परीक्षा नियंत्रण प्रकोष्ठ, जबलपुर इंजीनियरिंग महाविद्यालय, जबलपुर (म.प्र.)

क्रमांक / प.नि.प्र. / 2024 / 2682 जबलपुर, दिनांक 18 / 10 / 2024

सूचना

महाविद्यालय में अध्ध्यनरत B.Tech. (AICTE) / B.Tech. (PTDC) [AICTE] [Regular/Ex.] विद्यार्थियों को सूचित किया जाता है कि वे नवम्बर 2024 की परीक्षा एवं आगामी सत्र की परीक्षाओं में सम्मिलित होने से पूर्व अपने पेपर / विषय का Equivalence Syllabus महाविद्यालय के पोर्टल से Download कर प्राप्त कर सकते हैं अथवा महाविद्यालय के परीक्षा नियंत्रण प्रकोष्ठ में संपर्क कर सकते हैं। नवम्बर 2024 परीक्षा एवं आगामी सत्र की परीक्षा में उन्हें अपने पेपर / विषय में Equivalence Syllabus में ही सम्मिलित होना है। अतः Equivalence Syllabus की जानकारी न होने की दशा में सम्पूर्ण जिम्मेदारी स्वयं छात्र / छात्राओं की होगी।

Equivalence Syllabus हेतु निम्नानुसार Link का उपयोग कर सकते है:–

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जबलपुर इंजीनियरिंग महाविद्यालय
जबलपुर

पृ.क्रमांक / प.नि.प्र. / 2024 / जबलपुर, दिनांक / 10 / 2024

प्रतिलिपिः–

01. समस्त विभागाध्यक्ष, जबलपुर इंजीनियरिंग महाविद्यालय, जबलपुर।
02. पीटीडीसी कार्यालय, जबलपुर इंजीनियरिंग महाविद्यालय, जबलपुर।

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जबलपुर

Note : printed on 01/10/2024 after Corrections

EQUIVALENCE OF SUBJECTS OF DIFFERENT SCHEMES OF UNDER GRADUATE COURSES (B.Tech.) OF MECHANICAL ENGG.

S.No.	Schemes	Subject Code & Subject Name (Semester) Having Equivalence in Syllabus	Final Subject code & subject (after equivalence)
(i)	(ii)	(iii)	(iv)
1	AICTE	BT204 Basic Mechanical Engineering **B.Tech. I/II Sem.**	BT24 Basic Mechanical Engineering **B.Tech. I/II Sem.**
	Scheme 2023	BT24 Basic Mechanical Engineering **B.Tech. I/II Sem.**	
2	AICTE	ME302 Material Science **B.Tech. III Sem./B.Tech. (PTDC) II Sem.**	ME32 Material Science **B.Tech. III Sem.**
	Scheme 2023	ME32 Material Science **B.Tech. III Sem.**	
3	AICTE	ME303 Strength of Materials **B.Tech. III Sem./B.Tech.(PTDC) I Sem.**	ME33 Mechanics of Materials **B.Tech. III. Sem.**
	Scheme 2023	ME33 Mechanics of Materials **B.Tech. III. Sem.**	
4	AICTE	ME304 Manufacturing Process **B.Tech. III Sem./ B.Tech. (PTDC) III Sem.**	ME34 Manufacturing Process **B.Tech. III Sem.**
	Scheme 2023	ME34 Manufacturing Process **B.Tech. III Sem.**	
5	AICTE	ME305 Thermodynamics **B.Tech. III Sem./ B.Tech. (PTDC) I Sem.**	ME35 Thermodynamics **B.Tech. III Sem.**
	Scheme 2023	ME35 Thermodynamics **B.Tech. III Sem.**	
6	AICTE	ME405 Energy Conversion System **B.Tech. IV Sem.** ME405A Energy Conversion System **B.Tech. (PTDC) III Sem.**	ME41 Energy Conversion Systems **B.Tech. IV Sem.**
	Scheme 2023	ME41 Energy Conversion Systems **B.Tech. IV Sem.**	
7	AICTE	ME402 Fluid Mechanics **B.Tech. IV Sem./ B.Tech. (PTDC) IV Sem.**	ME42 Fluid Mechanics **B.Tech. IV Sem.**
	Scheme 2023	ME42 Fluid Mechanics **B.Tech. IV Sem.**	

