slum Areas etc.

• Conduction of Health and Hygiene Awareness Camp forSociety.

• Studyofeconomicstatusofthe society–Surveydata collection,analysisandany suggestions.

• Study of impacts of technology onsociety.

TEXT BOOKS:

1. "Professional Ethics and Human Values", M.P. Raghavan, Scitech Publications (India) Pvt Ltd.

2. "Human Values and Professional Ethics", Jayashri and Suresh B S ,S Chand .

3. "Ethics in Engineering", Mike Martin and Roland Schinzinger, , Tata McGraw-Hill, New York, (1996).

4. "Engineering Ethics(Including Human Values)",Govindarajan M, Natarajan S, Senthil Kumar V. S, Prentice Hall of India, New Delhi.

5. "A Textbook on Professional Ethics and Human Values", Naagarazan, R.S. ,New Age Publishers .

REFERENCE BOOKS:

1. "Engineering Ethics", Charles D. Fleddermann, Pearson Education / Prentice Hall of India , New Jersey, (Indian Reprint now available).(2004)
2. "A foundation course in Human Values and professional Ethics", R. R. Gaur, R. Sangal, G P Bagaria, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2
3. "Engineering Ethics –Concepts and Cases" Charles E Harris, Michael S. Protchard and Michael J Rabins, , Wadsworth Thompson Leatning, United States, (Indian Reprint now available), (2000).
4. "Ethics and the Conduct of Business", John R Boatright, Pearson Education, New Delhi, (2003).
5. "Fundamentals of Ethics for Scientists and Engineers", Edmund G Seebauer and Robert L Barry, Oxford University Press, Oxford.
6. "Business Ethics – An Indian Perspective", Prof. (Col) P S Bajaj and Dr. Raj Agrawal, Biztantra, New Delhi, (2004).

RELEVANT WEBSITES, MOVIES AND DOCUMENTARI

1. Value Education websites, http://uhv.ac.in, http://www.uptu.ac.in
2. Story of Stuff, http://www.storyofstuff.com
3. Al Gore, An Inconvenient Truth, Paramount Classics, USA
4. Charlie Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology – the Untold Story
6. Gandhi A., Right Here Right Now, Cyclewala Productions

SHIVAJI UNIVERSITY, KOLHAPUR

Final Year B.Tech(Mechanical Engineering) **CBCS PATTERN Semester VII**

AUTOMOBILE ENGINEERING (ELECTIVE –I)

SUBJECT CODE: PCE ME 404

TeachingScheme:	**ExaminationScheme:**
Lectures: 3Hrs/Week	ESE: 70 Marks
Practical: 2Hrs/Week	CIE: 30 Marks
Credits: 4	Term work: 25Marks

Pre-requisites: IC Engine & Power plant

Course Objectives:

The course aims to:

1. Describe importance and basic knowledge of automobileengineering.
2. Classify various automobile layouts andbodies.
3. Demonstrate automobile systems, wheels and tyres and automobile electrical and electronic systems for understanding construction and workingprinciple.
4. Enable students to analyze and solve problems on automobile system by focus and critical thinking.
5. Demonstrate use of modern trends, techniques and skill to fulfill industrial needs by arranging industrialvisit.

Course Outcomes:

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

1. Explain components ofautomobile.
2. Distinguish various types of automobile lay outs as per drive given towheels.
3. Identify types of automobile bodies and materials used for thesame.
4. Demonstrate various automobile systems like clutch, gearbox final drive, brake,steering suspension wheels and Tyres, and its construction andworking.
5. Demonstrate various electrical and electronic systems like lighting, starting charging electronic controlled management system and its construction and working principle, sensors used inautomobile
6. Solve the problems related with various resistances for the automobile, engine power calculation.
7. Explain modern trends, techniques used inindustries.

Unit 1. Introduction **[06]**

Automobile history and development, Classification, vehicle layouts- engine location and drive arrangement, safety regulations, specifications of vehicles, Type of vehicle bodies, body parts and its advanced materials, Type of vehicle coaches , Chassis types, constructional details, Types of Frames, sub frames, frameless vehicles, details of chassis material.

Unit 2. TransmissionSystem **[06]**

Clutch – Function and requirements, Classification, Construction and working of Single-plate, Multi-plate, Diaphragm spring and centrifugal clutches, Fluid flywheel.

Gear Box – Necessity, classification, construction of manual gear boxes like Sliding mesh, constant mesh, Synchromesh, Epicyclic gear train, Automatic transmission, Torque convertor, Electronic transmission control, Overdrive. Propeller shaft, Differential and final drive.

Unit 3 Steering andSuspension Systems **[08]**

Live and dead axles, live axle arrangementSteering systems, function, principle of steering, Ackerman and Davis, steering geometry, center point steering, cornering force, slip angle, scrub radius, steering characteristic, steering gearbox, power steering, collapsible steering.

Suspension system- Functions, Sprung and un sprung mass, Types of suspension linkages, types of spring - leaf, coil, air springs, telescopic shock absorber, hydro gas suspension, rubber suspension, Air suspension

Unit 4 Brakes, WheelsandTyres **[07]**

Brakes: Need, principle, types, Mechanical, hydraulic and pneumatic brakes disc and drum types, airbrakes, servo and power braking, ABS, brake adjustments, defects and causes, Electronic Brake Distribution(EBD).

Wheels and Tyres: Wheel construction, alloy wheel, Types, tyre construction, tread design, specification, factors affecting tyre performance, tyre wear and its causes, wheel balancing.

Unit 5 Electrical andElectronicSystems **[07]**

Automotive batteries - lead acid batteries, Advances in batteries ,battery charging system, alternators, principle and operation of cutout and regulators, starter motor, Bendix drive, lighting and electrical accessories, automobile air conditioning, panel board instruments. Electronic Controlled Management (ECM) Systems, Automobile wiring. Sensors used in automobile.

Unit 6 Performance & Recent TrendsinAutomobiles **[06]**

Resistance to vehicle motion, Air, Rolling and Gradient resistance, Acceleration, Gradability and draw bar pull, Traction and Tractive effort, Distribution of weight, Power required for vehicle propulsion, (Numerical on Vehicle Resistance), Cruise Control, Adaptive Cruise Control (ACC), Electronic Stability Program (ESP), Traction Control System (TCS).

Term Work:

Minimum eight experiments from Group A and all experiments from Group B are to be performed.

Group A.

1. Study and demonstration of four wheeler chassis layout and vehicle body parts and itsmaterials.
2. Study and Demonstration of working of single plate automobile clutch and clutch plate lining materials.
3. Study and demonstration of synchromesh gearbox. (necessity, interlocking mechanism, gear shifting mechanism(Troubleshooting)
4. Study and demonstration of final drive and differential. (Types of final drive gear, Troubleshooting)
5. Study and demonstration of front wheel steering geometry and steering mechanism. (Troubleshooting)
6. Study and demonstration of suspension system of a four-wheeler. (Any one suspension system from conventional or independent, trouble shooting)
7. Study and demonstration of working Hydraulic braking system. (Air bleeding of hydraulic brake, Trouble shooting)
8. Study and demonstration of Lead acid Battery.(Troubleshooting)
9. Study and demonstration of electricalcharging system. (Troubleshooting)
10. Study and demonstration of electrical starting system.(Troubleshooting)
11. Study and demonstrationof

a) D. C. Electric Horn b) Electric Fuel Gauge c) Flasher Unit. d) Wiper Circuit

12. Study of automobile air conditioningsystem.

Group B.

1 Experiment on wheel balancing and front wheelalignment.

2 Visit to servicing station for study of vehicle maintenance, repairs and report.

OR

2. Visit to Automobile manufacturing industry.

Text Books:

1. "Automobile Engineering",Dr. Kirpal Singh (Vol. I and II) Standard Publishers, NewDelhi.
2. "Automobile Mechanics",N KGiri.
3. "Automobile Engineering", G.B.S. Narang., KhannaPublication ,3rdEdition.
4. "Automotive Technology", H.M. Sethi. Tata McGraw-Hill Education,(2001).
5. "Automobile Engineering", Banga andSingh.
6. "Automotive Mechanics", Joseph Heitner, Affiliated Eastern Law House, 2ndEdition.,(1967).
7. "Motor Vehicle Technology and Practical Work",Dolan. J.A., ELBS,(1978).
8. "Automobile ElectricalEquipment",P.L.Kohali,TechnicalEducationSeries,1st Edition.
9. "Automobile Engineering", R.B.Gupta, SatyaPrakasan, 9thEdition.
10. "Automotive Excellence Volume 1 and 2", Gelncoe, Tata McGraw-HillPublication.

Reference Books:

1. “Motor Vehicles”,Newton andSteed
2. “Motor Manuals (Vol I to VII)”, A.W. Judge., Chapman and HallPublication.
3. “Automobile Mechanics”,W.H. Crouse.,Tata McGraw Hill PublishingCo.

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech(Mechanical Engineering) **CBCS PATTERN Semester VII**

COMPUTATIONAL FLUID DYNAMICS (Elective I)

SUBJECT CODE: PCE ME 404

TeachingScheme:	**ExaminationScheme:**
Lectures: 3Hrs/Week	ESE: 70Marks
Practical: 2Hrs/Week	CIE: 30Marks
Credits:4	Term Work: 25Marks

Pre-requisites: Fluid Mechanics, Heat and Mass Transfer, Applied NumericalMethods

Course Objectives:

The course aims to:

1. Provide Fundamental fluid dynamic principles and their applications.
2. Carry out research in the area of Computational Fluid Dynamics.
3. Provide students with the necessary skills to use commercial Computational Fluid Dynamics packages
4. Introduce the student to widely used techniques in the numerical solution of fluid equations, issues that arise in the solution of such equations, and modern trends in CFD.

Course Outcomes:

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

1. Understand of the basic theory of Computational Fluid Dynamics, including discretisation, accuracy and stability.
2. Capable of writing a simple solver and using a sophisticated commercial CFD package.
3. Develop programming skills to solve some specific CFD problems.
4. Ability to assess fluid mechanics problems commonly encountered in industrial and environmental settings, construct and apply computational models, determine critical control parameters and relate them to desired outcomes and writereports.

Unit 1 Introduction to Computational Fluid Dynamics and Principles of Conservation [08]

Computational Fluid Dynamics: What, When, and Why? CFD Applications, Numerical vs. Analytical vs. Experimental, Modeling vs. Experimentation, typical problems, Problem Solving with CFD — Methodology, The Governing Equations of Fluid Dynamics and Heat transfer, Models of the flow- Control Volume, Fluid Element, Substantial Derivative, Divergence of Velocity, Continuity Equation Different Models and their Equivalence, Integral versus Differential Form of the Equations, The Momentum Equation, The Energy Equation, Summary Equations for Viscous Flow (the Navier-Stokes Equations) Equations for Inviscid Flow (the Euler Equations) Forms of the Governing Equations Particularly Suited forCFD

Unit 2 Basic of Discretization and Grid Generation [06]

Basic aspects of discretization - Discretization techniques Finite difference - Finite volume and Finite element method Comparison of discretization by the three methods, Transformation of non-uniform grids to uniform grids - General transformation of the equations -Form of the governing equations suitable for CFD - Compressed grids - Boundary fitted co-ordinate systems Elliptic grid generation - Adaptive grids - Modern developments in gridgeneration.

Unit 3 Finite Difference Method [06]

Finite Difference Formulations: Introductory remarks, Taylor Series Expansions,. Finite difference equations, Central Forward, Backward Numerical error, Explicit, Implicit, Semi-implicit(Crank- Nicholson method), Solution methods Direct, Iterative, Thomas algorithm, Gauss- Jacobi, Gauss- seidal method, Alternate Directional Implicit, Applications. 1-D examples, 2-Dexamples.

Unit 4 Finite Volume Method [08]

i. For Diffusion

Introduction, FVM for 1D steady state Diffusion, FVM for 2 D Diffusion

i. For Convection Diffusion

Introduction, Steady 1-D Convection and Diffusion, Central Differencing, Upwind Differencing, Hybrid Differencing, Power Law Scheme, QUICK scheme.

Unit 5 Introduction to Solution Algorithms for Pressure Velocity Coupling in Steady Flows and Turbulence and Multiphase Modeling(IntroductoryTreatment) [06]

Introduction, staggered grid, introduction to SIMPLE, SIMLEC, SIMPLER, PISO algorithms, Modeling of multiphase problems, Level set methods, VOF method. Coupled LS+VOF.

Unit 6 Introduction to Turbulence anditsModeling [06]

What is turbulence?; Transition from laminar to turbulent flow; Effect of turbulence on time averaged Navier -Stokes equations; Characteristics of simple turbulent flows; Introduction to Turbulent Models like Mixing length Model, k-epsilon model, Reynolds stress equation models,Algebraicstressequationmodels;SomerecentAdvances,introductiontoLES,DNS.

Term Work:

1. Simulate and solve two problems, each 2-d and 3-d steady and unsteady flows using any commercial CFD package like Ansys-FLUENT, STAR CCM, FLUIDYNE, Ansys-CFX, Open Sourceetc.
2. Write codes using C, C++, SciLab for at least one each, 1-d and 2-d steady flows and do the post processing to verify with analyticalresults.

Text Books:-

1. "Computational Fluid Mechanics the Basics with Applications",Anderson J. D. Jr,Tata McGraw Hill Education Pvt.Ltd.
2. "An Introduction to Computational Fluid Dynamics the Finite Volume Method" H. K.Versteeg and W. Malalasekera, Pearson Publication.
3. "Numerical Heat Transfer Fluid Flow",Suhas V. Patankar ,Taylor andFrancis.
4. "Introduction to Computational Fluid Dynamics", PradipNiyogi, S. K. Chakrabarthy,M. K. Laha , Pearson Publication.
5. "IntroductiontoComputationalFluidDynamics:Development,ApplicationandAnalysis", Atul Sharma,Wiley

Reference Books:-

1. "Computational Fluid Dynamics: A Practical Approach",JiyuanTu, Guan HengYeoh, Chaoqun Liu, Butterworth –Heinemann.
2. "Computational Fluid Dynamics", T. J. Chung, Cambridge UniversityPress.
3. "Introduction to Computational Fluid Dynamics",AnilW. Date, Cambridge University Press.
4. "Convective Heat and Mass Transfer",S. MostafaGhiaasiaan, Cambridge University Press.

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech(Mechanical Engineering) **CBCS PATTERN Semester VII**

Process Equipment Design (Elective- I)

SUBJECT CODE: PCE ME 404

TeachingScheme:	**ExaminationScheme:**
Lectures: 3Hrs/ Week	ESE: 70 Marks
Practical: 2Hrs/Week	CIE: 30Marks
Credits:4	Term Work: 25Marks

Pre-requisites: Heat and Mass Transfer.

Course Objectives:

1. Acquaint several design codes used in the designprocess.
2. Studydesignofprocessequipmentsuchaspressurevessel,storagetank,heatexchanger etc.

Course Outcomes:

1. Illustrate understanding of process designparameters.
2. Design and develop pressurevessels.
3. Demonstrate capabilities developed for designing storage tank,agitators.

Unit 01 **(6)**

Process Design Parameters

Basic concepts in process design, block diagrams for flow of processes, material flow balance. Importance of codes and standards and their applications. Pand ID, Process Data Sheet, PFD and other documents used for designing. Review of Design pressures, temperatures, design stresses, factor of safety, minimum shell thickness and corrosion allowance, weld joints efficiency, design loading, stress concentration and thermal stresses, failure criteria. Selection of material for process equipment's using ASME Codes.

Unit 02

Design of Pressure Vessels **(8)**

Types of pressure vessels, selection of various parameters for their design Pressure vessel subjected to Internal Pressure: Complete design as per ASME code of Cylindrical andspherical

shells. Design of various end closures such as: Flat, Hemispherical, Torrispherical, Elliptical and Conical.
Design of openings: nozzles and manholes. Design of Flanged joints; Gasket selection and design of supports for process vessels.Pressure vessel subjected to External Pressure: Design of shell, heads, nozzles, flanged joints and stiffening rings.

Unit 03 **(6)**

Design of Tall Vessels and Large Storage Tanks

(a) Determination of equivalent stress under combined loadings including seismic and wind loads application of it to vertical equipment like distillation column.
(b) Design of Storage Tanks:
Study of various types of storage vessels and applications.Atmospheric vessels, vessels for storing volatile and non-volatile liquids. Various types of roofs used in storage vessels. Manholes, nozzles and mounting design. Design of Rectangular tanks.

Unit 04 **(6)**

Vessel Supports

Introduction and classification of supports.Design of skirt support considering stresses due to dead weight, wind load, seismic load and periodic vibration.Design of base plate, skirt bearing plate, anchor bolts.Design of Lug and bracket support.

Unit05 **(6)**

Process Piping Design

Flow diagrams and pipe work symbols, design of layout of water, steam and compressed airpipes work, pipe fitting, linings and flanged connections. Types of valves used on pipe line. Fabrication of pipe lines, expansion joints and pipesupports.

Unit06 **(6)**

Heat Exchangers

Heat exchangers: Design of vessels, Design of Shell and Tube Heat Exchanger, Study and design of various types of jackets like plain half coil, channel, limpet coil.

Agitator

Study of various types of agitators and their applications. Baffling, Power requirement of agitation. General design of agitator including blades, shaft, blade assembly.

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

1) Design of Pressure vessels and largetanks.
2) Design of Heat exchangers used inindustries.
3) Design and development of equipment useful to process industries such as sugar, cement, chemical industries.
4) Preparing flow diagrams of processes, piping layout,etc.
5) Report based on visit to industries such as sugar, cement, chemicalindustries.

TEXT BOOKS:

1) "Process Equipment Design", Dr. M.V. Joshi, Mc-Millan Publication.
2) "Process Equipment Design", Browell and Young, Wiley India.
3) "Chemical Equipment Design", B.C.Bhattacharya.

REFERENCE BOOKS:

1) "Plant Design and Economics", Max and TimasulausKalus , Tata McGrawHill.
2) "Industrial Instrumentation Servicing Hand Book", Cannel Grady, Tata McGrawHill.
3) "Handbook of Instrumentation and Control", KellenHeward, Tata McGrawHill.
4) "Chemical Engineering Handbook", Perry John, Tata McGrawHill.
5) "Industrial Pipe Work", D.N.W. Kentish, Tata McGrawHill.
6) "Chemical Engineering", J.M. Coulson, Richardson, Sinnott,Maxwell, McMillan. Publication.
7) "Pressure Vessel Design Hand Book," H.Bedna.
8) "Dryden's Outlines of Chemical Technology" ,RoaM. Gopala, Sitting M., East West Press Pvt. Ltd., NewDelhi.

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech(Mechanical Engineering) **CBCS PATTERN Semester VII**

ADVANCED FOUNDRY TECHNOLOGY (Elective I)

SUBJECT CODE: PCE ME 404

TeachingScheme:	**ExaminationScheme:**
Lectures: 3Hrs/ Week	ESE: 70 Marks
Practical: 2Hrs/Week	CIE: 30Marks
Credits:4	Term Work: 25Marks

Course Prerequisites:

1. Manufacturingprocesses,
2. Thermodynamics
3. Machinedrawing,
4. MachineDesign

Course Objectives:

1. To acquaint students with the basic concepts of foundry processes
2. To impart knowledge of Ferrous and Non Ferrous Metal Processing
3. To study casting design process
4. To analyze the casting process

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

1. Understand the basic casting design procedure.
2. Understand fundamental knowledge of Ferrous and Non-Ferrous Metal.
3. Design of the castings for different application.
4. Understand the need of castability.