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S.No.	Schemes	Subject Code & Subject Name (Semester) Having Equivalence in Syllabus	Final Subject code & subject (after equivalence)
8	AICTE	ME403 Machine Drawing & CAD **B.Tech. IV Sem./ B.Tech. (PTDC) II Sem.**	ME43 Machine Drawing & CAD **B.Tech. IV Sem.**
	Scheme 2023	ME43 Machine Drawing & CAD **B.Tech. IV Sem.**	
9	AICTE	ME404 Theory of Machines & Machanisms **B.Tech. IV Sem./ B.Tech. (PTDC) II Sem.**	ME44 Kinematics of Machines **B.Tech. IV Sem.**
	Scheme 2023	ME44 Kinematics of Machines **B.Tech. IV Sem.**	
10	AICTE	ME401 Machine Design-I **B.Tech. IV Sem.** ME401A Machine Design-I **B.Tech. (PTDC) IV Sem.**	ME45 Machine Design - I **B.Tech. IV Sem.**
	Scheme 2023	ME45 Machine Design-I **B.Tech. IV Sem.**	
11	AICTE	ME502A Instrumentation Measurement & Control **B.Tech. V Sem./ B.Tech. (PTDC) V Sem.**	ME51A Instrumentation Measurement & Control **B.Tech. V Sem.**
	Scheme 2023	ME51A Instrumentation Measurement & Control **B.Tech. V Sem.**	
12	AICTE	ME503 I.C. Engines **B.Tech. V Sem./** ME503 Internal Cumbusion Engines **B.Tech. (PTDC) IV Sem.**	ME52 Internal Cumbusion Engines **B.Tech. V Sem.**
	Scheme 2023	ME52 Internal Cumbusion Engines **B.Tech. V Sem.**	
13	AICTE	ME504 Turbo Machines **B.Tech. V Sem./B.Tech. (PTDC) V Sem.**	ME53 Turbo Machines **B.Tech. V Sem.**
	Scheme 2023	ME53 Turbo Machines **B.Tech. V Sem.**	
14	AICTE	ME505 Dynamics of Machines **B.Tech. V Sem./ B.Tech. (PTDC) III Sem.**	ME54 Dynamics of Machines **B.Tech. V Sem.**
	Scheme 2023	ME54 Dynamics of Machines **B.Tech. V Sem.**	
15	AICTE	ME501 Enterpreneurship and Management Concepts **B.Tech. V Sem.**	BT53 Enterpreneurship & Management Concepts **B.Tech. V Sem.**
	Scheme 2023	BT53 Enterpreneurship & Management Concepts **B.Tech. V Sem.**	

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S.No.	Schemes	Subject Code & Subject Name (Semester) Having Equivalence in Syllabus	Final Subject code & subject (after equivalence)
16	AICTE Scheme2023	ME601A Solid of Mechanics **B.Tech. VI Sem./ B.Tech. (PTDC) VI Sem.** ME61A Mechanics of Materials-II **B.Tech. VI Sem.**	ME61A Mechanics of Materials-II **B.Tech. VI Sem.**
17	AICTE	ME601C Finite Element Method **B.Tech. VI Sem./ B.Tech. (PTDC) VI Sem.**	ME61C Finite Element Method **B.Tech. VI Sem.**
	Scheme 2023	ME61C Finite Element Method **B.Tech. VI Sem.**	

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S.No.	Schemes	Subject Code & Subject Name (Semester) Having Equivalence in Syllabus	Final Subject code & subject (after equivalence)
18	AICTE	ME602A Power Plant Engineering **B.Tech. VI Sem./ B.Tech. (PTDC) VI Sem.**	ME62A Power Plant Engineering **B.Tech. VI Sem.**
	Scheme 2023	ME62A Power Plant Engineering **B.Tech. VI Sem.**	
19	AICTE	ME602B Intellectual Property Right **B.Tech. VI Sem./ B.Tech. (PTDC) VI Sem.**	ME62B Intellectual Property Right **B.Tech. VI Sem.**
	Scheme 2023	ME62B Intellectual Property Right **B.Tech. VI Sem.**	
20	AICTE	ME601B Alternate Automotive Fuels & Emission **B.Tech. VI Sem./ B.Tech. (PTDC) VI Sem.**	ME62C Automotive Fuels & Emission **B.Tech. VI Sem.**
	Scheme 2023	ME62C Automotive Fuels & Emission **B.Tech. VI Sem.**	
21	AICTE	ME603 Heat & Mass Transfer **B.Tech. VI Sem./ B.Tech. (PTDC) V Sem.**	ME63 Heat & Mass Transfer **B.Tech. VI Sem.**
	Scheme 2023	ME63 Heat & Mass Transfer **B.Tech. VI Sem.**	
22	AICTE	ME604 Metal Cutting & Machine Tools **B.Tech. VI Sem./ B.Tech.(PTDC) V Sem.**	ME64 Metal Cutting & Machine Tools **B.Tech. VI Sem.**
	Scheme 2023	ME64 Metal Cutting & Machine Tools **B.Tech. VI Sem.**	
23	AICTE	ME605 Industrial Engineering & Management **B.Tech. VI Sem./ B.Tech. (PTDC) VI Sem.**	ME65 Industrial Engineering **B.Tech. VI Sem.**
	Scheme 2023	ME65 Industrial Engineering **B.Tech. VI Sem.**	
24	AICTE	ME703 Operation Research & Supply Chain **B.Tech. VII Sem./ B.Tech. (PTDC) VII Sem.**	ME71A Operation Research & Supply Chain **B.Tech. VII Sem.**
	Scheme 2024	ME705M D Operation Research & Supply Chain **B.Tech. VII Sem.**	
	Scheme 2023	ME71A Operation Research & Supply Chain **B.Tech. VII Sem.**	

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S.No.	Schemes	Subject Code & Subject Name (Semester) Having Equivalence in Syllabus	Final Subject code & subject (after equivalence)
25	AICTE	ME802 Automobile Engineering **B.Tech. VIII Sem./ B.Tech.(PTDC) VIII Sem.**	ME71B Automobile Engineering **B.Tech. VIII Sem.**
	Scheme 2024	ME704M D Automobile Engineering **B.Tech. VII Sem.**	
	Scheme 2023	ME71B Automobile Engineering **B.Tech. VIII Sem.**	
26	AICTE	ME704C Gas Dynamics and Jet Propulsion **B.Tech. VII Sem./ B.Tech. (PTDC) VIII Sem.**	ME71C Gas Dynamics and Jet Propulsion **B.Tech. VII Sem.**
	Scheme 2024	ME704M C Gas Dynamics and Jet Propulsion **B.Tech. VII Sem.**	
	Scheme 2023	ME71C Gas Dynamics and Jet Propulsion **B.Tech. VII Sem.**	
27	AICTE	ME705A Renewable Energy Systems **B.Tech. VII Sem./ B.Tech.(PTDC) VII Sem.**	ME72A Renewable Energy Systems **B.Tech. VII Sem.**
	Scheme 2024	ME705M A Renewable Energy Systems **B.Tech. VII Sem.**	
	Scheme 2023	ME72A Renewable Energy Systems **B.Tech. VII Sem.**	
28	AICTE	ME704B Product Design **B.Tech. VII Sem./B.Tech. (PTDC) VIII Sem.**	ME72B Product Design **B.Tech. VII Sem.**
	Scheme 2024	ME704M B Product Design **B.Tech. VII Sem.**	
	Scheme 2023	ME72B Product Design **B.Tech. VII Sem.**	
29	AICTE	ME705B Artificial Intelligence **B.Tech. VII Sem./B.Tech. (PTDC) VII Sem.**	ME72C Artificial Intelligence **B.Tech. VII Sem.**
	Scheme 2024	ME705M B Artificial Intelligence **B.Tech. VII Sem.**	
	Scheme 2023	ME72C Artificial Intelligence **B.Tech. VII Sem.**	