Unit 1: Metalcasting–overview **(6)**

Applicationsandproduction,historicalperspective,castingprocess,sandcasting,characteristicsofsand castingprocesses,Classification,,metalmoldcastingprocessesandcastingprocessesusingother mould/corematerials,Patternmaterials,typesofpatterns,Mouldandcoremakingmaterialsandtheircharacter istics, investment casting, die casting, ferrous casting, nonferrous castings, new casting development

Unit 2: Solid modelingof casting **(8)**

ElementaryaspectsofpatternandmoulddesignusingCADsoftware.Resinbondedmouldandcore makingprocessesandmachines.Specialcastingprocessesandtheirapplications-lowpressuredie casting,investmentcasting,squeezecasting,

Casting features, modeling techniques, graphical user interface, model representation, model exchange format, model verifications.

Unit 3: Pattern mold andcoredesign **(8)**

Mouldproduction-equipmentformoulding,mouldingtechnique-patternutilization,handand machinecompaction,machinemoulding,moulddryingandhardening.Coresandcoremaking-core boxes,compaction,corehardening,closingofmould.

Orientationandparting,mouldpartinganalysis,patterndesign,coredfeatures,coreprintdesignand analysis,Mouldcavitylayout

Unit 4: Feeder and Gating designandanalysis **(8)**

Castingsolidification,solidificationtimeandrate,feederlocationandshape,feederandneckdesign, feedaiddesign,solidificationanalysis,vectorelementmethod,optimizationandvalidation,examples basedonfeedingdesign

Mouldfilling,gatingsystemandtypes,gettingchannellayout,optimalfillingtime,gatingelement design,mouldfillinganalysis,numericalsimulation,optimizationandvalidation,examplesbasedon gatingdesign

Unit 5: Process planningandcosting **(6)**

Castingprocessselection,processshapesandparameters,toolingcostestimation,materialcost estimation,conversioncostestimationproductdesignforcastability,castabilityanalysis

Unit 6: Quality controlinfoundry **(6)**

Meltingandqualitycontrolofvarioussteelsandnon-ferrousalloys-castingdefects-fettling,inspection andtestingofcastings.Predictionofcastingdefects-porosity,segregation,shrinkageandhottearing.Castingdefects,theircausesandremedies. Shop floor quality control tests such as composition control, Wedge test, fluidity,temperature measurement.CastingModificationbydifferentmethodslikeFrictionstirprocessing.

TERMWORK

1. Designofpatternlayoutforagivencomponent

2. Designofgatingsystemforagivencomponent(ferrous/nonferrous)

3. Designofrise ringsystemforagivencomponent(ferrous/nonferrous)

4. Diedesignforpressurediecasting/centrifugalcasting

5. StudyofTS/ISO/QSnormsforfoundryindustry

6. Industrialvisittoamodernfoundryanditsreport

(Useofcomputerindesignsisessential)

Text Books

1) Metalcasting:computeraideddesignandanalysis,B.Ravi,prenticehallIndia.

2) PrinciplesofMetalCastings-Heine,LoperandRosenthal(TMH)

3) PrinciplesofFoundryTechnology-P.L.Jain(TMH)

REFERENCE BOOKS

1) Indian Institution of Foundry men-Foundry Journal

2) Advanced Pattern Making–CoxI.I. (TheTechnical Press, London.)

3) ASM Handbook–Vol.15Castings.(McGrawHill)

4) Metal Castings–Principles & Practice-T.V.RamanaRao.(NewAgePublishers.)

5) AFS and Control handbook–AFS.

6) Mechanization of Foundry Shops–Machine Construction-P.N.Aeksenov (MIR)

7) Fundamentals of Metal Casting Technology-P.C.Mukherjee (Oxford,IBH)

8) Foundry Engineering–Taylor, Fleming & Wulff (JohnWiley)

9) The Foseco Foundry man's Handbook,-Foseco, CBS Publishers & Distributors

10) The New Metallurgy of Cast Metals Castings–Campbell, CBS Publishers & Distributors,

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech(Mechanical Engineering) **CBCS PATTERN Semester VII**

IntroductiontoAircraftSystem(Elective-I)

SUBJECT CODE: PCE ME 404

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hours/ week	ESE: 70 marks
Practical: 2 Hours/ week	CIE : 30 marks
Credit: 4	Term work: 25 marks

Pre- requisites: Fluid Mechanics, Materials Science, Hydraulics and Pneumatics, I. C. Engines.

Course Objectives:

1. To identify components and design configurations of Aircraft.
2. To understand basics of aerodynamics and structure of Aircraft.
3. To impart the knowledge about various systems of Aircraft.
4. To study different materials of Aircraft.

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

1. Describe the basic components and various types of aircraftconfigurations.
2. Discuss the basics of aerodynamics andstructure.
3. Outline the working of various power plants used inaircraft.
4. Discuss the principles and working of various systems involved inaircraft.
5. Describe the significance and suitability of different aircraft materials.

UNIT I

Introduction to Aircraft: **[6]**

Types of Aircrafts-Lighter than Air/Heavier than Air aircrafts Conventional Design configurations based on power plant location, Wing vertical location, intake location, tail unit arrangements, landing gear

arrangements. Unconventional configurations- Biplane, variable sweep, canard layout, twin boom layouts, span loaders, blended body wing layout, STOL and STOVL Aircraft, stealth Aircraft. Advantages and disadvantages of these configurations.

UNIT II

Basics of Aerodynamics and Structures: [8]

Aerofoil Nomenclature, Types of Aerofoil, Wing section- Aerodynamic Center, Aspect Ratio, Effects of lift, drag speed, air density on drag. Forces on the airplane, Airflow over wing section, Pressure Distribution over a wing section, Generation of Lift, Drag, Pitching Moments, Types of Drag, Lift curve, Drag Curve, Lift/ Drag Ration Curve, Factors affecting lift and drag, Center of pressure and its effects. Basic components of an Aircraft, structural members, Aircraft Axis system, Aircraft Motions, Control surfaces and high lift devices.

UNIT III

Introduction to Propulsion System: [6]

Principles of aircraft propulsion, Types of power plants, basic components in power plants - inlet, compressor, combustion chamber, turbine and nozzle.Types of fuel - Illustration of working of air breathing engines.

UNIT IV

Aircraft Mechanical, Electrical and Electronic Systems: [8]

Types of Mechanical Systems, Environmental control systems (ECS), Pneumatic systems, hydraulic systems, Fuel systems, Landing gear systems, Engine Control systems, Ice and rain protection systems, Cabin pressurization and air conditioning systems, steering and brakes systems auxiliary power unit, avionics, Flight controls, Autopilot and Flight management systems, Navigation systems, Communication, Information systems Rader system**.** fire protection systems, de- icing and anti -icing system.

UNITV [6]

Aircraft Fuel and Hydraulic Systems:

Characteristics of aircraft fuel system. Gravity feed and pressure. A generalized fuel system. Fuel pumps-classification. Fuel control unit. Engine starting sequence. Starting and Ignition systems. Engine oils and a typical lubricating system. Hydraulic fluid.Hydraulic system and components.Study of typical workable system.Power packs. Hydraulic actuators. Pneumatic system and components. Use of bleed air. Emergency lowering of landing gear and braking.Shock absorbers - Retractionmechanism.

UNIT VI

Introduction to Aircraft Materials: [6]

General properties of materials, Definition of terms, Requirements of aircraft materials, Testing of aircraft materials, Inspection methods, Application and trends in usage in aircraft structures and engines, Introduction to smart materials and nanomaterials; Selection of materials for use in aircraft.

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

1. Assignment on Study of basic components and design configurations ofAircraft.
2. Assignment on Study of Aerodynamics and structures ofAircraft.
3. Assignment on Study of Mechanical systems ofAircraft.
4. Assignment on Study of Electrical and Electronic systems ofAircraft.
5. Assignment on Study of Fuel supply system and Hydraulic, Pneumatic systems ofAircraft.
6. Assignment on Study of different Aircraftmaterials.
7. Two reports on Industrial Exposure orVisit.

Practical Exposure:

With an intent to get some exposure on Aerospace and related industries, the colleges can arrange

- Industry visits to some of the Industries in Aerospace like HAL (Hindustan Aeronautics Ltd.), NAL (National Aerospace Ltd.), ISRO (Indian Space Research Organization) and students need to submit a report on the learning from thevisits.
  (**OR**)
- Visits to AerospaceMuseums
  (**OR**)
- Building Miniature models of Aircraft/ Gliders etc. as Hands on Exercises conducted as competitions.

TEXT BOOKS:

1. Fundamentals of Flight, Shevell, Pearson Education, 2nd Edition.
2. Mechanics of Flight by A.C Kermode, Pearson Education, 5thEdition
3. Ian Moirand Allan Sea bridge, Aircraft Systems: Mechanical, Electrical and Avionics-Subsystem Integration,,, AIAA Educational Series,2001.
4. Aircraft Material and Processes, Titterton G F, English Book Store NewDelhi, 1998

REFERENCE BOOKS:

1. Flight without Formulae by A.C Kermode, Pearson Education, 10 thEdition
2. Introduction to Flight by DaveAnderson
3. Treager, S., "Gas Turbine Technology", McGraw Hill1997.
4. William A Neese, Aircraft Hydraulic Systems, Himalayan Books;2007.
5. S R Maunder, Pneumatic Systems,,, Tata McGraw Hill Publishing Co.;1995.
6. Advanced Aerospace Material, H Buhl, Spring Berlin1992
7. 'Aircraft Maintenance and Repair', Frank Delp, Michael J. Kroesand William A. Watkins, Glencoe and McGraw- Hill , 6th Edition,(1993).

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech(Mechanical Engineering) **CBCS PATTERN Semester VII**

TOTAL QUALITY MANAGEMENT (Elective–II)

SUBJECT CODE:PCE ME 405

Teaching Scheme:	**Examination Scheme:**
Lectures: 3Hrs.perweek	ESE: 70Marks
Practical- 2 Hrs. per week	CIE: 30Marks
Credit: 04	Term Work: 25 Marks
	Practical/Oral : 00 Marks

Pre-requisites:

Course Objectives:

1. Know the concept of total quality and role of quality assurance.
2. Understand planning and controlling techniques for quality
3. Understand the key issues and some popular approaches to TQM implementation
4. Know the reliability approach for quality
5. Understand the current trends in TQM

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

1. Understand the concepts of total quality and quality assurance approaches.
2. They will identify and solve issues in quality related problems in manufacturing or service sector at various stages by using various TQM tools and techniques,
3. Understand vendor rating and select suitable vendor

4 Interpret various quality attributes and discuss the various quality approaches.

5 Calculate reliability of system

6 They will identify and solve issues in industries using the various techniques of TQM such as 5S, JIT, TPM, Reliability Engineering, Quality Circle etc.

Unit 1 **Quality Assurance System:** [6]

Concept of total quality ,role and objectives of Q.A. Q.A. cycle, process approach to Q.A. (input-process-output), Information feedback, Significance of feedback and field complaints analysis in Q.A., Significance of internal customer approach, Defect prevention programs for Q.A.

Unit 2 **Planning and Controlling Techniques for Quality** [7]

Planning for quality – The dimensions of Quality(quality of Design, conformance, performance and service) Quality planning with vendors, Vendor control procedures, Vendor-rating.
Controlling techniques for quality – Seven statistical tools, Process capability analysis, Problem solving new management tools, Why-why analysis, Six sigma-Concept, Need, Implementation.

Unit 3 **Robust and Reliable Product Approach for Quality** [7]

Product and system reliability: Basic concepts, Prediction and evaluation of parallel, Series and combined system reliability, Reliability tests (life testing, burn - intest, accelerated life testing),

FMEA; and FTA, Taguchi's quality Philosophy, System design, Parameter design,

Tolerance design, Orthogonal arrays, S/N ration, Loss functions.

Unit 4 **Principles and Approaches to TQM:** [6]

Basic concepts: definition of TQM, TQM and traditional management approach, Principles, characteristics, and benefits of TQM. Approaches to TQM: Deming's approach, Juran's triology, Crosby and quality improvement, Ishikawa's CWQC.

Unit 5 **The Essentials of TQM:** [7]

CustomerFocus,-Customerperceptionofquality,Qualitypolicydeployment,Quality function deployment, Voice of customer, Customer satisfaction, Kano's modelof satisfaction, Customerretention.

TQM Leadership- Role and commitment and accountability of leadership, Quality policy and objectives, Organizational structure for TQM, Role of HR in TQM, Training for TQM, Developing quality culture.

Tools and Techniques for TQM:5-Scampaign, TEI, quality circles, QFD, poka-yoke, KAIZEN

Unit 6 **Current Trends in TQM:** [7]

TQM in service sector: Definition and meaning and service, problems in defining service quality, attributes of service quality, SERVQUAL model, Implementing TQM in service industries, Measurement system for service quality.

Quality Management Systems: ISO9001:2008 Series Standards–Clauses, contents, interpretation and implementation, audit Sector Specific Standards–AS9100, ISO/ TS 16949,TL9000,

Quality Awards: National and International quality awards, Criteria and case studies.

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

Term Work: case studies through industrial visits on:

1. Tools and techniques ofTQM
2. TQM implementation in manufacturingsector
3. TQM implementation in ServiceSector
4. ISO 9001-2008implantation.

(Presentation is preferable for case studies)

Content Assessment Tool

1. case studies on abovetopic
2. case studies on above topic
3. case studies on abovetopic
4. case studies on above topic.
5. Four assignments based on thesyllabus

TEXT BOOKS:

1 "Practical Reliability Engineering",Patrick D.T. O'connor, , Wiley India, (ISBN 978-81-265- 1642-1), 4th Edition.

2 "TotalQualityManagement–Textandcases",JankiramanandGopal,PrenticeHallIndia Publication. (ISBN978-81-203-2995-9).

3 "Total Quality Management" Dr. Suri and Dr. Sharma, Wiley Publication, (ISBN 978-93- 5004-317-2).

4 "Total Quality Management",Dr. Rajaram, Wiley Publication, (ISBN 978-81-7722-63-2).

REFERENCE BOOKS:

1 "TotalQualityManagement",DaleH.Besterfiled,et.al.,PearsonEducation,Asia(ISBN 978-81-317-3227-4).

2 "TotalQualityManagement",Dr.PoornimaCharantimathPearsonEducation,Asia(ISBN 978-81-317-3262-5) ,2ndEdition.

3 "Quality Planning and Analysis",Juran J.M and Gryna.

4 "HandbookofTotalQualityManagement"Dr.R.P.Mohanti,R.R.LakheJaicoPublishingHouse , (ISBN 81-7224-833-44).

5 "Inspection,QualityControlandReliability",SharmaS.C.,KhannaPublishers(ISBN81- 7409-022-3).

6 "GlobalManagementSolutionsDemystified",DineshSeth,SubhashC.Rastogi,CeneageEducation (FormerThomsonAsiaPvt.Ltd.)(ISBN981-265-142-X).

7 "ManagingQuality",BarrieGDale,WileyIndiaPvt.Ltd.(ISBN978-81-265-2246-0), 5thEdition..

8 "Total Quality Control", Feigenban, Tata McGraw Hill Book Company, New York.

9 "FundamentalsofQualityControlandImprovement",AmitavaMitraPearsonEducation ,Asia.

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech(Mechanical Engineering) **CBCS PATTERN Semester VII**

Industrial Product Design (Elective- II)

SUBJECT CODE:PCE-ME-405

TeachingScheme:	**Examination Scheme:**
Lectures: 3Hrs/ Week	ESE: 70Marks
Practical: 2Hrs/Week	CIE: 30 Marks
Credits:4	Term Work: 25Marks

Pre-requisites: Machine Design, Manufacturing Engineering.

Course Objectives:
The course aims to:
1. Studythe various parameters in product design and developmentlike
- Finding CustomerNeed
- Doing Market Research in various parameters forproduct
- Product Specificationscriteria
- Product Architecture andPrototyping
- Cost and ValueEngineering
- Design for Manufacturing andAssembly
- Standards in Ergonomics and IndustrialSafety

2. Practice exposure to Case Studies and CAD Software with a productcase.

Course Outcomes:
Upon successful completion of this course, the student will be able to:
1. Find the Customer Needs for a Quality Product through Market Research in product development process, Concept Generation, Selection andTesting.
2. Describe basics of Product Architecture, Prototyping and Cost and Value Engineering. Select the Standard Ergonomics and Industry Safety parameters in Product Design.

Unit01 [06]

Introduction
Challenges of product development, Identify customer needs, Successful product development, Quality aspect of product design, Market Research, Survey.

Unit02 [07]

Product Development Process and Planning

Innovation and Creativity in Product Design, Product Planning Processes, Product specifications: Process of setting specifications. (Concept Generation–Selection–Testing)

Unit03 [07]

Product Architecture

Product Architecture: Implication of architecture, Establishing the architecture, Related system level design issue, Product Data Management, Use of Computerized Data Management and `Process, Industrial Design: Overview.

Unit04 [07]

Design for Manufacturing and Assembly

Tolerance, Design of Gauges, Design for Environment, Prototyping, Engineering Materials, Concurrent Engineering, Product Costing, Value engineering.

Unit05 [08]

Aesthetics:

Aesthetic Considerations, Visual Effects of Form and Color in Product Design.

Ergonomics:

Ergonomics and product design and automated systems, Anthropomorphic data and its applications in ergonomic design, Limitations of Anthropomorphic data, General approach to the Man-Machine Relationship - Work station Design and environment (working position and posture).

Control and Displays:

Configurations and sizes of various controls and displays, Design of controls in automobiles, machine tools etc., Design of instruments and controls.

Unit06 [05]

Industrial Safety:

An approach to Industrial Design - Elements of Design Structure for Industrial Design in engineering applications in manufacturing systems.Personal protective Equipment and Environment Control Prevention and specific safety measures for manufacturing and processing industry and chemical industry.

Term Work:

1. CaseStudyonanyTWO(byagroup,agroupofMin.02andMax.04studentstobe presented in front of all students) covering followingpoints,
    a. Product Development Process /Planning.
    b. ProductArchitecture.
    c. Design forManufacturing.
    d. Design forAssembly.
    e. Aesthetic and Ergonomic considerations in ProductDesign.
    f. Industrial Safety in Machine and EquipmentHandling.
    g. Health Safety in ProductDesign.
    h. Environmental Safety and ISO 14000Systems.
2. DevelopmentofanyProductusinghighendCADsoftwareconsidering followingpoints.

a) Need of Customer, Methodology ofMarket Survey.
b) Invention / Innovation of a product with modificationsrequired.
c) Aesthetics (Form and Color) and Ergonomics consideration indesign.
d) Preparation of various Views ofthe product.
e) Design for Assembly Procedures.
f) Product and MaintenanceManual.
g) Product Database Management.

A report should be prepared with details, drawing sheet, Bill of Material, Assembly–Disassembly Procedure, Maintenance Manual and Cost Estimation (if required) Presentation of the productdesigned.

Text Books:

1. "Product Design and Development",KarlT.Ulrich,StevenG.Eppinger;Irwin TataMcGrawHill, 3rdEdition.
2. "Product Design and Manufacturing", A.C.ChitaleandR.C.Gupta,PrenticeHall ofIndia, 3rdEdition.
3. "Product Design", Otto and Wood, Pearsoneducation.
4. "Human Factor Engineering", L P Singh ,Galgotia Publication Pvt.Ltd,1st Edition.

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Reference Books:

1. "New Product Development", Tim Jones, Butterworth, Heinemann, Oxford,(1997).
2. "AssemblyAutomationandProductDesign",GeoffreyBoothroyd,MarcelDekker,CRC Press.
3. "Industrial Product Design", C WFlureshem.
4. "Industrial Design for Engineers",MayallW.H, London,HiffeebooksLtd.
5. "Introduction to Ergonomics",R.C. Bridger,TataMcGrawHillPublicatio

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech(Mechanical Engineering) **CBCS PATTERN Semester VII**

ADVANCED FORMING PROCESSES (Elective-II)

SUBJECT CODE:PCE-ME-405

TeachingScheme:	**ExaminationScheme:**
Lectures: 3Hrs/Week	ESE: 70Marks
Practical: 2Hrs/Week	CIE: 30Marks
Credits:4	Term Work: 25Marks

Course objectives:

The course aims to:

1. Understand the fundamentals of various traditional, nontraditional and advanced metalforming processes
2. Study different types of traditional, nontraditional and advanced metal working processes,their advantages, limitations and applications
3. Understand how the processes are carried out in industry

Course Outcomes:

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

1. Solve for strain rates, temperatures and metallurgical states in forming problems usingconstitutive relations
2. Develop process maps for metal forming processes using plasticity principles
3. Estimate formability limits for bulk metals and sheets
4. Evaluate high energy rate deformation process parameters.

Unit 1 Introduction and Fundamentals of Forming Processes: [05]

Importance of manufacturing technology, Classification of manufacturing processes, Selection of materials and manufacturing processes. Study of various forming processes their significance and comparison of various manufacturing processes on different criteria. Need for near net shape manufacturing.

Theory of elasticity, Simple Stress and Strains- Elastic stresses and strains, Plastic stresses and strains, Poisson's ratio, True stress and True strain, Empirical relations for the stress strain curve, Idealized stress strain curve. Two and three dimensional stresses and strains- Principal stresses and strains, Mean (Hydrostatic) stress and stress deviators, Principal strains, Equilibrium in Cartesian, cylindrical and spherical coordinates

Unit 2 Theory of Plasticity [07]

Theory of dislocations, Slip line field theory, Slab method and lower and upper bond methods for load , their significance in investigating and modeling of metal working operations. Plastic work.Yield criteria-Tresca and Von-mises yield criteria, General plastic stress-strain relations (Theory of plasticity). Effect of Temperature on plastic deformation, Cold forming- and effect of annealing on cold formed materials-recovery, Recrystallization and grain growth, warm forming and hot forming. Effect of strain rate on plastic deformation and super plasticity.Effect of friction and lubrication in metal forming. Classification of forming processes on various criteria

Unit 3 Bulk Forming of Metallic Materials [08]

Forging Processes: Introduction to types of forging and forging equipment's, Modeling of forging process, Calculation of forging loads in closed die forging, Effect of forging variables on properties, forging die design, Design principles, Pre form design considerations and die materials, Forging Defects.

Rolling Process: Introduction to types of rolling and rolling mills, Forces and geometrical relationships in rolling, Simplified analyses of rolling load , Variables, Torque and power, Roll pass design, Rolling mill control, Theories of cold rolling, hot rolling, transverse rolling, Rolling of bars and shapes. Rolling defects

Extrusion: Classification and applications, Extrusion equipment. Hot and cold extrusion, hydrostatic extrusion. Patterns of metal deformation in extrusion, Analyses of extrusion process, Extrusion Defects.

Rod, Wire and Tube Drawing: Classification of drawing processes. Rod Drawing, Wire Drawing, Tube Drawing. The Drawing Die.Modeling of Drawing Process.

Unit 4 Sheet Metal Forming Processes: Introduction and Classification [07]

Shearing Processes: Classification and applications, Open Contour Shearing, Closed Contour Shearing. Shearing mechanism.

Bending Processes: Applications, Bending Parameters, Spring back in Bending, Residual stresses in bending. Bending equipment, Press Brake, Roll Bending Machines and Contour Roll forming.

Stretch Forming: Applications, Stretch forming machines and accessories.

Deep Drawing: Applications. Deformation zones in deep drawing, Blank holding pressure. Ironing. Deep Drawing force. Limiting Drawing Ratio.Effect of Anisotropy.Redrawing.

Unit 5 High Velocity Forming and High Energy Rate Forming [06]

Introduction and Classification.Characteristics of HVF and HERF Processes.

High Velocity Forming Machines: Pneumatic (Compressed air) Hammer, Compressed Gas Forming Hammer, Gas Combustion High Speed Hammers,

High Energy Rate Forming Processes: Explosive Forming, Principles and Types of Explosives. Classification of Explosive Forming Methods, Process variables, Failure of Formed products, Advantages and limitations,

Electro Magnetic Forming: Principles of the process, Basic Methods of Electromagnetic Forming, Pressure required in EMF, Advantages and Limitations of EMF. Safety Considerations.

Electro Hydraulic Forming: Principles of the Process, Energy requirements, Process variables, Advantages and Limitations, Future of HVF and HERF.

Unit 6 Recent Trends in Forming: [07]

Thixo-forging, isothermal forging, super plastic forming technology, forming of super conductors, forming of ceramics and glasses, Forming of plastics and composite materials- Extrusion, Form moulding, Thermo forming, Cold forming and Solid phase forming, Design and economic considerations.

Rubber Pad Forming (Flexible – Die Forming) and **Hydro forming** (Fluid forming Processes).

Spinning: Conventional spinning, Flow Turning (Shear spinning), Tube spinning,

Super Plastic Forming of Sheets: Blow Forming and Vacuum Forming, Thermo forming Methods, Super Plastic Forming/ Diffusion Bonding Process. Sheet Metal Formability, Testing of Formability, Forming Limit Diagrams.

Term Work:

1. One exercises each on i. Rolling ii. Forging iii. Extrusion, iv. Wire and deep drawing forming processes
2. Four exercises on High velocity and high energy rate forming
3. Industrial visits to observe bulk metal, sheet metal and High velocity and high energy rate forming processes

Text Books:

1. “Modern Manufacturing”, MikellGroover, Wiley publication.
2. “Mechanical Metallurgy”, George E. Dieter, Tata McGraw Hill Education (India) Pvt. Ltd. 3rd Edition, (ISBN 978-1-25-906479-1), (2013).
3. “Manufacturing Technology – Materials, Processes and Equipments”, Helmi A. Youssef, Hassan A. El- Hofy, Mahmoud H. Ahmad, CRC Press, Taylor and Francis Group, ISBN 978- 1-4398-1085-9.
4. “Production Technology”,R.K. Jain, Khanna Publishers (ISBN :81-7409-099-1)
5. “Manufacturing Processes and Systems”,Phillip F Ostwald, J. Munoz, Wiley Student Edition, ISBN 978-81-26518944.

Reference Books:

1. “Metal Forming Handbook” Schuler, Springer-Verlag, Berlin Heidelberg New York ISBN 3-540-61185-1 (2008).
2. “Forging Design and Practice”,R. Sharan, S.N. Prasad Chand, (1982).
3. “Forging Equipment, Material and Processes”,J. Altan, F. W. Boulger- Metals Cewramic Information Centre Columbus ,(1973).
4. “Roll Forming Handbook”, Geotge T. Halmos ,(CRC Press, Taylor and Francis)- ISBN 0-8247-9563-6, (2006).
5. “Metal Forming Fundamentals and Applications”,Altan T, American Society of Metals, Metal Park, (1983).
6. “ASM Hand Book”, Forming and Forging, Vol. 14, 9th Edition, (1998).
7. “Manufacturing Engineering and Technology”, SeropeKalpakjain, Steven R. Schmid, Pearson Education Asia, 4thEdition (ISBN 978-81-7758-170-6).
8. “Fundamentals of Metal Forming Processes”, B.L. Juneja New Age International Publishers, (ISBN 978-81-224-3089-9). 2nd Edition.
9. “Roll Forming Handbook”, Geotge T. Halmos CRC Press, Taylor and Francis(ISBN :0-8247-9563-6) ,(2006).

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech(Mechanical Engineering) **CBSE PATTERN Semester VII**

DESIGN OF THERMAL SYSTEM(Elective-II)

SUBJECT CODE:PCE ME 405

TeachingScheme:	**ExaminationScheme:**
Lectures:3Hrs/Week	ESE: 70Marks
Practical:2Hrs/Week/Batch	CIE:30 Marks
Credits:4	TermWork:25Marks

Pre-requisites: Applied Thermodynamics, Heat and Mass Transfer.

Courseobjectives:
The course aimsto:
1. Learn Thermal system designmethodology.
2. Understand real life situations and be able to decide an approach for problemsolving.
3. Design simple thermal systems with advanced tools where in integration of more than one component is required.

Course Outcomes:
Upon successful completion of this course, the student will be able to:
1. Understand the thermal system designmethodology.
2. Decide an approach to solve real life thermal system designproblems.
3. Design simple thermal systems with advanced computer aidedsystems.
4. Gain confidence in problemsolving.

Unit 1
Introduction to ThermalSystemDesign **[06]**
Classification of design, Optimal and nearly optimal design, Methodology of design, Aspects of thermal system design, Assessment concept and creation, Component modeling.

Unit 2
Design ofRefrigerationSystem **[07]**
Design of basic components of refrigeration system, Design of refrigeration systems: vapour compression system- Household refrigerator, Ice plant, Vapour absorption systems using waste heat and solar energy.

Unit 3
Heat Transfer and Design Analysis of AirConditioningSystem **[07]**
Design of Air conditioning systems: Design considerations, Load calculations, Single unit room air conditioners, Central air conditioning plant, Industrial drying systems, Component selection and Computer Aided PipingDesign.

Unit 4

Design ofSolarSystem [07]

Design of solar assisted water heating systems, Preliminary specifications, Concepts development, detailed design for feasibility study, Component design.

Unit 5

Design of AdvancedCooling Systems [06]

Design of advanced heat exchanger networks, Design of electronic miniature cooling systems, Utilization of Nano- Fluids for cooling systems.

Unit 6

Design and Economic Analysis of Waste HeatRecovery Systems [07]

Designofwasteheatrecoverysystems,Designspecifications, Conceptdevelopment,Detailed specifications and component design, Thermo Economic Evaluation and additional costing Considerations.

Term Work:

Any six assignments to be completed

1. Design of water chillingplant
2. Design of cold storageplant
3. Design and optimization offins
4. Designofwasteheatrecoverysystemfor dieselpowerplant
5. DesignofDehumidificationplantusedforindustrialdrying.
6. Design of gas turbinesystem
7. Design of shell and tube heatexchangers

***(Designing of any one basic component with CAE software like ANSYS, HYPERWORKS)**

Text Books:

1. "HVAC System Design Handbook"ASHRAE.
2. "Design and Optimization of Thermal Systems", Yogesh Jalurkar, CRCPress.
3. "Design and Simulation of Thermal Systems", N.V.Suryanarayana, OnerArici,TataMcGraw HillInc.
4. "Thermal System Design",Stoecker, Tata McGrew Hill Publication,3rd Edition.

Reference Books:

1. "Essentials of Thermal System Design", C. Balaji, CRCPress.
2. "Design of Fluid Thermal Systems", Janna W.S., Cengage Learning, 4thEdition.
3. Online Tutorials and ANSYS User Guide.

Shivaji University Kolhapur

Final Year B.Tech(Mechanical Engineering) **CBCS PATTERNSemester VII**

SMART MATERIALS (Elective-II)

SUBJECT CODE:PCE ME 405

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/ Week	**ESE: 70 Marks**
Practical: 2 Hrs/ Week	**CIE: 30 Marks**
Credits: 4	**Term Work: 25 Marks**

Pre-requisites: Mechatronics, Testing and Measurement.

Course Objectives: The course aims to:

1. The course is designed to give an insight into the latest development regarding, Smart materials & their types.
2. Study HBLS and LBHS based smart materials.
3. Study use of actuators and sensors in forming a smart system and its applications.
4. To know advances in smart structures and materials
5. To understand smart composites.

Course Outcomes:

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

1. Classify smart materials and explain their functions.
2. Explain the smart materials and their uses
3. Use of different sensors and actuators
4. Should suggest suitable material for actuators
5. Ability to interpret emerging technical literature related to smart materials and structures and demonstratesknowledge in a project.

Unit 1 Overview of Smart Materials **[06]**

Introduction, Components of smart systems – Sensors, actuators, Transducers, MEMS, Introduction to piezoelectric materials, Magnetostrictive smart materials, Active smart polymers, Shape memory alloys

Unit 2 Types of Smart Materials **[06]**

Introduction to HBLS (high bandwidth low strain) generating smart materials- Piezoelectric and Magnetostrictive materials, LBHS (low bandwidth high strain) generating smart materials- Shape memory alloys and electro-active polymers.

Unit 3 Actuators Based on Smart Materials **[08]**

HBLS based actuators- Piezoelectric actuators- Induced strain actuation model, Unimorph and bimorph actuators, Actuators embedded in composite laminate. Magnetostrictive actuators - Mini actuators, Thermal instabilities, Magnetorstrictive composites, MEMS based actuators. LBHS based actuators: Shape memory alloy based actuators, Electro-active polymer.

Unit 4 Sensors Based on Smart Materials **[06]**

Sensors based on HBLS smart materials- Piezoelectric sensors, Magnetostrictive sensors, MEMS sensors, Sensors based on LBHS smart materials- Shape memory alloy based encoders, EAP based sensors.

Unit 5 Integration of Smart Sensors and Actuators **[08]**

Case studies to advanced smart materials - Active fiber composites, Energy harvesting Actuators, energy Scavenging sensors, Self-healing smart materials

Unit 6 Applications of Smart Material **[06]**

Structural applications of smart materials, Structural acoustic control, and vibration control applications. Aerospace and transportation applications

Term work:

Any eight assignments based on above syllabus.

Text Books:

1. “Smart Materials and Structures”, Gandhi, Thompson and Gandhi, ChapmannandHall London.
2. “Smart Structures and Materials”, Bryan Culshaw, ARtech House, (1996).

Reference Books:

1. “Smart Material Systems and MEMS”, Vardhan, Vinoy, Gopalkrishanan, Willey India Edition.

2. Smart Structures, Gauenzi, P., Wiley, 2009, Dover Publication.

Shivaji University Kolhapur

Final Year B.Tech (Mechanical Engineering) **CBCS PATTERN Semester VII**

DESIGNFORSUSTAINABILITY(Elective-II)**SUBJECT**

CODE:PCE ME 405

Teaching Scheme:	**Examination Scheme:**
Lectures :03 Hrs. per week	ESE : 70Marks
Practical : 02 Hrs. per week	CIE : 30Marks
Credit : 04	TermWork : 25Marks

Pre-requisites:

Course Objectives:

1 Enable student to design products and equipment for sustainability

2 Use appropriate methodology to analyze and improve product design in terms of sustainability issues.

3 Know contextual factors impacting the engineering discipline.

4 Apply systematic engineering synthesis and design processes.

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

1 Explain the role of sustainability in the design process

2 Describe principles of materials selection based on sustainable principles

3 Apply a systematic approach to system redesign in terms of energy efficiency, water efficiency and transport efficiency

4 Give examples of engineering innovation including sustainable design

5 Explain and Apply principles of disposal and recycling

6 Design the products that are environmental friendly.

Unit 1 INTRODUCTION TO SUSTAINABILITY [06]

Definition and Language of sustainability in engineering design, natural resource terminology,carryingcapacity,strategiesusedduringsustainabledesignscopeand significance

Unit 2 TOOLS AND TECHNIQUES [08]

Lifecycleanalysis,carbonfootprint,lifecycleassessment(LCA)anditstypes& sustainableproductdesign,lightweightandmaterialreduction,wholesystem design, design for durability, repairs &upgrade,disassembly&recycling,reducing energylosses.

Unit 3 FOUNDATIONAL CONCEPTS & PRINCIPLES [09]

Infrastructure for managing flows of materials, energy and activities;sustainable value creation approaches for all stakeholders, environmental design characteristics; design changes & continual improvement; inclusive sustainable designprinciples, crowd sourcing, multiple-objective designs; infrastructures that support system thinking;knowledgemanagementforsustainabledesign,learningsystemsand experimentation;smartdatasystems,understandingvariation

Unit 4 CONSIDERATION DURING SUSTAINABLE DESIGN [06]

IndustrialEcology,MultipleLifecycleDesign,GreenEngineering,Bio-mimicry,Design for environment, Design for Flexibility

Unit 5 HUMAN DESIGN [07]

Preservationfornaturalconditions,UrbandesignandIndustrialsitesplanningwith humanandenvironmentalcomfort,simplecasestudyofsustainabilitydesign consideration in the Automobile components, Components used in Industries and societal routineuse.

Unit 6 ECONOMICAL ASPECTS AND CONSERVATION [04]

Economical aspects of sustainable design, energy conservation, water conservation, material conservation, bio-degradability of materials.

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

1. Minimum Six Assignments based on the abovesyllabus.

Note: Assignments should include case study of live example.

TEXT BOOKS:

1 "DesignforSustainability:Apracticalapproachfordevelopingeconomics",M.R.M.Cruland J.C. Diehi, Delf , University of Technology, USA.

2 "Introduction to Sustainability", Jong Jin Kim; National Polution Prevention center for higher education.

3 "Design for Sustainability a Practical Approach", Tracy Bhamra; Gower Publication.

REFERENCE BOOKS:

1 "Integral Sustainable Design: Transformative Perspectives", Mark Dekay Earth Scan animprint of Tailor and Francis Group.

2 "Sustainable Energy Systems and Applications",Ibrahim Dincer; Calin Zamfirescu Springer Publications.

3. Clarke,Abigail&JohnK.Gershenson2006.DesignfortheLifeCycle.Life-cycleEngineering Laboratory, Department of Mechanical Engineering-Engineering Mechanics, Michigan TechnologicalUniversity.

4 Ramaswamy,Rohit,1996.DesignandManagementofServiceProcesses:Keeping Customers for Life, Prentice Hall.

5 Finster, Mark P., 2013. Sustainable Perspectives to Design and Innovation.

6 Schmitt, Brent, Customer Experience Management, Wiley and Sons, 2003.

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech(Mechanical Engineering) **CBCS PATTERN Semester VII**

Flexible Manufacturing Systems (Elective II)

SUBJECT CODE: PCE ME405

TeachingScheme:	**ExaminationScheme:**
Lectures: 3Hrs/Week	ESE: 70 Marks
Practical: 2Hrs/Week	CIE: 30Marks
Credits:4	Term Work: 25Marks

Pre-requisites: Manufacturing Processes, Computer Integrated Manufacturing Systems.