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S.No.	Schemes	Subject Code & Subject Name (Semester) Having Equivalence in Syllabus	Final Subject code & subject (after equivalence)
30	AICTE	ME702 Vibration & Noise Control **B.Tech. VII Sem./ B.Tech. (PTDC) VI Sem.**	ME74 Vibration & Noise Control **B.Tech. VII Sem.**
	Scheme 2024	ME702M Vibration & Noise Control **B.Tech. VII Sem.**	
	Scheme 2023	ME74 Vibration & Noise Control **B.Tech. VII Sem.**	
31	AICTE	ME701 Refrigeration & Air Conditioning **B.Tech. VII Sem./ B.Tech. (PTDC) VII Sem.**	ME75 Refrigeration & Air Conditioning **B.Tech. VII Sem.**
	Scheme 2024	ME701M Refrigeration & Air Conditioning **B.Tech. VII Sem.**	
	Scheme 2023	ME75 Refrigeration & Air Conditioning **B.Tech. VII Sem.**	
32	AICTE	ME801 Advance Machine Design **B.Tech. VIII Sem./ B.Tech. (PTDC) VIII Sem.**	ME73 Machine Design-II **B.Tech. VII Sem.**
	Scheme 2024	ME703M Advance Machine Design **B.Tech. VII Sem.**	
	Scheme 2023	ME73 Machine Design-II **B.Tech. VII Sem.**	
33	AICTE	ME704A Industrial Robotics **B.Tech. VII Sem./ B.Tech. (PTDC) VIII Sem.**	ME704M A Industrial Robotics **B.Tech. VII Sem.**
	Scheme 2024	ME704M A Industrial Robotics **B.Tech. VII Sem.**	
34	AICTE	ME705C Internet of Things **B.Tech. VII Sem./B.Tech. (PTDC) VII Sem.**	ME705M C Internet of Things **B.Tech. VII Sem.**
	Scheme 2024	ME705M C Internet of Things **B.Tech. VII Sem.**	
35	Scheme2024	ME801M A Computer Integrated Manufacturing **B.Tech. VIII Sem.**	ME81 A Computer Integrated Manufacturing **B.Tech. VIII Sem.**
	Scheme 2023	ME81 A Computer Integrated Manufacturing **B.Tech. VIII Sem.**	

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S.No.	Schemes	Subject Code & Subject Name (Semester) Having Equivalence in Syllabus	Final Subject code & subject (after equivalence)
36	AICTE	ME803B Tribology **B.Tech. VIII Sem.**	ME81B Tribology **B.Tech. VIII Sem.**
	Scheme 2024	ME801M B Tribology **B.Tech. VIII Sem.**	
	Scheme 2023	ME81B Tribology **B.Tech. VIII Sem.**	
37	AICTE	ME803C Advance Machining Processes **B.Tech. VIII Sem.**	ME81C Advance Machining Processes **B.Tech. VIII Sem.**
	Scheme 2024	ME801M C Advance Machining Processes **B.Tech. VIII Sem.**	
	Scheme 2023	ME81C Advance Machining Processes **B.Tech. VIII Sem.**	
38	AICTE	ME804A Energy Conservation & Audit **B.Tech. VIII Sem./ B.Tech. (PTDC) VIII Sem.**	ME82A Energy Conservation & Audit **B.Tech. VIII Sem.**
	Scheme 2024	ME802M A Energy Conservation & Audit **B.Tech. VIII Sem.**	
	Scheme 2023	ME82A Energy Conservation & Audit **B.Tech. VIII Sem.**	
39	Scheme 2024	ME802M B Quality Management **B.Tech. VIII Sem.**	ME82B Quality Management **B.Tech. VIII Sem.**
	Scheme 2023	ME82B Quality Management **B.Tech. VIII Sem.**	
40	AICTE	ME804C Management Information System **B.Tech. VIII Sem./ B.Tech. (PTDC) VIII Sem.**	ME82C Management Information System **B.Tech. VIII Sem.**
	Scheme 2024	ME802M C Management Information System **B.Tech. VIII Sem.**	
	Scheme 2023	ME82C Management Information System **B.Tech. VIII Sem.**	