Course Objectives:

1. To study fundamental concepts of flexible manufacturingsystems
2. To familiarize students to various components ofFMS.
3. To impart knowledge of flexible assemblysystems.

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

1. Understand meaning of flexible manufacturing system
2. Know about activities in modern PPCsystem.
3. Explain the concept of group technology, and how it relates to cellular manufacturing.
4. Explore primary capabilities of flexibility in theFMS.
5. Explore automated inspectiontechniques.
6. Know about different types of FMS with components.

Unit 1: Introduction and control structure of FMS: [07]

Flexible and rigid manufacturing, F.M. Cell and F.M. System concept, Types and components of FMS, Tests of flexibility, Group Technology and FMS, unmanned factories, Economic and Social aspects of FMS. Architecture of typical FMS, Automated work piece flow, Control system architecture – Factory level, Cell level; hierarchical control system for FMS, transmission medium, signaling, network topology, Manufacturing Automation Protocol; communication interfaces, Structure and functions of manufacturing cell, Distributed Numerical Control (DNC), FMS Diagnostics, conceptual DBMS, relevance of DBMS inFMS

Unit 2: Production planning and control in FMS: [07]

Activities in modern PPC system, process planning, computer aided process planning systems-retrieval and generative, material requirement planning, and shop floor control, scheduling algorithms, heuristic approach and optimized production technology approach to scheduling , automated scheduling systems, inventory control in FMS, MRP-II or ERP

Unit 3: Tooling and Fixturing in FMS: [08]

Modern cutting tools and tool materials, tool holders, modular tooling, tool monitoring, presetting and offsets, wear and radius compensation, tool magazines, automatic tool changers, robotized tool assembly, tool management systemPart holding on Pallets, standard fixtures, pallet changers, pallet pool, flexible fixturing – principles and methodologies, modular fixturing system: Tslot based, dowel pin based, fixturing components, computer aided fixture design – locating and clamping, use of GT in fixture design, fixture database

Unit 4 : Group Technology and material handling in FMS: [09]

GT concepts, Advantages of GT, Part family formation-coding and classification systems; Part machine group analysis, Methods for cell formation, Cellular vs. FMS production. Material Handling in FMS: Functions of an integrated material handling system in FMS, Flexibilities in material handling, Industrial robots for load / unload applications, Robotic cell layouts and FMS layouts, Automatically Guided Vehicles (AGVs) – types, features, guidance technologies and applications; Automated warehousing - AS/RS, storage and retrieval machines in AS/RS.

Unit 5: Automated Inspection Systems: [05]

Online offline infection, automated inspection techniques, contact non-contact inspection, application of m/c vision system in inspection, CMM, study of inspection and post inspection software, FIS (flexible inspection system)

Unit 6: Flexible Assembly Systems: [05]

Basic Concepts, classification, planning and scheduling in FAS, loading and scheduling in F.A. cells. Lean & Agile Manufacturing: definition and principles of lean manufacturing, benefits, methodologies for transferring to lean manufacturing, definition, principles of agility, market forces and agility, reorganizing the production system for agility, managing relationships for agility.

TERM WORK:

Minimum eight assignments based on the following.

1. Develop a form code using any classification system for 3 parts.
2. Application of rank order clustering algorithm to identify logical part families and machines groups.
3. Exercise on any schedulingalgorithm.
4. Exercise on flexible Fixturing.
5. Simulation of FMS shop, using Simulation software package (like ARENA, OpenCIM/ OpenFMS or equivalent) using various modules like Arrive, Server, Depart, Simulate modules, Creating models of FMS shops and simulating the performance to obtain outputresults
6. Exercises on assessment of performance of batch production systems for the followingmeasures

a) Manufacturing lead time, b) Work - in – process, c) Machine utilization

TEXT BOOKS:

1. Flexible manufacturing systems in practice applications, design and simulation: by joseph talavageet. Al: publisher: Taylor and FranciesUS
2. Computer integrated design and manufacturing by Bedworth el.alMcGraw-Hill,1991
3. Performance modeling of automated manufacturing systems by N. Viswanadham, Y. Narhari-1992
4. Automation, production systems and computer integrated manufacturing by Groover- Pearson education
5. CAD/CAM by P.N. Rao, Tewari NK, Kundra TK, "Computer Aided Manufacturing", Tata McGraw HillPublications
6. FMS By H KShivanand
7. Hand book of CIMS Teicholds and Orre McGrawHill

REFERENCE BOOKS:

1. Ranky, Dr. Paul, (1984), "The Design & Operation ofFMS".
2. Groover, Mikell P. (2002), 2/e, " Automation, Production Systems & Computer Integrated Manufacturing", Pearson Education orPHI
3. Viswanadhan, N. &Narahari, Y. (1998), "Performance Modelling of Automated Manufacturing Systems",PHI
4. Pinedo, Michael & Chao, Xiuly(1999), "Operations Scheduling with Applications in Manufacturing & Services", McGraw Hill International Editions (with 2 Floppy Disks of LEKIN SchedulingSoftware)
5. Kelton, Sadowsky&Sadowsky, "Simulation with ARENA",2/e, McGraw Hill International Editions (with CD of ARENA SimulationSoftware)
6. Radhakrishnan, Subramanyan, "CAD / CAM / CIM", JohnWiley
7. Rong, Yeming; "Computer Aided Fixture Design", Marcel Dekker, ISBN0-8247-9961-5
8. Hobbs, "Lean Manufacturing Implementation", J. Ross Publishing, ISBN1-932150-14-2
9. Chowdiah, Gargesa& Kumar, "Agile Manufacturing",TMH
10. Automation, Production System & Computer Integrated Manufacturing by Groover , publication-Englewood
11. Design and Operation of SMS by Rankey, publication-IFS
12. Flexible Manufacturing System by Wernecks, publication-Spring-Verlag.
13. FMS in Practice by Bonetto, publication- Northox Ford
14. Flexible Manufacturing Cells and systems by W.W. Luggen, Publication-PHI
15. Performance Modeling of Automated Manufacturing Systems by Vishwanathan&Narahari, publication-Prentice Hall India

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech(Mechanical Engineering) **CBSE PATTERN Semester VII**

SEMINAR

SUBJECT CODE:PCC ME 406

Teaching Scheme:	**Examination Scheme:**
Practical: 02Hrs/week	Term Work: 25 Marks

Credit:1

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

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech (Mechanical Engineering) **CBCS PATTERN Semester VII**

SUMMER INTERNSHIP

SUBJECT CODE: -SI ME 407

Teaching Scheme:

Credits: 01

Examination Scheme:
Term Work: 25 Marks

Course Objective:
The course aims to:

1. Familiar the students to realize an industrial work.

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

1. Comprehend the knowledge gained in the coursework
2. Create, select, learn and apply appropriate techniques, resources, and modern engineeringtools.

Industrial Training
The students have to undergo an industrial training of minimum two weeks in an industry preferably dealing with Mechanical engineering during the semester break after Sixth semester and complete within 15 calendar days before the start of seventh semester. The students have to submit a report of the training undergone and present the contents of the report before the evaluation committee constituted by the department. An internal evaluation will be conducted for examining the quality and authenticity of contents of the report and award the marks at the end of the semester.
It is expected that students should undertake small assignment or work related to any of the course related aspect. Report is based on compilation of work carried out related to facility and layout planning, Industrial engineering- time study and motion study, Line efficiency evaluation and improvement, Process capability evaluation, Industrial automation, Process or machinery modification as identified.

Industrial Training Report Format:
Maximum fifteen students in one batch, involving three groups of maximum five students, shall work under one Faculty. The same group shall work for project under the same guide. However, each student should have different industrial training and its presentation.
The report should be of 20 to 30 pages. For standardization of the report the following format should be strictly followed.

1. Page Size: TrimmedA4
2. Top Margin: 1.00Inch
3. Bottom Margin: 1.32Inches
4. Left Margin: 1.5Inches
5. Right Margin: 1.0Inch
6. Para Text: Times New Roman 12 Point. Font

7. Line Spacing: 1.5Lines
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.

The entire report should be documented as one chapter with details like

1. "Name of Industry with address along with completed training certificate"
2. Area in which Industrial training is completed

All Students have to present their reports individually.

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech(Mechanical Engineering) **CBCS PATTERN Semester VII**

PROJECT PHASE–I

SUBJECT CODE: PW ME408

Teaching Scheme:
Practical:2 Hrs/Week/Batch
Credits: 3

Examination Scheme:
Term Work: 25Marks
Oral Exams: 25Marks

Course Objectives:
The course aims to:

1. Embed the skill in group of students to work independently on a topic/ problem/ experimentation selected by them and encourage them to think independently on their own to bring out the conclusion under the given circumstances of the curriculum period in the budget provided with the guidance of thefaculty.
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 makingprocess.

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

1. Improve the professional competency and research aptitude in relevantarea.
2. Develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and currentresearch.

Project Phase I Load:
A batch of maximum three groups of four to five students per group, shall work under one Faculty member of department. The group of one student is strictly not allowed.

Project Phase I Definition:
The project phase I work can be a design project / experimental project and or computer simulation project on Mechanical engineering or any of the topics related with Mechanical engineering stream. The project phase I work is allotted in groups on different topics.
The students groups are required to undertake the project phase-I during the seventh semester and the same is continued in the eighth semester (Phase-II). Project Phase-I consists of reviews of the work carried earlier and the submission of preliminary report. Report should highlight scope, objectives, methodology, approach and tools to be used like software and others, outline of project and expected results and outcome along withtimeframe.
The project phase I work is to be extended for project phase II at B. E. (Mech.) Sem. VIII with same group working under guidance of same Faculty member assigned for project phase I.

Project Phase I Term Work:
The term work under project submitted by students shall include
1. Work Diary: Work Diary maintained by group and countersigned by the guide weekly. The contents of work diary shall reflect the efforts taken by project groupfor

a. Searching suitable projectwork
b. Brief report preferably on journals/research or conference papers/books or literature surveyed to select and bring up theproject.

c. Day to day activities carried out related to project work for entiresemester.
d. Synopsis.

The group should submit the synopsis in following format

i. Title ofProject
ii. Names ofStudents
iii. Name ofGuide
iv. Relevance
v. Present Theory andPractices
vi. Proposedwork
vii. Expenditure
viii. References

2. The synopsis shall be signed by the each student in the group, approved by the guide and endorsed by the Head of theDepartment
3. Presentation: The group has to make a presentation in front of the Faculty members of department at the end ofsemester.

Project Phase I Report Format:

Project Phase I report should be of 25 to 30 pages (typed on A4 size sheets). For standardization of the project phase I reports the following format should be strictly followed.

1. Page Size: TrimmedA4
2. Top Margin: 1.00Inch
3. Bottom Margin: 1.32Inches
4. Left Margin: 1.5Inches
5. Right Margin: 1.0Inch
6. Para Text: Times New Roman 12 Point.Font
7. Line Spacing: 1.5Lines
8. Page Numbers: Right Aligned at Footer. Font 12 Point. Times NewRoman
9. Headings: Times New Roman, 14 Point , BoldFace
10. References: References should have the following format

ForBooks: “Title of Book”, Authors, Publisher,Edition
ForPapers: “Title of Paper, Authors, Journal/Conference Details,Year

Important Notes:

- Project group should continue maintaining a diary for project and should write (a) Book referred (b) Company visited (c) Person contacted (d) Computer work done (e) Paper referred (f) Creativethinking.
- The Diary along with Project Phase I Report shall be assessed at the time of oral examination
- One copy of the report should be submitted to Institute/ Department, One copy to Guide and one copy should remain with each student of the projectgroup.

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech(Mechanical Engineering) **CBCS PATTERN Semester VIII**

Mechatronics

SUBJECT CODE:PCC ME 409

Teaching Scheme:	**Examination Scheme:**
Lectures : 03 Hrs. per week	ESE : 70Marks
Practical : 02 Hrs. per week	CIE : 30 Marks
Credit :04	TermWork : 25Marks
	External Oral : 25 Marks

Pre-requisites:

Course Objectives:

1	To learn how to apply the principles of Mechatronics and automation for the development of system.
2	To learn the automation technology and industrial automation as applications of Mechatronics in manufacturing system.
3	To supply qualified personnel to meet the requirement of specialist in Mechatronics.
4	To prepare Mechanical Engineering students for advanced graduate studies in Mechatronics, Manufacturing engineering and related field.

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

1	DevelopasimulationmodelforsimplephysicalsystemsandexplainMechatronics design process.
2	Outline appropriate sensors and actuators for an engineering application
3	Write simple PLC programs
4	Explain various applications of design of Mechatronic systems

Unit 1 Introduction to Mechatronics **6**

Introduction to Mechatronics, Mechatronics systems, multi discipline scenario Transducers & Sensors, Position Sensors: Limit switch, photoelectric switches, proximity sensors, incremental & absolute encoders, decoders & relays. Displacement: Potentiometer sensors, capacitive displacement sensors. Velocity sensors: Tachogenerator, use of encoders, advances in sensors.

Unit 2 Signal Conditioning **6**

Signal conditioning process, Operational amplifier (inverting amplifier, non-inverting amplifier, summing, integrating amplifier, differtianting amplifier, logarithmic amplifier), protection, filtering, data acquisition, multiplexer, analog to digital converter (ADC), digital to analog converter (DAC). Sample and hold, demultiplexing. Polling and interrupts.

Unit 3 Digital circuits, Microprocessor and Microcontroller **8**

Introduction to Digital logic gates, Boolean algebra, application of logic gates, Combinational and sequential logic, flip flop, D flip flop, JK flip flop, Master slave flip flop.Comparison between microprocessor and micro controller, organization of a microprocessor and microcontroller system, architecture of PIC controller, instruction types and set,Introduction and applications of Arduino and Raspberry, Pi microcontroller, Applications of microcontroller.

Unit 4 Introduction to PLC **6**

Introduction, definition, PLC system and components of PLC input output module, PLC advantages and disadvantages. Ladder diagram & PLC programming fundamentals,machine control terminology, update – solve ladder – update, physical components Vs. program components.

Unit 5 Applications of PLC **8**

Internal relays, light control example, disagreement circuit, majority circuit, oscillator, holding (sealed or latches) contacts, always ON always OFF contacts, fail safe circuits, PLC timer and counter functions – Introduction and types.Industrial applications – Automatic liquid filling system, liquid mixture, traffic control.

Unit 6 Industrial control systems **6**

Introduction Human machine Interface (HMI), Difference between HMI and PLC, Introduction to SCADA and its industrial applications, motion controller, applications of RFID technology and machine vision, Introduction to DCS.

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

1. Trial on sensors (minimumfour)
2. Assignment on Microprocessor and Microcontroller.
3. PLC programming on Industrial Applications basedon Timers, Counters, internal relays (Minimum 4applications)
4. Fabrication of Simple Mechatronics working project by a group of 4/5 students using hardware and suitable software.
5. Assignment on HMI and SCADA
6. Industrial visit to study Mechatronics system application & submission of visitreport.

Note: Mechatronics Laboratory is expected to have a simple 8 input 8 output PLC

REFERENCE BOOKS:

1 Mechatronics – Mahalik, TATA McGraw Hill

2 Mechatronics – W. Bolton, Pearson education

3 Microprocessor 8085 – Gaokar

4 Introduction to PLC programming, NIIT

5 Programmable logical controller, Hackworth % Hackworth, Pearson Education

6 Programmable logical controller, Reis Webb, Prentice Hall

7 SCADA, Stuart A. Boyer, ISA Publication.

8 Mechatronics –AppuKuttam, Oxford publications

9 Human Machine Interface –Dhananjay R. Kalbande, PrashantKanade, Wiley Publications

10 Arduino - Richard Blum, Pearson education

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech(Mechanical Engineering) **CBCS PATTERN Semester VIII**

ENERGY AND POWER ENGINEERING

SUBJECT CODE:PCC ME 410

Teaching Scheme:	**Examination Scheme:**
Lectures: 3Hrs/Week	ESE: 70Marks
Practical: 2Hrs/Week	CIE: 30Marks
Credits:4	Term Work: 25Marks

Pre-requisites: Basic mechanical Engineering, Thermodynamics, Heat and Mass Transfer, Fluid and Turbo Machinery.

Course Objectives:

1. Enable the student to estimate the potential of energy sources.
2. Acquire the knowledge of renewable sources of energy and utilization.
3. Understand the new trends in power and energy sectors.
4. Study various power stations, Performance and economic analysis.

Course Outcomes

1. Analyze the utilization of solar, wind energetic.
2. Demonstrate need of different energy sources and their importance.
3. Illustrate power plant economics.
4. Comprehend various equipment's /systems utilized in power plants

Unit 01

Solarenergy [07]

Introduction to Renewable Energy sources, Solar potential, Solar radiation spectrum, Solar radiation geometry, Solar radiation data, Solar Collectors - flat plate, evacuated tube, Cylindrical parabolic, Concentrating paraboloid, Graphical representation of efficiency of various Collectors, Modern thermal energy storage - Ultra capacitors / Super capacitors, Super conducting materials, New generation batteries.

Unit02

Solar photovoltaic system[08]

Operating Principle of Photovoltaic cell concepts, Photo-cell materials, Cell module array, Series and parallel connections, Maximum power point tracking, Study of standalone system with battery and AC or DC load, Hybrid systems (Diesel-PV, Wind-PV, Biomass-Diesel systems), Applications, Introduction, Principle and operation of fuel cells, classification and types of fuel cell, Fuel for fuel cells, Application of fuelcells.

Unit03

Wind energy [04]

Wind parameters and wind data, Power from wind, Site selection, Wind energy conversion systems and their classification, Construction and working of typical wind mill, Introduction to OTEC.

Unit04

I. Power plants [08]

Different types of power plants – Thermal, Hydro, IC Engine, Gas Turbine, Nuclear and their characteristics, Combined Cycle, Pumped storage, Compressed Air storage power plants and their characteristics, Comparison of Power plants with respect to various parameters, Issues in Power plants,

II. Power scenario in India

Power scenario in India and world, NTPC, NHPC and their role in Power development in India, Power generation in Private sector, Power distribution, Power grid corporation of India, State grids, Railway grids and International grids.

Unit05

I. Instrumentation [08]

Flow measurement of feed water, fuel, air, steam with correction factor for temperature, Speed measurement, Level recorders, Radiation detectors, Smoke density measurement, Dust monitor, Flue gas oxygen analyzer – Analysis of impurities in feed water and steam – Dissolved oxygen analyzer – Chromatography – PH meter – fuel analyzer – Pollution monitoring instruments, Integration of instrumentation system.

II. LoadCurves

Load Curves and Load duration curves (Numerical treatments), Performance and operational characteristics of power plants, Peak load, Intermediate load and Base load plants and their characteristics, Input output characteristics of power plants, Economic division of between Base load plant and peak load plants, Tariff methods.

Unit06

Energy Marketing and Management[05]

Energy Management, Energy Marketing: Selling and marketing in India, Creating supply chain in India, Successfully working with business and virtual teams in India, Navigating the financial, legal and accounting environment, Human Resources issues, India's business culture in energy sector, Conservation ofenergy.

Term Work

1. Study of performance of solarcollectors.
2. Demonstration and measurement of solar radiation usingpyranometer.
3. Study of power plantinstruments.
4. Study of combined cycle gas based and coal based Powerplant.
5. Study of load curves and selection of plants for powergeneration.
6. Study of Indian electricity gridcode.
7. Industrial visit to any power plant / Survey based / Project based industrialvisit.
8. Energy Audit - Case study of an organization andreport

Text Books

1. "Solar Energy", S.P.Sukhatme and J.K.Nayak, Tata McGraw-Hill, 3rd Edition,(2008).
2. "Non-Conventional Energy Sources", G.D.Rai.-Khanna Publisher, 4thEdition.
3. "Power Plant Technology", M.M.ElWakil, Tata McGraw-Hill. Int, 2nd Edition. Reprint, (2010).
4. "Power Plant Engineering", Domkundwar and Arora, Dhanpatrai andSons.
5. "Modern Power Engineering", John Weisman and L.E. Eckart, Prentice Hall of India, (1985).

Reference Books

1. "Solar Photovoltaic Fundamentals, Technologies and Applications", Chetan Singh Solanki, Prentice Hall of IndiaPublications.
2. "Modern Power Station Practice", Vol.6, Instrumentation, Controls and Testing, by Pergamon Press, Oxford,(1971).
3. "Power System Analysis", Grainger John J, and Stevenson Jr.. W.D., Tata McGraw Hill, (2003).
4. "Economic Operation of Power Systems", L.K. Kirchmeyer, John Wiley and Sons,(1993).
5. "Power System Analysis", C.A. Gross, John Wiley and Sons, Inc.(1986).

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech(Mechanical Engineering) **CBCS PATTERN Semester VIII**

Noise and Vibrations

SUBJECT CODE: **PCC ME 411**

Teaching Scheme:	**Examination Scheme:**
Lectures: 3Hrs/ Week	ESE: 70Marks
Practical: 2Hrs/Week	CIE: 30 Marks
Credits: 4	Term Work: 25Marks
	Oral Exam: 25 marks

Pre-requisites: Engineering Mathematics, Theory of Machines.

Course Objectives:

The Course aims to

1. Study basic concepts of vibration analysis.
2. Acquaint with the principles of vibration measuring instruments.
3. Create awareness about principles of sound level measurement and noise.

Course Outcomes:

On Completion of the course, student will be able to

1. Understand relevance of noise in mechanical systems.
2. Carryout measurement of various vibration parameters.
3. Analyze vibratory response of mechanical element/system.
4. Estimate natural frequency of mechanical element/system.
5. Develop mathematical model to represent dynamic system

Unit 01

Introduction **(7) Hrs**

Vibration and oscillation, Causes and effects of vibrations, Vibration parameters – spring, mass, damper, Motion – periodic, non-periodic, harmonic, non- harmonic, Degree of freedom, Static equilibrium position, Vibration classification, Steps involved in vibration analysis, Simple harmonic motion, Equivalent stiffness of spring combination, un-damped free vibration.

Unit 02

Single DoF System **(7) Hrs**

a) Damped free vibrations, Types of damping, Logarithmic decrement and damping materials.

b) Forced Vibrations: Types of excitation, Forced excitation, Transmissibility-Force transmissibility and motion transmissibility, Vibration isolators, commercial isolation materials and shock mounts.

Unit 03

Two DoF System **(6) Hrs**

a) Free undamped vibrations – Principal modes and natural frequencies, Co-ordinate coupling and principalco-ordinates.

b) Forced vibrations (Undamped) – Harmonic excitation, Vibration Dampers and absorbers.

Unit 04

Introduction to Multi DoF System **(7) Hrs**

a) Free vibrations of Multi DOF System-Flexibility and stiffness influence coefficient matrix, Equation of motion.

b) Rayleigh's method and Holzer method.

Unit 05

Vibration Measuring Instruments **(6) Hrs**

Instruments for measurement of displacement, velocity, acceleration and frequency of Vibration, Exciters FFT analyzer. Introduction to Condition Monitoring and Fault Diagnosis.

Unit 06

Introduction to Noise **(7) Hrs**

Frequency dependent human response to sound, Sound pressure dependent human response, Decibel scale, Relation among sound power, Sound intensity and sound pressure level, Non auditory effects of noise on people, Auditory effects of noise, Noise standards and limits, Ambient emission noise standards in INDIA.

TERM WORK:

Minimum Eight Experiments out of following list. (Any 8 out of 1 to 9)

1. Experiment on equivalent spring mass system.
2. Experiment on study of forced vibration characteristics
3. Determination of logarithmic decrement for single DOF damped system
4. Experiment on torsional vibration of two rotors without damping
5. Experiment on torsional vibration of three rotors without damping
6. Use of different types of exciters for vibration analysis.
7. Measurement of vibration parameters using vibration measuring instruments
8. Introduction to FFT analyzer, and prediction of spectral response of vibrating machine from workshop.
9. Measurement of Noise by using noise measuring instruments.

TEXT BOOKS:

1. “Mechanical Vibrations”, Singiresu S. Rao, Pearson Education, ISBM –81-297-0179-0- (2004).
2. “Mechanical Vibrations”, G. K. Grover, Published by Nemchand and Brothers,Roorkee.
3. “Mechanical Vibrations”, Dr. V. P. Singh, Published by S. Chand and Sons NewDelhi.
4. “Noise and Vibration Control”, Leo L. Bernack, Tata Mc- Graw HillPublication.
5. “Mechanical Vibration and Noise Engineering”,A. G. Ambekar, Prentice Hall ofIndia.
6. “Fundamentals of Vibrations”, Balchandran Magrab ,CengageLearning.
6. “Theory of Vibrations with Applications”, W. Thomson, Pearson Education,2nd Edition.
7. “Mechanical Vibration”, Dr Debabrata Nag, Wiley India Pvt. Ltd ,ISBN978-81-265-3090-8.

REFERENCE BOOKS:

1. “Mechanical Vibration", Austin Church, Wiely Eastern. 2nd Edition.
2. “Schaumm's Outline Series in Mechanical Vibration”, S. Graham Kelly, 6th Edition.
3. “Kinematics, Dynamics and Design of Machinery", Waldron, Willey India, 2nd Edition.
4. “Mechanical Vibrations ”,J.P.Den Hartog,Tata Mc Grawhill Book CompanyInc.,4th Edition.
5. “Introduction to Dynamics and Control”, Leonard Meirovitch, J. Wiley, New York.
6. “Elements of Vibration Analysis” Leonard Meirovitch, Tata Mc Graw-Hill, New York. 2nd Edition.
7. “Principles of Vibration”, Benson H. Tongue, Oxford University Press., 4th Edition.
8. “Vibrations and Noise for Engineers”, Kewal Pujara Dhanpat Rai and Sons,(1992).
9. “Mechanical Vibration”, William J Palm III Wiley India Pvt. Ltd.,ISBN978-81-265-3168-4, 1st Edition.

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech(Mechanical Engineering) **CBCS PATTERN Semester VIII**

INDUSTRIAL ENGINEERING (ELECTIVE-III)

SUBJECT CODE: PCE ME 412

TeachingScheme:	**ExaminationScheme:**
Lecturers: 3Hrs/Week	CSE: 70Marks
Practical:2Hrs/Week	CIE: 30 Marks
Credits: 4	Term Work: 25Marks

Pre-requisites: Industrial Management and Operation Research

Course Objectives:

1. To introduce students the concepts, principles and framework of Industrial Engineeringand various productivity enhancementtechniques.
2. To understand Method study and time studytechniques.
3. To acquaint the students with tools and technique of materialhandling.
4. To acquaint the students the concept of value analysis, job evaluation and meritrating.

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

1. Manage an dimplementdifferentconceptsinvolvedinmethods studyandunderstandingof workcontent in different situations.
2. Measure and estimate standard time for job.
3. Understand different types of plant layouts.
4. Interpret job evaluation and merit rating.

Unit 1: Introduction to Industrial Engineering Productivity [06]

(A) Introduction to Industrial Engineering–Definition,Scope,Responsibilities, Important contributors to I.E., Tools and techniques of industrialengineering. **(B)Productivity**–Concept,objectives,Factorsaffectingproductivity,Tools andtechniquestoimprove productivity, Productivity measurementmodels

Unit2: Method Study [08]

Historical background, role of work study in improving productivity, method study procedure, selection of jobs, information, collection and recording; Recording techniques, charts, diagrams, templates, models, critical analysis, development, installation, and maintaining bettermethod

Unit3: Motion Study & Human Factor Engineering (Ergonomics) [06]

A) Motion Study: Principles of motion economy, micro motion study, SIMO chart, MEMO motion study, cycle graph, chronocyclegraph

B) Human Factor Engineering (Ergonomics): Introduction, objectives definition, man machine system, physiological work measurement, design ofcontrols.

Unit 4: Work Measurement (TimeStudy) **[08]**

Definition, objectives, procedure, time study equipment, performance rating, allowances, concept of normal time and standard time, calculation of standard time, work sampling, predetermined motion time analysis.

Unit 5:Facility Design **[06]**

Plant site selection, factors influencing the selection, optimum decision on choice of site and analysis, types of plat layout, advantages and disadvantages of layout, principles and objectives of plant layout, tools and techniques of layout planning, material handling- Objective, elements, functions, principles, types of material handling equipments.

Unit 6: Value analysis & Job evaluation andmeritrating **[06]**

A] Value analysis: Definition, concept of approaches of value analysis and engineering,steps, evaluation, and applications of value analysis.

B] Job evaluation and merit rating: Definition, objectives, procedure of job evaluation, different schemes and their advantages anddisadvantages.

TERM WORK

Any Eight Assessments of the following:

1. Problems on productivity.
2. Case study on method study.
3. Man; Machine chart program.
4. Two handed process chart.
5. Stop watch time study for an operation.
6. Work sampling.
7. Plant site location analysis.
8. Case study on Value analysis concept.
9. Case study on job evaluation and merit rating.

TEXT BOOKS:

1. Introduction to Work Study, ILO, Geneva and Oxford and IBH Publi. Co. Pvt.Ltd.
2. M. Telsang, "Industrial Engineering and Production Management", S. ChandPublication.
3. L.C. Jhamb, "Industrial Engineering", Everest Publication,Pune.
4. O.P. Khanna, "Work Study" DhanpatRaiPubli. NewDelhi.
5. M Mahajan, Industrial Engineering and Production Management, DhanpatRai andCo.
6. Banga and Sharma, Industrial Organization & Engineering Economics, Khannapublication.

REFERENCE BOOKS:

1. R.M. Barnes, "Motion and time study design and measurement of work" John Willey &Sons Inc. 7th Edi.
2. H.B. Maynard and others, "Industrial Engg. Handbook" IVth Edi. McGraw HillPubli.
3. J.AdamEE,RJEbert"ProductionandOperationManagement",PrenticeHallEnglewoodCliff N.
4. David Sumanth, "Productivity Engg. And Management", Tata McGraw Hill, NewDelhi.
5. Gavrial Salvendy" Hand book of Industrial engineering" John Wiley andsons,New York,2007
6. M. I. Khan "Industrial engineering" New age international(P) ltd, NewDelhi,2004.
7. International labour office, "Introduction to work study" Publisher International labour office,1969.

Digitalized2008.
8. Introduction to Work Study by ILO, ISBN 978-81-204-1718-2, Oxford &IBH Publishing Company, New Delhi, Second Indian Adaptation,2008.
9. Zandin K.B., Most Work Measurement Systems, ISBN 0824709535, CRCPress,2002.

SHIVAJI UNIVERSITY, KOLHAPUR

Final Year B.Tech(Mechanical Engineering) **CBCS PATTERN Semester VIII**

PRODUCTION MANAGEMENT (ELECTIVE-III)

SUBJECT CODE: PCE ME 412

TeachingScheme:
Lectures: 3Hrs/Week
Practical:2Hrs/Week
Credits:4

ExaminationScheme:
ESE: 70Marks
CIE: 30Marks
Term Work: 25Marks

Pre-requisites: Mathematics, Production Engineering.

Course Objectives:
The course aims to:

1. Get acquainted with basic aspects of Productionmanagement
2. Study various important planning, organizing and controlling aspects of Operations management
3. Study different operational issues in manufacturing and serviceorganizations.

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

1. The students will have fair understanding of the role of Production / Operations Management played in businessprocesses.
2. Emphasis on both familiarization of various production processes and service systems and quantitative analysis of problems arising in the management ofoperations.

Unit 1 Introduction to Production Management [07]

Production types, Objectives and scope of Production Management(1), Production Planning and Control (PPC)- Definition and elements and activities of production planning and production control Relevance(2), Strategy formulation process(3), Order qualifiers and order winners(4), Strategic options for Operations- Product – Process Matrix(5), Product portfolio, Process technology(6), WCMpractices(7).

Unit 2 Product and Process Design [06]

Determinants of process characteristics- Volume, Variety, Flow, Types of processes(1), Choice of Process, Equipment selection(2), Use of BEP in selection process- Product matrix(3). Estimation of Demand- Time series Analysis and causal forecasting techniques, Least square method, Moving average and exponential smoothing forecasting method(4) Role of Product Development in competitiveness(5), Product Life Cycle (PLC),Product Development Process (6).

Unit 3 Capacity and Scheduling of Operations [07]

Capacity- Definition, Measure of Capacity(1), Capacity strategies,Estimation of number of machines(2), Overcapacity and under capacity factors, Aggregate Planning, Aggregate Planning

Strategies(3), Use of transportation model approach to aggregate planning Loading, schedulingand sequencing(4), Priority sequencing rules(5). Sequencing problems, n job 2 machines, n Job '3' machines(6). Forward and backward scheduling, Critical ratio scheduling, Production Control Activities(7)

Unit 4 Supply Chain Management and Advanced Manufacturing Techniques [08]

Concept of supply chain and supply chain management(1), Manufacturing supply chain, SCM activities, Supply chain strategies, Managing supply chain, Measuring supply chain performance(2),JIT Philosophy, Origin and core logic of JIT, Elements of JIT(3), Kanban System- Design of Kanban containers(4), JIT.Implementation issues and performance(5), Lean Manufacturing- Pillars(6), features and process comparison with Traditional Manufacturing(7-8).

Unit 5 Total Productive Maintenance and Replacement [06]

Introduction, Definition, Six big losses, Stages of maintenance(1), Pillars stages of TPM Development(2), Overall Equipment Effectiveness (OEE) (3) Computation Replacement - need, Replacement of items whose maintenance cost increases with time(4) (with and without considering time value of money), Replacement of items that fail suddenly(5-6)

Unit 6 Production Economics [06]

Demand and supply, Demand curve and supply curve(1), Equilibrium of supply and demand(2), Elasticity of demand Production function, Factors of production, Isoquants(3), Review - Time value of money, Cash flows(4), Evaluation criteria for capital projects(5) (investment) Payback period, IRR and BCR(6)

Term Work:

1. Presentation on Case study on "Interdepartmental relationship in a businessorganization"
2. Presentation on Case study on "Design for Manufacturing andAssembly".
3. Assignment on DemandForecasting.
4. Problems on Job sequencing- Single Machine Scheduling, Priority Sequence and Johnson'sAlgorithm.
5. Presentation on Case study on "Implementation of JIT in a small/ mediumcompany".
6. Problems on Estimate OEE and ReplacementAnalysis.
7. Exercises on Analyzing tools in Projectpreparation.
8. Presentation on World Class Manufacturing Practices like Toyoto Mfg. system,etc.

Text Books:

1. "Industrial Engineering and Production Management", Martand Telsang, S Chand and Company New Delhi,(2009).
2. "Productions and Operations Management", KanishkaBedi, Oxford Higher Education., 3rdEdition.
3. "Production and Operation Management", Tripathi, ,ScitechPublications.
4. "ProductionandOperationManagement",S.N.Chary,TataMcgGrawHill,5thEdition.

ReferenceBooks:

1. "Production and Operations Management", Buffa. Elwood modern Wiley India,8thEdition.
2. "Operation Management, Process and Value Chain", Krajewski and Ritzman, MalhotraPearsonEducation.

3. “Production and Operations Management”, Ashwathappa, Bhat , HimalayaPublishing
4. “Techniques of Value Analysis and Engineering”, MilesLawrence.
5. “Operation Management Theory and Practice”, Mahadevan B PearsonEducation,(2007)
6. “Operations Management” Kaitherand Frazer, CengagePublication
7. “Production and Operation Management”, Everett E. Adam and Ebert, PHI Publication, ISBN no.9788120308381.

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech(Mechanical Engineering) **CBCS PATTERN Semester VIII**

Fracture Mechanics (Elective- III)

SUBJECT CODE:PCE ME 412

TeachingScheme:	**Examination Scheme:**
Lectures: 3Hrs/ Week	ESE: 70Marks
Practical: 2Hrs/Week	CIE: 30Marks
Credits: 4	Term Work: 25Marks

Pre-requisites: Advanced strength of materials or theory of elasticity

Course Objectives:

1. Develop basic fundamental understanding of the effects of crack-likedefects.
2. Identify and formulate the stress intensity factor ((k) for typical crackconfigurations
3. Identify and formulate the strain energy release rate(g).
4. Identify and formulate j - integral and the stress and strain fields around a crack tip for nonlinear and elasto-plasticmaterials.
5. Define fracture toughness of materials using kc, gc andjc.
6. Employ the standard and nonstandard fracture mechanics tests to determine the fracture toughness ofmaterials.
7. Predict the fatigue life of structures using fracture mechanicsapproaches.

Course Outcomes:

1. Understand and account for the theoretical background of linear and nonlinear fracture mechanics.
2. Carry out fracture mechanics analysis and design, using handbooks, of simple crack problems in linear and nonlinearmaterials.
3. Determine the loading applied on acrack.
4. Evaluate fracture mechanicstesting.
5. Carry out analyses of crackgrowth
6. Determine whether or not stable crack growth can becomeunstable.
7. Apply the knowledge from the course on practical cases where linear fracture mechanics issufficient

Unit01 **[07]**

Fracture mechanics principles: Introduction and historical review, Mechanisms of Fracture, Sources of micro and macro cracks. Stress concentration due to elliptical hole, Griffith's energy balance approach. Fracture mechanics approach to design- strengths, stiffness and toughness. Stress intensity approach

Unit02 **[07]**

Linear elastic fracture mechanics, Crack tip stress and deformations, Relation between stress intensity factor and fracture toughness, Stress intensity factor. Dislocation theories of brittle fracture, ductile fracture, Notch effects, Fracture under combined stresses.

Fatigue Failure: Stress cycle, S-N curve, Description of fatigue fractured parts, Phases of fatigue fracture, Fatigue crack propagation, Effects of metallurgical variables, Temperature, Stress concentration, Size and surface factors, Fatigue under combined stresses.

Unit03 **[06]**

Elasto plastic fracture mechanics introduction, Elasto–plastic factor criteria, Crack-opening displacement (COD) and crack tip opening displacement (CTOD), J- Integral to solve energy of crack formation, the crack resistance (R-curves).

Unit04 **[07]**

Creep Failure: Creep curve, Structural changes and mechanisms during creep, Activation energy for steady-state creep, Fracture at elevated temperature.