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(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) I/II Semester (All Branches)

COURSE CONTENTS w.e.f. July 2023

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
BT24	Basic Mechanical Engineering	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work	150	L	T	P	4
		70	20	10	30	20		3	-	2	

Course objective:

1. To familiarize with the basics concepts of mechanical engineering.
2. To familiarize with the scope of mechanical engineering.
3. To familiarize with the job prospects of mechanical engineering.

Course contents:

Module-I

Materials: Classification of engineering material, composition of cast iron and carbon steels, Alloy steels their applications. Mechanical properties of materials (strength, hardness, toughness, ductility, brittleness, malleability etc), tensile test stress-strain diagram of ductile and brittle materials, Hooks law and modulus of elasticity, Hardness and impact testing of materials, BHN etc.

Module-II

Measurement: concept of measurements, error in measurement, temperature, pressure, velocity, flow, strain, force and torque measurement, Vernier calliper, micrometer, dial gauge, slip gauge, sine-bar and combination set.

Module-III

Fluids: fluid properties pressure, density and viscosity etc. types of fluids, Newton's law of viscosity Pascal's law, Bernoulli's equation for incompressible fluid, working principle of Hydraulic machines.

Module-IV

Thermodynamics: thermodynamic system, properties, state, process, Zeroth, First and Second law of thermodynamics, thermodynamic processes at constant pressure, constant volume, enthalpy & entropy.

Steam engineering: classification and working of boilers, mounting and accessories of boilers, efficiency and performance analysis, natural and artificial draught, introduction to steam properties.

Module-V

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Reciprocating Machines: - Working principal of steam engine, Carnot, Otto, diesel and dual cycles, P-V & T-S diagram and its efficiency, working of two stroke & four stroke petrol & diesel engines, working principle of compressor.

Evaluation:

Evaluation will be continuous and integral part of the class as well as through external assessment.

Reference Books:

1. Kothandaraman & Rudramoorthy, Fluid Mechanics & Machinery, New Age.
2. Nakra & Chaudhary, Instrumentation and Measurements, TMH.
3. Nag, P.K Engineering thermodynamics, TMH.
4. Ganesan, internal Combustion Engines, TMH.
5. Agrawal C.M Basic Mechanical Engineering, Wiley Publication,
6. Achuthan M, Engineering Thermodynamics, PHI.

Course outcomes:

At the completion of this course, students will be able to

CO1	Classify the Engineering materials and their mechanical properties.
CO2	Outline the basics of thermodynamics and boilers.
CO3	Illustrate the working of internal combustion engines.
CO4	Illustrate various machine tools and production processes.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1											
CO2	2	1										
CO3	2	1										
CO4	2	1										

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Basic Mechanical Engineering Lab

List of suggestive core Experiments:

Theory related eight to ten experiments including core experiments as follows:

1. Study of UTM and perform tensile test on it.
2. Verification of Bernoulli's Theorem
3. Linear and angular measurement using, micrometer, slip gauge, dial gauge and sine bar.
4. Study of different types of boilers and mounting.
5. To find COP of a Refrigeration unit.
6. Study of different IC Engines.
7. Study of lathe & drill machines.

Evaluation:

Evaluation will be continuous and integral part of the class followed by the final practical examination as well as through external assessment.

Course outcomes: Laboratory

At the completion of this course, students will be able to

CO1	Demonstrate working of petrol and diesel engine.
CO2	Explain testing of mechanical properties of materials.
CO3	Classify various types of boilers.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2								1			
CO2	2	1							1			
CO3	1								1			

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(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) III Semester (Mechanical Engineering)

COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME32	Material Science	70	20	10	-	-	100	3	1	-	4

Course objective:

1. To give basic knowledge of science behind materials and physical metallurgy.
2. Introduce the concept of structure property relations:
3. Lay the ground work for studies and fields such as solid state physics, mechanical behavior of materials, phase and phase diagram, heat treatment, failure of materials and their protection.