Brittle Fracture: Transition temperature curves, Fracture analysis diagrams, various types of embitterment, Fracture under very rapid loading.

Unit05 **[06]**

Ductile Fracture: Condition for necking, Dislocation and void formation activities, Types of fractured parts.

Assessment of Types of Fractures by Observation: Comparison between different fractured parts undergoing various type of fracture.

Unit06 **[07]**

Design Application of the Knowledge of Failure: Design considering fatigue-Geber's parabola, Soderberg equation, Lubricating optimally to combat bearing failures. Selection of materials to prevent seizure, galling, etc. Wear reduction techniques, Fracture toughness consideration in design.

TERM WORK:

Minimum eight assignments from the following

1. The Evaluation of Fracture toughness by Numerical Methods of finite elements.
2. Methods for Evaluating Fracture toughness by Numerical Methods of Finite Differences (FD).
3. Evaluating Fracture toughness by Numerical Methods of Boundary Integral Equations.
4. The Evaluation of Fracture toughness by ExperimentalMethods.
5. Study of the Methods for Evaluating Fracture toughness by ComplianceMethod.
6. The Evaluation of Fracture toughness by Photoelasticity.
7. The Evaluation of Fracture toughness by Interferometery and Holography.
8. The Experimental evaluation of Fracture toughnessby
    a. Plane strain fracture toughness method
    b. JIntegral
9. Comparison between computer modeling and Experimental verification of Fatigue propertiesof S-N diagram, fatigue limit, fatigue crack growth rate, Parislaw.

TEXT BOOKS:

1. "Fracture Mechanics – Fundamentals and application", T.L. Anderson,CRCPress.
2. "Elements of Fracture Mechanics", Prashant Kumar, Tata McGraw –Hill, NewDelhi.

REFERENCE BOOKS:

1. "Metal Fatigue Design and Theory", Madoyag,F.
2. "Fatigue Design of Machine Components", Sors, L., PergamonPress.
3. "Fracture and Fatigue Control Structures", Rolfe, S.T. and Barson, J.M., Prentice Hall ofIndia.
4. "Elementary Engineering Fracture Mechanics", Broek, D.,Noordnoff.
5. "Mechanical Metallurgy", Dieter, G.E., Tata McGraw Hill Book Co., NewDelhi.

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech(Mechanical Engineering) **CBCS PATTERN Semester VIII**

Reliability Engineering (Elective- III)

SUBJECT CODE:PCE ME 412

TeachingScheme:	**ExaminationScheme:**
Lectures: 3Hrs/ Week	ESE: 70Marks
Practical: 2Hrs/Week	CIE: 30 Marks
Credits: 4	Term Work: 25Marks

Pre-requisites: Manufacturing Engineering, Mathematics.

Course Objectives:

1. Introduce principles of reliability in engineering design.
2. Develop understanding of concepts of failures, maintainability and availability of the intended products/systems and services.
3. Develop an ability to analyze field failure data in order to evaluate system reliability.
4. Develop an ability to apply various reliability techniques to solve interdisciplinary reliability problems.

Course Outcomes:

1. Explain basics of reliability, maintain ability and availability and differentiate among them.
2. Apply fundamentals of reliability to estimate reliability of mechanical systems, electronic devices, software's andhuman.
3. Analyze field failure data for reliabilityanalysis.
4. Evaluate system reliability using varioustechniques.

Unit 01

Fundamentals of Reliability anditsMeasures **[07]**

Brief history of reliability, Concepts, Terms and definitions, System safety, Quality and reliability, Lifecyclecostofaproductorsystem, Systemeffectiveness, Conceptoffailure, Laws of probability, Random variables, Discrete and continuous probabilitydistributions.

Measures: Reliability function, Hazard rate function, CDF, PDF, MTTF, MTBF, Median time to Failure, Mean, Mode, Median, Skewness, Kurtosis, Variance and standard deviation, Typical forms of hazard rate function, Bathtub curve.

Unit 02

ReliabilityDistributions [06]

Basic reliability distribution, Conditional reliability, Constant Failure Rate (CFR) model, Binomial distribution, Normal, Poisson, Lognormal, Rayleigh, Weibull etc., Fitting probability distributions graphically and estimation of distribution parameters, Calculation of R(t), F(t), f(t), λ(t), MTTF, tmed, tmode for above distributions.

Unit 03

Reliability Evaluation of Systems [07]

System Reliability block diagram- Series configuration, Parallel configuration, Mixed configurations, Redundant systems, Standby redundant, Load sharing systems etc. High level versus low level redundancy, k-out-of-n redundancy, Network reduction and decomposition methods, Cut and tie set approach for reliability evaluation. Fault tree analysis (FTA), Success tree method, Failure mode and effect analysis (FMEA), Failure modes effects and criticality analysis (FMECA), Morkov analysis, Monte Carlo simulation.

Unit 04

Maintainability and Availability [07]

Maintainability - Objectives of maintenance, Types of maintenance, Concept ofmaintainability, factors affecting maintainability, System downtime, Measures of maintainability, Mean time to repair (MTTR), Analysis of downtime, Repair time distributions, Stochastic point processes, Reliability centered maintenance(RCM).

Availability -Availability concepts and definitions, important availability measures, Inherent, achieved and operational availability.

Unit 05

Reliability Testing and Data Analysis [06]

Reliability Testing - Life testing, Burn-in testing, Acceptance testing, Accelerated life testing, highly accelerated life testing (HALT) and reliability growth testing.

Data Collection and Analysis - Data collection, Empirical methods, Estimation of performance measures for ungrouped compete data, Grouped complete data, Analysis of censored data, Pareto analysis, and Goodness-of-fit tests.

Unit 06

Interdisciplinary Approach and Life Cycle Cost (LCC) [07]

Electronics - Reliability of electronic components, Component types and failure mechanism.Software – Introduction, errors, Software testing, Hardware/ software interface.Human reliability analysis (HRA) - Introduction, human error in maintenance, Impact on system reliability. Reliability costs, effect of reliability on LCC, Categories of costs, Calculation of LCC.

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

Any Four Assignments out of following.

1. Theory of Reliability and Probability.
2. Fitting probability distributions graphically and estimation of distribution parameters.
3. Numerical based on Reliability Evaluation of Systems.
4. Maintainability andavailability
5. Reliability testing

TEXT BOOKS:

1. "Introduction to Probability Models", Sheldon M. Ross, Elsevier,9thEdition.
2. "An Introduction to Reliability and Maintainability Engineering", Charles E. Ebling, Tata McGraw Hill Education Private Limited, New Delhi(2004).
3. "Reliability Engineering", L. S. Srinath, East West Press, New Delhi(1991).
4. "Reliability Engineering", K. K. agarawal, Springer InternationalEdition.
5. "Reliability Engineering", E. Balagurusamy, Tata McGrawHill.
6. "Reliability Engineering: Theory and Practice", Alessandro Birolini, Springer(2010).
7. "Reliability Evaluation of Engineering Systems: Concepts and Techniques", Roy Billiton and Ronald Norman Allan,Springer(1992).
8. "PracticalReliabilityEngineering",PatrickD.T.O'Conner,DavidNewton,Richard Bromley, John Wiley andSons.(2002)
9. "Reliability Engineering: Probabilistic Models and Maintenance Methods", Joel A. Nachlas Taylor and Francis(2005).
10. "Reliability in Engineering Design", K. C. Kapur, L. R. Lamberson, John Wiley andSons.
11. "Reliability Theory with Application to Preventive Maintenance", I. Gertsbakh , Springer Inc.Edition.
12. "Reliability Engineering and Quality Management", Onkar N. Pandey, BhupeshAneja, Katson andSons.

REFERENCE BOOKS:

1. "Reliability Engineering and Risk Analysis – A practical Guide", Mohammad Modarres, Mark Kaminskiy, VasiliyKrivstov, CRC Press, Taylor and FrancisGroup.
2. "Life Cycle Reliability Engineering", Guangbin Yang, John Wiley and Sons(2007).
3. "Case studies in Reliability and Maintenance", W. R. Blischke, D.N.P. Murthy, John Wiley and Sons(2003).
4. "Maintenance, Replacement and Reliability: Theory and Applications", Andrew Kennedy, Skilling Jardine, Albert H. C. Tsang, CRC/Taylor and Francis(2006).
5. "Engineering Reliability–New Techniques and Applications", B.S.Dhillon, Chanan Singh, John Wiley and Sons(1981).
6. "Engineering Maintainability", B. S. Dhillon Prentice Hall ofIndia., (1999).

SHIVAJI UNIVERSITY, KOLHAPUR

Final Year B.Tech(Mechanical Engineering) **CBCS PATTERN Semester VIII**

ADVANCED I.C.ENGINE (Elective –III)

SUBJECT CODE:PCE ME 412

TeachingScheme:	**Examination Scheme:**
Lectures: 3Hrs/Week	ESE: 70 Marks
Practical: 2Hrs/Week	CIE: 30 Marks
Credits: 4	Term work: 25Marks

Pre-requisites: I C Engine

Course Objectives:

The course aims to:

1) Understand modern fuel injectionsystems.
2) Understand thermodynamics of combustionphenomenon.
3) Understand cause of emission and itscontrol.
4) Understand alternative fuels for I Cengines.

Course Outcomes:

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

1) Analyze fuel injection system of ICengines
2) Analyze the combustion in thermodynamic point ofview.
3) Know design aspects of combustionchamber.
4) Know new trends in ICengines.
5) Know the modification in engines for alternativefuels.
6) Know advanced emission controlmethods

Unit 1 SI Engines [06]

Review of SI engine, Over-expanded engine cycle, Fuel characteristics, Fuel rating.Modern Carburetor. Recent Spark Plug, Spark Timing. Multi-Point Fuel injection system and its components, Sensors and transducers, ECU. Feedback system, Airflow and fuel flow phenomenon, Fuel injection pumps.

Unit 2 CI Engines [06]

Review of CI engine, Electronic fuel injection system, ECU, sensors and transducers, Feedback system, Fuel spray behavior, recent fuel injector and injection timing, Advance turbo charging system.

Unit3 Combustion [08]

SI engine combustion phenomenon, Turbulence characteristics, Chamber optimization Strategy, Thermodynamic analysis of SI engine combustion (Combustion Analyzer)CI Engine combustion phenomena, Swirl, Swirl Measurement, Generation of Swirl during induction, Swirl within cylinder, Chamber optimization Strategy, Thermodynamic analysis of CI engine combustion (Combustion Analyzer)

Unit4 AlternateFuels [07]

Hydrogen and Fuel cells, Ethanol, Bio-Diesels, Alcohols, LPG- Engine Modification, Combustion and Emission characteristics of SI and CI Engine using alternative fuels.

Unit5 Engine Emission, Pollution AndItsControls [07]

Formation of HC, NOx, CO mechanism, Smoke and Particulates emission, Methods of Controlling Emissions, Measuring Equipment's and methods, International and National EmissionNorms

Unit 6 Trends in IC Engines [06]

Variable Valve Timing, Recent CRDI engine, Variable Turbo Geometry system, 3- Way Catalytic Converter, Homogeneous Charge Compression Ignition, Variable compression ratio engine , Low Heat Rejection Engine, Lean Burn Engine, Six- Stroke Engine, Gasoline Direct Injection System.

Term Work:

Seven assignments (One Assignment on each unit and two assignments on unit three) and One case Study.

Text Books:

1. "Internal Combustion Engines Fundamentals", E. F. Obert, Harper and Row Publication, New York.

2. "Internal Combustion Engines",J. B. Heywood, McGrawHill.

3. "Internal Combustion Engines", Maleev, CBS Publication andDistributors.

4. "Internal Combustion Engines", J.Ganesan.

Reference Books:

1. "Internal Combustion Engines", Gills andSmith.

2. "Diesel and High Compression Gas Engines",J. M.Kates.

3. "Engg. Fundamentals of the I.C. Engines" W.W.Pulkrabek, Pearson Education.

SHIVAJI UNIVERSITY, KOLHAPUR,

Final Year B.Tech(Mechanical Engineering) **CBCS PATTERN Semester VIII**

MACHINE TOOL DESIGN (Elective III)

SUBJECT CODE:PCE ME 412

Teaching Scheme:	**Examination Scheme:**
Lectures:3Hrs. /Week	ESE: 70 Marks
Practical: 2Hrs./Week/Batch	CIE: 30Marks
Credits:4	Term Work: 25Marks

Course Objectives:

1. To understand core concepts of Machine Tool & ProductDesign.
2. To understand the basic approach for designing machine tool components and implement the appropriatemethod.
3. To compute the power requirements of various machinetools.
4. To learn to design quality based manufacturingsystem.
5. To learn to design a product using innovative concepts of 'ProductDesign'

Course Outcomes:

At the end of this course the student will be able to -

1. The student shall be able to apply the concepts of machine tool design.
2. The student shall be able to select the correct design approach & design the important components of machine tools.
3. The student shall be able to calculate the forces acting and the subsequent power requirements of machine tools.
4. The student shall be able to specifically design the critical components comprising a manufacturing system & emphasize on the quality of the system.
5. The student shall be able to analyse the various phases of the design cycle sequentially and envision the concept of "Scratch to Market" w. r. t a product.

Unit-1

Introduction to Machine & Machine Tool **(06)**

Types, capabilities, features of construction like working & auxiliary motions in machine tools, parameters defining the working motions of a machine tool, machine tool drives, general requirements of machine tool design, methodology for machine tools design considering quality, quantity of production and economic aspects.

Principle of Machine Tool Design from the point of view of quality, production rate, strength, rigidity, assembly, ergonomics, aesthetics, maintenance and interchangeability

Unit-2

a) Analysis offorces(2)

Forces affecting machine tool elements, determination of motive power for different operating conditions, useofhandbooks.

b) Design considerations and selection of standardcomponents(3)

Drive systems with pulleys, belts, ropes and chains; selection of oil seals, gaskets and electric motors from standard catalogues.

Unit-3

Kinematics of Machine Tools(8)

Classification of various driving systems, basic considerations in the design of drives, aims of speed & feed regulation, stepped regulation of speeds, design of gear box, laws of stepped regulations, selection of range ratio, G.P. ratio, break up of speed steps, structural diagram, Ray diagram & speed chart, design of feed box, machine tool drives using multiple speed motors, general recommendations for developing gearing diagram, determining the number of teeth on gears, stepless regulation of speed and feed rates.

Unit-4

a) Design of Spindle & SpindleSupport(3)

Functions of spindle unit and requirements, materials and construction, spindle ends, spindle support, design calculations, mounting arrangements of spindle bearings, spindlebearinglubrication

b) Selection of Machine ToolBearing (4)

Journal, rolling and hydrostatic bearings, basic principles, assembly, mounting and maintenance, procedure for selection of bearings from manufacturer's catalogue based on load and lifeconsiderations

Unit-5

a) Design of Machine ToolStructures(5)

Functions of machine tool structures and their requirements, design criteria, materials, static and dynamic stiffness, profiles of machine tool structures, basic design procedure, design of beds, columns, housings, rams etc, Causes of vibrations in machine tools and methodsof elimination.

b) Design of Guideways (5)

Functions and types of guide ways, materials, design criteria and calculations of slide-ways based on wear and accuracy, design of anti-friction guide ways, hydrostatic and hydrodynamic lubrication of guide ways.

Unit-6

Recent Trends of Machine Tool Design(5)

Recent trends in machine tools, Design considerations for SPM, NC/CNC, Micro/Nano machining, Retrofitting, Autonomous machine tool, Installation, Calibration and Machine tool testing.

SHIVAJI UNIVERSITY, KOLHAPUR,

Final year B. Tech. (Mechanical Engineering) CBCS PATTERN Semester VIII

DESIGNOFAIRCRAFTSYSTEMS(Elective–III)

SUBJECT CODE: PCE ME 412

TeachingScheme:	**ExaminationScheme:**
Lectures:3Hrs/Week	ESE: 70Marks
Practical:2Hrs/Week	CIE:30 Marks
Credits:4	TermWork:25Marks

Pre-requisites: Analysis of Mechanical Elements, Machine Design, Theory of elasticity.

Course Objectives:
The course aims to:
1. Study the fundamentals of aircraft design and structural analysis.
2. Study structural analysis of various components like plates, shells, beams.
3. Know about air worthiness.
4. Study aircraft structural repair.

Course Outcomes:
Upon successful completion of this course, the student will be able to
1. Understand the basics of aircraft systems and aircraft structures.
2. Know industry practices on design of aircraft structures and systems.
3. Understand the applicability of designaspects in aircraft design.
4. Relate the theoretical knowledge with the design of aircraft structures and systems.

Unit 01

Fundamentals of Aircraft Design and Structural Analysis (6)

Introduction, Phases of Aircraft Design, Aircraft Conceptual Design Process, Conceptual Stage, Preliminary Design, Detailed Design, Design Methodologies Review of Hooke' s Law, Principal stresses, Equilibrium and Compatibility, Determinate Structures, Conservation of Energy, Stress Transformation, Stress StrainRelations.

Unit 02

Aircraft Structures and Loads (7)

Types of Structural members of Fuselage and wing section Ribs, Spars, Frames, Stringers, Longeron, Splices, Sectional Properties of structural members and their loads, Types ofstructural

Joints, Type of Loads on structural joints Aerodynamic Loads, Inertial Loads, Loads due to engine, Actuator Loads, Maneuver Loads, VN diagrams, Gust Loads, Ground Loads, Ground conditions, MiscellaneousLoads.

Unit 03

Structural Analysis of Aircraft Structures - I (7)

Theory of Beams- Stress distribution diagram for cantilever and simplysupported beam.Equation of Bending. Symmetric Beams in Pure Bending, Deflection of beams, Unsymmetrical Beams in Bending, Plastic Bending of beams, Shear Stresses due to Bending in Thin Walled Beams, Bending of Open Section Beams, Bending of Closed Section Beams, Shear Stresses due to Torsion in Thin Walled Beams.

Unit 04

Structural Analysis of Aircraft Structures - II (7)

Theory of Plates -Analysis of plates for bending, stresses due to bending, Plate deflection under different end conditions, Strain energy due to bending of circular, rectangular plates, Plate buckling, Compression buckling, shear buckling, Buckling due to in plane bending moments, Analysisofstiffenedpanelsinbuckling,Rectangularplatebuckling,AnalysisofStiffenedpanels in Post buckling, Post buckling undershear

Unit 05

Structural Analysis of Aircraft Structures - III (7)

Theory of Shells-AnalysisofShellPanelsforBuckling,Compressionloading,ShearLoading/Shell Shear Factor, Circumferential Buckling Stress.

Theory of Torsion-Assumptions in theory of pure torsion, Torsion equation for solid and hollow circular shaft. Shafts of Non-Circular Sections, Torsion in Closed Section Beams, Torsion in Open Section Beams, Multi Cell Sections

Unit 06

Airworthiness and aircraft Structural Repair (6)

Airworthiness Regulations, Regulatory bodies, Type Certification, General Repair, Airframe Requirements, Landing Requirements, Fatigue and Failsafe Requirements. Types of Structural damage, Nonconformance, Rework, Repair, Allowable Damage Limit, Repairable Damage Limit, Overview of ADL Analysis, Types of Repair, Repair Considerations and bestpractices

Term Work:

Eight Assignments based on the Syllabus.

Out of eight, two assignments should contain the following:

• Hands-on calculation on Exercises related to Fundamentals of Structural Analysis

• Hands-on Calculation on Exercises involving, plate theory, beam theory and shell theory, Panel buckling, Shear flow Exercises in AircraftStructures.

Industrial Visits

With an intent to get some exposure on Aerospace and related industries, arrange

• Industry Visits to some of the Industries in Aerospace like HAL (Hindustan Aeronautics Limited),NAL(National Aerospace Limited),ISRO(Indian Space Research Organization)OR

• Visits to Aerospace MuseumsOR

• Building miniature Models of Aircraft /Gliders etc as a Hands on Exercises conducted as competitions

Text Books:

1. "AircraftDesign-AConceptualApproach",DanielP.Raymer,AIAAeducationseries,6th Edition.
2. "Airframe Structural Design", Michael Niu, ConmilitPress, 2nd Edition (1988).
3. "Airframe Stress Analysis and Sizing",Michael Niu, ConmilitPress,3rd Edition (1999).

Reference Books:

1. "Mechanics of flight", A.C. Kermode, Pearson Education, 5th Edition.
2. "The Elements of Aircraft Preliminary Design" , Roger D. Schaufele, Aries Publications (2000).
3. "Aircraft Structural Maintenance", Dale Hurst, Avotek publishers, 2nd Edition (2006).
4. "Aircraft Maintenance and Repair", Frank Delp, MichaelJ. Kroes and WilliamA.Watkins, Glencoe and McGraw-Hill,6th Edition (1993).
5. "Theory of Plates and Shells", S. S. Bhavikatti, New age International Publications, 3rd Edition(2017)

SHIVAJI UNIVERSITY, KOLHAPUR,

Final year B. Tech. (Mechanical Engineering) CBCS PATTERN Semester VIII

INDUSTRIAL AUTOMATION & ROBOTICS (Elective –IV)

SUBJECT CODE: PCE ME413

Teaching Scheme:	**Examination Scheme:**
Lectures : 03 Hrs. per week	ESE : 70Marks
Practical : 02 Hrs. per week	CIE : 30Marks
Credit :04	TermWork : 25Marks

Pre-requisites:

1. Knowledge computer integrated manufacturing,FMS,

Course Objectives:

1. Introduce automation and basic elements of automated systems.
2. Get knowledge of advanced automated and levels of automations.
3. Introduce the industrial robotics and its applications.
4. Knowledge of programming associated with robo-control.

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

1 Design techniques for the analysis and control of discrete event system

2 Applyknowledgeofautomationtoolsandotherequipment'sformanufacturingandassembly components

3 Operate in research and development centre for automation

4 Identify efficiencies and limitation and provide in depth evaluation of robotic system for

Unit 1 **Introduction to Automation** [06]

Automated manufacturing systems, Fixed/programmable/flexible, Automation, Need of automation, Basic elements of automated systems- Power, program and control. Low cost automation, Economic and social aspects of automation, Advanced automation functions, Levels of automation.

Unit 2 **Industrial Control and Transfer Line** [08]

A. Industrial control systems in process and discrete manufacturing industries, Continuous and discrete control; Computer process control.

B. Fundamentals of transferlines, Configurations, Transfer mechanisms, Storag ebuffers, Control, Applications

Unit 3 **Assembly Automation** [06]

Assembly Automation: Types and configurations, Parts delivery at workstations, Various vibratory and non-vibratory devices for feeding and orientation, Product design for automated assembly.

Unit 4 **Fundamentals of Industrial Robots** [06]

Specifications and Characteristics, Criteria for selection, Robotic Control Systems: Drives, Robot Motions, Actuators, Power transmission systems, Robot controllers, Dynamic properties of robots-stability, Control resolution, Spatial resolution,Accuracy, Repeatability, Compliance,Workcellcontrol,Interlocks

Unit 5 **Robotic End Effectors and Sensors** [07]

Transducers and sensors-Sensorsinroboticsandtheirclassification,Touch(Tactile)sensors, Proximity and range sensors, Force and torque sensing, End Effectors-Types, grippers, Various process tools as end effectors; Robot End effectors interface, Active and passive compliance, Gripper selection and design,

Unit 6 Robot Teaching [07]

Introduction, Various teaching method, Task programming, Survey of Robot level programming languages, A Robot programs a Pathinspace, Motion interpolation, WAIT, SIGNAL and DELAY commands, Branching, Robot language structure, Various textual robot, Languages such as VALII, Typical programming examples such as palletizing, Loading a machine etc., Application of Robot.

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

Term Work:

1. A Case study on low cost automation
2. Study of part delivery system at work stations in automated assembly.
3. Study of robot end effectors and sensors
4. Two Programming exercises using various commands of VALII.
5. Demonstration of various robotic configurations.
6. One Industrial visit for Industrial automation and robotic application

TEXT BOOKS:

1 Automation, Production Systems and Computer Integrated Manufacturing", Groover, M.P., Pearson Education, ISBN: 81-7808-511-9 2nd Edition (2004).

2 "Industrial Robotics, Technology, Programming and Applications", Groover, M.P.; Weiss, M.; Nagel, R.N. and Odrey, N.G. , McGraw Hill Intl. Edition.,ISBN: 0-07-024989- X.

3 "Introduction to Robotics, Analysis, Control and Applications", Niku, Saeed B., Willey Publication, ISBN 9788126533121, 2nd Edition.

4 "Robotics-Control, Sensing, Vision and Intelligence", Fu, K.S.; Gonzalez, R.C. and Lee, C.S.G., McGraw Hill Intl. Ed., ISBN:0-07-100421-1.

REFERENCE BOOKS:

1. "Robot Technology Fundamentals", Keramas, James G, Thomson Learning–Delmar ISBN:981- 240-621-2,(1998).
2. Handbook of Robotics", Noff, Shimon Y., John Wiley and Sons.
3. "Introduction to Robotics, Analysis, Systems and Applications", Niku, SaeedB.(2002),Prentice Hall of India.
4. "Robotics for Engineers", Koren, Yoram, Tata McGraw Hill.,(2003)
5. "Fundamentals of Robotics, Analysis and Control", Schilling, R

SHIVAJI UNIVERSITY, KOLHAPUR,

Final year B. Tech. (Mechanical Engineering) CBCS PATTERN Semester VIII

CRYOGENICS (Elective- IV)

SUBJECT CODE: PCE ME413

TeachingScheme:	**ExaminationScheme:**
Lectures:3Hrs/Week	ESE: 70Marks
Practical:2Hrs/Week/Batch	CIE: 30Marks
Credits:4	TermWork:25Marks

Pre-Requisites: Applied Thermodynamics, Refrigeration

Course Objectives:

The course aims to:

1. Enable the students to analyze and solve cryogenics related problems by applying principles of mathematics, science and engineering.
2. Prepare students to use modern tools, techniques and skills to fulfill industrial needs related to low temperature systems.
3. Effective communication skill to demonstrate cryogenics theories.
4. Develop skills in the analysis of cryogenics systems in research or design.
5. Develop a professional approach to life long learning in the cryogenics to include the awareness of social and environment issues associated with engineering practices.

Course Outcomes:

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

1. Learn the concept of low temperature and its application.
2. Explain liquefaction systems and cryogenic heat exchangers.
3. Apply knowledge of mathematics, science, and engineering for the needs in Cryogenic.
4. Do the analysis the cryo-coolers
5. Design and analysis separation and distillation column.
6. Define and understand the cryogenic insulation and storage vessel.

Unit1 **[06]**

Introduction:

Cryogenics, Cryogenic Temperature scale, Historical Development of Cryogenics, Properties of cryogenic Fluids, Applications of cryogenics in different areas such as Space, Medical and Biological, Manufacturing processes.

Behavior of Structural Materials at Cryogenic Temperature:

Mechanical properties, Thermal properties.

Unit 2 **[07]**

Liquefaction of Cryogenic Gases:

Ideal cycle, System performance parameters, Production of low temperature methods in Cryogenics (Joule Thomson effect, Adiabatic expansion), Liquefaction systems; Simple Linde-Hampson system, Pre-cooled Linde-Hampson system, Cascade system, Claude system, Comparisonofabovesystems.

Unit 3 **[07]**

Liquefaction Systems for Neon, Hydrogen, Helium and Heat Exchanger:

Maximum Inversion temperature, Limitations of Linde -Hampson System for liquefaction of Neon,HydrogenandHelium,PrecooledLinde-HampsonsystemforNeonandHydrogen, ClaudesystemforHydrogen,CollinsHeliumLiquefactionsystem,Heatexchangerusedin liquefactionsystems

Unit 4 **[06]**

Cryogenic Refrigeration Systems:

Ideal refrigeration systems, Philips refrigerator,Vuilleumier refrigerator, Solvay refrigerator, Gifford-McMohan refrigerator, Pulse tube refrigerator.

Unit 5 **[07]**

Gas Separation and Purification:

Thermodynamic Ideal separation system, Temperature composition diagram, Principles of Gas separation, Principles of Rectifiers column, Air Separation Systems (Linde Single Column system, Linde double column system).

Unit 6 **[07]**

Insulation: Cryogenic fluid storage,Vacuum insulation, Fibrous materials, Solid foams, Gasfilled powder, Comparison.

VacuumTechnology: Importance,Pumpdowntime,Flowregimes,Componentsofvacuum systems,MechanicalVacuumpumps,andIonpumps

Term Work:

Any six experiments/ tutorial based on above syllabus

Text Books:

1. “CryogenicSystems”,BarronF.Randall,OxfordUniversityPress,NewYork.
2. "CryogenicEngineering”,ThomasM.Flynn,MarcelDekkcr.Inc,NewYork.
3. "CryogenicProcessEngineering”,KlausD.Timmerhaus,ThomasM.Flynn,PlenumPublishing Corporation (1989).
4. "AppliedCryogenicEngineering”,Vance,R.W,andDuke,Isted,W.M.,JohnWiley(1962).
5. “IntroductiontoCryogenics”B.S.Gawali,MahalaxumiPublication.

Reference Books:

1. "ExperimentalTechniquesinlowTemperaturePhysics",Guy,KWhite,ClaredonPress, Oxford,(1987).
2. "Cryogenic Research and Applications", Marshall Sitting and Stephen Kidd, D. Van Nostrand,IncUSA,(1963).
3. "Cryo-Cooler:FundamentalsPart-I",G.Walker,PlenumPress,NewYork.
4. "Cryo-Cooler:FundamentalsPart-II",G.Walker,PlenumPressNewYork.
5. "InternationalJournalofCryogenics",ElsevierPublication.
6. "Advanced Cryogenic Engineering", Proceedings of Cryogenic Engineering Conference, Vol.1-145,PlenumPress,NewYork(1968).

SHIVAJI UNIVERSITY, KOLHAPUR,

Final year B. Tech. (Mechanical Engineering) CBCS PATTERN Semester VIII

Enterprise Resource Planning (Elective-IV)

SUBJECT CODE: PCE ME 413

Teaching Scheme:	**Examination Scheme:**
Lectures : 03 Hrs. per week	ESE : 70Marks
Practical : 02 Hrs. per week	CIE : 30Marks
Credit :04	TermWork : 25Marks

Pre-requisites:

Course Objectives:

1 Know the basics, evolution , importance of ERP
2 Correlate ERP and related technology
3 Understand manufacturing perspectives of ERP
4 Know business modules of ERP
5 Understandthekeyimplementationissuesandsomepopular products inERP
6 Understand implementation of ERP package

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

1 Understand the structure of an ERP system and know how process chains in materialsmanagement,production,controllingandsalesareimplementedinan ERPsystem Implementation and customize an ERP system using the appropriate modeling methods, that are Entity Relationship Modeling (ERM) and Event-Driven Process
2 Chains (EPC)
3 Understand the customization of an ERP system and customize essential parts of materials management, production, controlling and sales in SAP ECC
4 Understand software design issues in state-of-the-art business software and realize the importance of project management in an ERP implementation project
5 Understand what to expect, and not to expect, from a consultant implementing an ERP system
6 Understand the importance of IT governance in long-term relationships with a software vendor, such as SAP

Unit 1 Introduction to ERP [07]

Introduction, Evolution, Reasons for the growth of ERP market, Advantages, Benefits of ERP-Reduction of lead time, On time shipment, Reduction in cycle time, Improved resource utilization, Better customer satisfaction, Input supplier performance, Increasedflexibility.

Unit 2 ERP and Related Technologies [08]

Business Process Reengineering(BPR),Management Information System(MIS), Supply Chain Management (SCM), Decision Support System (DSS), Executive InformationSystem(EIS),Customerrelationshipmanagement(CRM)

Unit 3 ERP- A Manufacturing Perspective [05]

CAD/CAM,MRP,MRP II,Distribution Requirement Planning (DRP),Product DataManagement (PDM).

Unit 4 ERP Modules [07]

Introduction and study of Business modules like Finance, Mfg. and Production, Plant maintenance, Quality and Material Management, Sales and Distribution.

Unit 5 ERP Implementation Life Cycle [07]

Introduction, Pre-evaluation Screening, Package evaluation, Project planning, Gap Analysis, Reengineering, Configuration, Team training, Testing, End user training and Post-implementation phases, Enterprises application integration.

Unit 6 ERP Market and Case Studies [06]

Brief account of ERP market, various ERP packages like SAPAG, Oracle, People Soft, etc. Indian scenario for ERP implementation, Case studies based on implementation of ERP for various areas in mfg., Marketing and other businesses, E-commerce, cloud based ERP system.

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

1. Six assignments on each of above units.
2. Detailed study of implementation of ERP and its benefits for any suitable industry/organization

TEXT BOOKS:

1 "Enterprise Resource Planning", Alexis Leon,Tata McGrawHillPublication,ISBN0-07-463712-6.

2 "EnterpriseResourcePlanning",BretWagner,DelmarLearning,InternationalEdition,ISBN 10: 1439081085, ISBN–13: 978-1439081082.

3 "Enterprises Resource Planning", Venkateshswara, Scitech Publication.

4 "Entrepreneurship", Chris Boulton, Patric Turner, Willey India.

5 "Management Information System", S. Sadagopan, PHI, New Delhi, 2nd Edition.

REFERENCE BOOKS:

1 "ModernERP:SelectImplementandUse",MarianneBradford,HandMBooks,ISBN: 978-0-557-01291-6.

2 "Enterprises Resource Planning", E.F. Monk, B.J. Wagner, Cengage Learning.

3 "Enterprises Resource Planning", A. R Singla, Cengage Learning.

4 "Enterprises Resource Planning-Concepts and Practices", Vinod Kumar Garg andVenkitakrishnan N. K. , PHI, New Delhi.

SHIVAJI UNIVERSITY, KOLHAPUR,

Final year B. Tech. (Mechanical Engineering) CBCS PATTERN Semester VIII

MICRO-ELECTRO-MECHANICAL SYSTEMS (MEMS) (Elective IV)

SUBJECT CODE: PCE ME413

Teaching Scheme:	**Examination Scheme:**
Lectures : 03 Hrs. per week	**ESE : 70Marks**
Practical : 02 Hrs. per week	**CIE : 30Marks**
Credits :04	**TermWork : 25Marks**
	Practical/Oral: --

Pre-requisites: Fluid Mechanics Course Objectives:

Thecourseaimsto

1	Understand the concepts and context of MEMS
2	Understand various MEMS fabrication technologies
3	Understand MEMS-specific design issues, constraints and dynamics and modeling of Microsystems
4	Understand applications of micro sensors and micro actuators
5	Getting access to fabrication and testing in academia and industry

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

1	Gain a fundamental understanding of standard micro fabrication techniques and the issues surrounding them
2	Know the major classes, components, and applications of MEMS devices/systems and to
3	Demonstrate an understanding of the fundamental principles behind the operation of these devices/systems
4	Understand the unique requirements, environments, and applications of MEMS

5 Apply knowledge of micro fabrication techniques and applications to the design

6 Manufacturing of an MEMS device or a micro system

Unit 1 Introduction [06]

Introduction to Micromachining and MEMS, IC Fabrication, Essential technical background for lithography-based micromachining, Glimpses of Microsystems, Scaling effects, Distributed and lumped modeling approaches used in MEMS analysis andsimulations.

Unit 2 Micro sensors and Micro actuators [08]

Micro-sensors: Chemical sensors, Optical sensors, Pressure sensors, Thermal sensors – Thermopiles, Thermistors, Micro machined thermocouple probes, MEMS magnetic sensor, Microactuators: Capacitance, Piezo mechanics, Piezo-actuators as grippers, Micro grippers, Micro motors, Micro valves, Micro pumps, Micro accelerometers,Shape memory alloy based optical switch, Thermally activated MEMS relay, Micro spring thermal actuator.

Unit 3 Micro fabrication Processes [06]

Structure of silicon, Silicon wafer processing, Thin-film deposition, Lithography, Wet etching and Dry etching, Process integration, Bulk micromachining and Surface micromachining, Wafer-bonding, LIGA and other moulding techniques, Soft lithography. Thick-film processing, Low temperature co-fired ceramic processing.

Unit 4 Mechanics of Solids [08]

Stresses and deformation: Bars and beams, Micro device suspensions: Lumped modeling, Residual stress and stress gradients, Poisson effect, Anticlastic curvature, Examples of micromechanical structures, Thermal loading: Bimorph effect, Dealing with large displacements, In-plane and 3D elasticity equations, Vibrations of bars and beams.

Unit 5 Thermal, Fluid Flow in MEMS [06]

Thermal sensors and actuators and their analysis, Micro fluidics, Flow through micro channels, Miniature heat exchangers. Heat conduction in multilayered thin films,conduction in solids in sub micrometer scale.

Unit 6 Electronics and Packaging [06]

Semiconductor devices: Basics, Control and Microsystems, Vibration control of a beam, Integration of Microsystems and microelectronics, Packaging, Testing and reliability of Microsystems: Why and how?

TERM WORK /LIST OF EXPERIMENTS/ LIST OF ASSIGNMENTS:

Complete any 7 Assignments from below.

1. Case study of MEMS Sensors (Pressure sensor/ Accelerometer/Gyroscope).
2. Case-studyofMEMSActuators(Micro-pump/RFswitch).
3. Case-studyofSystemonchipe.g.,Drugdeliverysystem.
4. Visit to Micro fabricationfacility.
5. Visit to MEMS characterization and testing facility.
6. Lumped modeling of MEMS sensors/actuators in MATLABSimulink.
7. Introductory modeling of MEMS in multiphysics softwaree.g.ANSYSCOVENT
8. Study of Electrostatic Applications in MEMS like Electrostatic actuation (parallelplate),Electrostaticactuation(combdrive),Electrostaticsensing, Piezoelectric actuation, Piezoelectricsensing.
9. Study of:-
   i. Gyroscopic effect, Frequency response, Damping, Quality factor, Basic micro-flows for dampingcalculation.
   ii. Op-Amp and Op-Amp circuits, Signal conditioning for micro systemdevices.

REFERENCE BOOKS:

1 "MEMS and MICROSYSTEMS: Design and Manufacture", Hsu, Tai-Ran, TMH, ISBN:0-07-048709-X, (2003).

2 "MEMS", Mahalik, N. P., TMH, ISBN: 0-07-063445-9, (2007).

3 "MicromanufacturingandNanotechnology",Mahalik,N.P.,SpringerIndiaPvt. Ltd.,ISBN:978-81-8128-505-8(DistributedbyNewAgeInternational,NewDelhi) (Ed.),(2006)

4 "HandbookofMicrolithography,MicromachiningandMicrofabrication",P.Rai-Choudhury,SPIE,(1997).

5 "IntroductiontoMicroelectronicFabrication",RichardC.Jaeger,PrenticeHall, 2nd Edition,VolumeV,ISBN:0-201-44494-7,(2002).

6 "Nanosystems:MolecularMachinery,ManufacturingandComputation",KE Drexler,Wiley,ISBN0471575186,(1992).

7 "Microsystem Design", Stephen D. Senturia, Kluwer Academic Publishers, Boston, (2001).

SHIVAJI UNIVERSITY, KOLHAPUR,

Final year B. Tech. (Mechanical Engineering) CBCS PATTERN Semester VIII

ADVANCED REFRIGERATION(Elective IV)

SUBJECT CODE: PCE ME413

Teaching Scheme:	**Examination Scheme:**
Lectures: 3Hrs/Week	ESE: 70Marks
Practical: 2Hrs/Week	CIE: 30Marks
Credits:4	Term Work: 25Marks

Pre-requisites: Applied Thermodynamics, Refrigeration and Air Conditioning

Course Objectives

1. Understand the various methods ofRefrigeration.
2. Explain thermal analysis of vapour compressionsystem.
3. Understand the environmental aspect of refrigerants and alternaterefrigerants

Course Outcomes

1. Aware about market trends in the field of RAC and availability of various components in the market.
2. Update their knowledge in the subject and will bridge the gap between academics andindustry.
3. Improve utility of the students to RAC industry and will improve employment opportunity for the students.

Unit 01

Multistage Systems **[06]**

Multi-evaporator system; Multi expansion system; Cascade systems; Study of P-h; T-s; h-s and T-h charts for various refrigeration cycles, Heat Pump

Unit02 **[06]**

Vapour Absorption Refrigeration

Standard cycle and actual cycle, Thermodynamic analysis, Li-Br-water, NH_3-water systems, threefluid absorption systems, half effect, Single effect, Single-double effect, Double effect and triple effect system

Unit03 **[08]**

Modern Refrigerants & Non-Conventional Refrigeration System

Refrigerant recycling, Reclaim and charging, Alternative refrigerants, Refrigerant-lubricant mixture behavior, Synthetic Lubricants, Blending of refrigerants, Secondary refrigerants, Thermoelectric refrigeration, Thermo-acoustic refrigeration, Adsorption refrigeration, Steam jet refrigeration, Vortex tube refrigeration, and Magneticrefrigeration.

Unit04 **[05]**

Refrigeration Equipment's& Motor Selection

Study and Selection of Reciprocating, Screw, Scroll and Centrifugal Compressor based on applications, Selection of Single phase, Three phase, Starters, Constant speed and Variable speed Drive.

Unit05 **[10]**

Evaporators, Condenser, Control and Instrumentation

Design and Selection**,** Types, Thermal design, Effect of lubricants accumulation, Draining of lubricants, Selection and capacity control, Design and selection, Types, Thermal design, Purging, Selection and capacity Control, Selection of expansion devices, Design of refrigerant piping, Refrigeration system controls and safety devices, Solenoid valves, Suction and evaporator pressure regulators, Refrigeration system controller, High pressure receiver, Thermal design of low pressure receiver, Accumulator, Filters, Driers, Oil separators, Relief valves, Safety valves, High and low pressure cut out, Thermostats, Water regulators, System controller.

Unit06 **[05]**

Industrial refrigeration applications

Selection and design of various components for various Industrial refrigeration applications: Cold storage, ice plant, Process applications - Textile, Pharmaceuticals, Chemical, Transport, Food preservation, Dairy etc.Application and selection softwares of refrigeration system.

Term Work

1. Study and trial on cascade refrigerationsystem.
2. Study and trial on multi evaporatorsystem.
3. Study and Trial on multi compressorsystem.
4. Study and trial on nonconventional refrigerationsystem.
5. Component selection casestudy.
6. Industrial visit andreport.
7. Casestudyondesignofcommercialrefrigerationsystem.
8. Case study of coldroom.

Text Books

1. "Principles of refrigeration", R.J. Dossat, Pearson Education Asia Pearson Education,4th Edition.
2. "Refrigeration and Air-Conditioning", C.P. Arora, McGraw-Hill, 2ndEdition.
3. "Refrigeration and Air-conditioning", Stoecker andJones.
4. "Refrigeration", Manohar Prasad.

Reference Books

1. “Refrigeration and Air-conditioning”, Jordan andPriester.
2. “Refrigeration and Air-conditioning”, A.R. Trott,Butterworths.
3. “Thermal Environmental Engineering”, J.L. Threlkeld, Prentice Hall ofIndia.
4. “Industrial Refrigeration Handbook”, W.F. Stoecker,McGraw-Hill.
5. “Technician’s guide to Refrigeration Systems”,JohnA. Corinchock,McGraw-Hill.
6. “Industrial Refrigeration: Principles, Design and Applications”, P.C. Koelet,Mcmillan.
7. “ASHRAE Handbook”, (i) Fundamentals (ii) System iii)Applications.
8. “ISHRAEHandbooks”
9. “ARIStandards”
10. “Refrigeration Handbook”, Wang, McGraw Hill,Int.

SHIVAJI UNIVERSITY, KOLHAPUR,

Final year B. Tech. (Mechanical Engineering) CBCS PATTERN Semester VIII

Tribology (Elective IV)

SUBJECT CODE: PCE ME413

Teaching Scheme:	**Examination Scheme:**
Lectures: 3Hrs/ Week	ESE: 70Marks
Practical: 2Hrs/Week	CIE: 30 Marks
Credits: 4	Term Work: 25Marks

Pre-requisites: Physics, Chemistry, Mathematics, Fluid Mechanics, Theory of Machines, Machine Design.

Course Objectives:

1. Make student aware about Importance, scope and application of thissubject
2. Introduce the concepts of wear friction and lubrication and its application in design of tribologicalsystems.

Course Outcomes:

1. Awareness about the field ofTribology
2. Understand basis of friction, wear processes andlubrication
3. Aware about tribological issues in the design of machine components such as journal bearing, thrust bearing, and roller elementbearing
4. Familiarize with antifriction and anti-wear components of the material and the lubricants used therein
5. Design the tribological system from strength point ofview

Unit 01

IntroductiontoTribology **(6)**

Introduction Definition of tribology, Friction, wear and lubrication, Importance of the tribological studies. Properties of oils and equation of flow: Viscosity, Newton's Law of Viscosity, Hagen-Poiseuille Law, Flow between parallel stationary planes, viscosity measuring apparatus. Lubrication principles, Classification properties and applications of lubricants. Regimes oflubrication,

Unit02 **(5)**

Friction and Wear

Friction: Introduction, laws of friction, Kinds of friction, Causes of friction, Friction measurement, Theories of friction, Effect of surface preparation.

Wear: Types of wear, various factors affecting wear, Measurement of wear, wear between solids and liquids, Theories of wear.

Unit03 **(9)**

Hydrodynamic Lubrication

Friction forces and power loss in lightly loaded bearing, Petroff's law, Tower's experiments, mechanism of pressure development in an oil film, Reynold's investigation and Reynold's equation in 2D. Numerical problems.

Introduction to idealized journal bearing, Load carrying capacity, Condition for equilibrium, Sommerfeld's numbers and significance of it; Partial bearings, End leakages in journal bearing, Numerical problems.

Unit04 **(6)**

Slider / Pad Bearing With a Fixed and Pivoted Shoe

Pressure distribution, Load carrying capacity, Coefficient of friction, Frictional resistance and loss of Power in a pivoted shoe bearing, Numerical examples.

Unit05 **(7)**

Hydrostatic Lubrication:

Introduction to hydrostatic lubrication, Hydrostatic step bearings, Load carrying capacity and oil flow through the Hydrostatic step bearing.Numerical Examples.

Unit 06

BearingMaterials: **(7)**

Commonly used bearings materials, Properties of typical bearing materials.Advantages and disadvantages of bearing materials.

Introduction to Surface engineering: Concept and scope of surface engineering. Surface modification – transformation hardening, surface melting, thermo chemical processes. Surface Coating – plating, fusion processes, vapor phase processes. Selection of coating for wear and corrosion resistance

TERM WORK :

(Any 5 out of 1 to 7)

1. Journal BearingApparatus
2. Tilting pad and thrust BearingApparatus
3. Study of lubricationsystems.
4. Friction in JournalBearings.
5. Four BallTester
6. Coefficient of friction using pin on disc type frictionmonitor
7. Industrial visit to study techniques of coating – casestudy.
8. Assignments based on topics in the syllabus. (Minimum5)

TEXT BOOKS:

1. “Introduction to Tribology Bearings”, Mujumdar B. C., S. Chand Company Pvt. Ltd(2008).
2. “Engineering Tribology” PrasantaSahoo, PHI,Estern EconomyEdition.
3. “Fundamentals of Tribology”, Basu S K., Sengupta A N., AhujaB.B., PHI(2006).
4. “Tribology in Industries”, Srivastava S., S Chand andCompany.
5. “Lubrication of Bearings – Theoretical Principles and Design”, Redzimovskay E I., Oxford Press Company(2000)
6. “Tribology”, Prof R B Patil, ISBN978-81-8492-812-9.

REFERENCE BOOKS:

1. " Engineering Tribology", G. W. Stachowiak and A. W. Batchelor, Butterworth-Heinemann (1992)
2. " Friction and Wear of Materials", Ernest Rabinowicz, John Wiley &Sons(1995)
3. "Basic Lubrication Theory", A. Cameron, Ellis Hardwoods Ltd.,UK
4. "Handbook of tribology: materials, coatings and surface treatments ", B.Bhushan, B.K.Gupta ,McGraw-Hill (1997)

SHIVAJI UNIVERSITY, KOLHAPUR,

Final year B. Tech. (Mechanical Engineering) CBCS PATTERN Semester VIII

PRECISION ENGINEERING (Elective IV)

SUBJECT CODE: PCE ME413

Teaching Scheme:	**Examination Scheme:**
Lectures: 3Hrs/Week	ESE: 70Marks
Practical:2Hrs/Week	CIE: 30 Marks
Credits:4	Term Work: 25Marks

Course objectives:

The course aims to:

1. Study the basics of precision engineering and different manufacturing technique in precision engineering
2. Get acquainted with various techniques of precision engineering like nano technology etc.
3. Understand importance of accuracy, influence of static stiffness, vibration accuracy etc.

Course Outcomes:

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

1. Specify what is meant by a precision engineering and list the basic components of an precision engineering
2. Explain how precision engineering can be specified.
3. Outline the Major issues of planning for the creation of precision engineering.
4. State points that arise from precision engineering quantitative analysis

Unit 1 Accuracy and Alignment Tests [08]

General concept of accuracy – Spindle rotation accuracy – Test methods- Displacement accuracy – Clamping errors - Setting errors -Location of rectangular prism, Cylinder-Basic type of tests – Measuring instruments used for testing machine tools - Alignment tests-Straightness, Flatness, Parallelism, Squareness, Circularity, Cylindricity.

Geometric Dimensioning and Tolerancing

Tolerance Zone Conversion-Surfaces, Features, Features of Size, Datum Features- Datum Oddly Configured and Curved Surfaces as Datum Features, Equalizing Datums - Datum Feature of Representation Form Controls, Orientation Controls-Logical Approach to Tolerancing.

Unit 2 Precision Machining [06]

Introduction - Top down and bottom up approach - Development of Nanotechnology – Precision and micromachining -Diamond turning of parts to nanometer accuracy- Stereo microlithography Machining of micro-sized components-Mirror grinding of ceramics-Ultra precision block gauges.

Unit 3 Nano Measuring Systems [06]

In - process measurement of position of processing point - Post process and online measurementof dimensional features - Mechanical measuring systems - Optical measuring systems – Electronbeam measuring systems – Pattern recognition and inspection systems.

Unit 4 Lithography [06]

Nano Lithography – Photolithography - Electron beam lithography – Ion Beam lithography - Optical lithography - LIGA process- Dip pen lithography-Deep UV lithography, Nanocoatings.

Unit 5 Reliability Engineering [06]

Introduction to reliability, System reliability, Quantification of reliability: MTBF, MTTF,Analytical treatment based on series, Parallel and combination systems, Failure modes, FMECA, calculation of Risk Priority Number (RPN).

Unit 6 Tolerance Analysis[08]

Process Capability, Mean, Variance, Skewness, Kurtosis, Process Capability Metrics, Cp, Cpk, Cost aspects. Feature Tolerances, Geometric Tolerances. Surface Finish: Review of relationship between attainable tolerance grades and different machining process. Cumulative effect of Tolerances sure fit law, normal law and truncated normal law, tolerance stacking.

Term Work:

1. Various alignment test for sample component to check parallelism, circularity, straightness, flatness, surface finish and tolerance.
2. Understanding of fits with some practical hand on based on sample components and brief write up based on above.
3. Visit to suitable set up/industry/Research and Development Laboratory where nanotechnology is used.
4. Numericals based on system reliability for series, parallel and combination (Min. Two problems on each type)
5. Numericals on tolerance analysis for any sample component.
6. Assignment on tolerance stacking.

Text Books:

1. "Precision Engineering in Manufacturing", Murthy.R.L, New Age International, Delhi.
2. "Nanotechnology", Norio Taniguchi, Oxford University Press, Cambridge, (1996).
3. "Precision Engineering", Venkantesh V.C., Inzman S., Tata McGraw Hill, New Delhi, (2007).

Reference Books:

1. "Precision Motion Control Design and Implementation", Lee Tong Hong, Springer Verlag, U.K., (2001).
2. "Precision Machining of Advanced Materials", Liangchi Zhang, Trans Tech Publications Ltd., Switzerland, (2001).
3. "Principles of Precision Engineering", HiromuNakazawa, Oxford Uni. Press, (1994).
4. "Geometric Dimensioning and Tolerancing", James D. Meadows, Marcel Dekker Inc. (1995).
5. "Engineering Design – A systematic Approach", Matousek, Blackie and Sons Ltd. London.

SHIVAJI UNIVERSITY, KOLHAPUR,

Final year B. Tech. (Mechanical Engineering) CBCS PATTERN Semester VIII

online Certificate Course****

SUBJECT CODE: PCE ME414***

TeachingScheme:	**ExaminationScheme:**
	Term Work: 25 Marks
Credit: 2	

Course Objective –
To teach use of Moodle/Swayam/MOOC/NPTEL.etc. as a learning platform designed to provide educators, administrators and learners with a single robust, secure and integrated system to create personalized learning environment.

Course outcome –
On successful completion of the course
Student should be able to Students will be able to choose course of their choice from Moodle/Swayam/MOOC/NPTEL. etc. and to be acquaintance with recent advance developments in Mechanical Engineering beyond syllabus.

The Student should register the online course with Moodle/Swayam/MOOC/NPTEL. etc. of his interest in Recent Advances in Mechanical Engineering at a Start of his/her final year (i.e. at Semester VII.) and Same is intimated to Head of Department. For Term Works Student has to Submit Completion Certificate of Course to the Department till end of Semester VIII. Term Work will be given at the end of Semester VIII.

The Student may choose**courses likes *****

1. **Design of Mechatronic Systems_**IIT Bombay
2. **Mechanics and Control of Robotic Manipulators_**IIT Palakkad
3. **Automation in Production Systems and Management,** IIT Kharagpur
4. **Toyota Production System,** IIT Roorkee
5. **Fundamentals of Artificial Intelligence,** IIT Guwahati
6. **Introduction to Airplane performance, IIT** Kanpur

***(These are Sample Courses given student has choice to select his own area)**

SHIVAJI UNIVERSITY, KOLHAPUR,

Final year B. Tech. (Mechanical Engineering) CBCS PATTERN Semester VIII

PROJECT PHASE–II

SUBJECT CODE: PWME 415

Teaching Scheme:
Practical:6Hrs/Week/Batch
Credit: 3Oral Exam: 25 Marks

Examination Scheme:
Term Work: 50 Marks

Course Objectives:
The course aims to:

1. Embed the skill in group of students to work independently on a topic/ problem/ experimentation selected by them and encourage them to think independently on theirown to bring out the conclusion under the given circumstances ofthe curriculum period inthe budget provided with the guidance of thefaculty.
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 makingprocess.

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

1. Improve the professional competency and research aptitude in relevantarea.
2. Develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and currentresearch.

Project Phase II Load:
A batch of maximum three groups of four to five students per group, shall work under one Faculty member of department. The group of one student is strictly not allowed. Same groups of Seventh Semester shall work under same faculty member of department.

Project Phase II Definition:
Project phase-II is a continuation of project phase-I started in the seventh semester. Beforethe end of the eighth semester, there will be two reviews, one at start of the eighth semester and other towards the end. In the first review, progress of the project work done is to be assessed. In the second review, the complete assessment (quality, quantum and authenticity) of the thesis is to be evaluated. Both the reviews should be conducted by guide and Evaluation committee. This would be a pre-qualifying exercise for the students for getting approval for the submission of the thesis. The final evaluation of the project will be externalevaluation.

Project Phase II Term Work:
The term work under project submitted by students shall include
1. Work Diary: Work Diary maintained by group and countersigned by the guide weekly. The contents of work diary shall reflect the efforts taken by project groupfor
a. Brief report preferably on journals/ research or conference papers/ books or literature surveyed to select and bring up theproject.
c. Brief report of feasibility studies carried to implement the conclusion.
d. Rough Sketches/ Design Calculations/ Testing reports/ Experimentation results.

Project Report:

Project report should be of 50 to 60 pages (typed on A4 size sheets). For standardization of the project reports the following format should be strictlyfollowed.

1. Page Size: TrimmedA4
2. Top Margin: 1.00Inch
3. Bottom Margin: 1.32Inches
4. Left Margin: 1.5Inches
5. Right Margin: 1.0Inch
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 NewRoman
9. Headings: Times New Roman, 14 Point Boldface
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 ofReport:

i) TitleSheet
ii) Certificate
iii) Acknowledgement
iv) Table ofContents.
v) List ofFigures
vi) List of Tables

1. Introduction
2. Literature Survey/Theory
3. Design/ Fabrication/ Production/ Actual work carried out for the same and Experimentation.
4. ObservationResults
5. Discussion on Result and Conclusion

12. References: References should have the followingformat

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

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

13. The Project report shall be signed by the each student in the group, approved by the guide and endorsed by the Head of theDepartment
14. Presentation: The group has to make a presentation in front of the faculty of department at the end ofsemester.

Important Notes:

- Project group should continue maintaining a diary for project and should write (a) Books referred (b) Company visited (c) Person contacted (d) Computer work done (e) Paper referred (f) Creativethinking.
- The Diary along with Project Report shall be assessed at the time of oralexamination
- One copy of the report should be submitted to Institute/ Department, One copy to Guide and one copy should remain with each student of the projectgroup.