Course Contents:

Module-I

Crystal Atoms of Solid: Structure of atom binding in solids metallic, Vander walls, ionic and covalent, Space lattice and crystal system arrangement of atoms in BCC, FCC and HCP crystal. Manufacture of refractory and ferrous metals, properties uses and selection of acid, basic and natural refractory, metallurgical coke, properties, types, uses and brief description of the manufacturing processes for iron and steel making.

Module-II

Mechanical Property measurement: Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery, Hardness: Rockwell, Brinell and Vickers and their relation to strength, Creep fatigue.

Module-III

Deformation of Metals: Point and line defects in crystals, their relation to mechanical properties, deformation of metal by slip and twinning stress strain curves of poly crystalline materials viz. mild steel, cast iron and brass yield point phenomenon. Cold and hot working of metals and their effect on mechanical properties, annealing of cold worked metals, principles of re-crystallization and grain growth phenomenon, fracture in metal and alloys, ductile and brittle fracture, fatigue failure.

Module-IV

Alloy Formation and Binary Diagram: Phase in metal system solution and inter-metallic. compounds. Hume-Rottery's rules, solidification of pure metals and alloy equilibrium diagrams of isomorphous, eutectic peritectic and eutectoid system, non-equilibrium cooling and coring iron, iron carbon equilibrium diagram. Introduction to cast iron and steel.

Module-V

Principles of Heat Treatment & Heat treatment of Metals & Alloys: TTT curves heat treating processes, normalizing, annealing spheroidizing, hardening, tempering, and Case hardening. austempering, mar-tempering, precipitation hardening process with reference to Al, Cu alloys Non Ferrous metals base alloys, Bronze, Brasses, Duralumin, and Bearing Metals.

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Powder Metallurgy: Property and Applications of Powder Metallurgy, Various process and methods of making products by powder Metallurgy techniques.

Evaluation:

Evaluation will be continuous an integral part of the class followed by the final examination as well as through external assessment.

References:

1. Narula GK, KS and Gupta VK; Material Science; TMH
2. Raghavan V; Material Science and Engineering, PHI Publication.
3. Raghavan V; Physical Metallurgy Principles and Practice; PHI
4. Rajendran V Physical Metallurgy Principles and practice; PHI
5. Sriniwasan R; Engineering materials and metallurgy; TMH
6. Navneet Gupta, Material Science & Engineerign, Dhanpat Rai.
7. G.E Dieter, Mechanical Metallurgy, Mc-Graw Hill 1987
8. D.S clark and W.Varney Physical Metallurgy for Engineers 2ed., East-West 1994
9. B.K Agrawal introduction to Engineering Materials, TMH

Course outcomes:

At the completion of this course, students should be able to

CO1	Explain the crystal structure and classification of materials.
CO2	Illustrate methods of determining properties and their suitability for applications.
CO3	Interpret the phase diagrams of materials.
CO4	Selection suitable heat-treatment process to achieve desired properties of metals and alloys.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1									
CO2	2	3	1									
CO3		2		1			1					
CO4	1	3	2									

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Bachelor of Technology (B.Tech.) III Semester (Mechanical Engineering)

COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME33	Mechanics of Materials- I	70	20	10	30	20	150	3	-	2	4

Course Objective:

At the completion of course the students will be able:

1. To calculate the stresses and strain of different members of machines.
2. To draw shear force and bending moment diagram for various types of beams with different loadings.
3. To find the deflection of various types of beams with different loadings.
4. To study torsion of shafts and stresses in thin cylinders and spheres.

Course Contents:

Module-I

Stress and Strain: Stresses in members of a structure, Axial loading, normal stress, shear stress, analysis of simple structures, stepped rods, bars of varying section, stress-strain diagram, Hooke's law, stress due to temperature, Poisson's ratio, Bulk modulus, shear strain, relation among elastic constants, residual stress, strain energy under axial loads and stresses due to impact of falling weights. Transformation of stress and strain principal stresses, normal and shear stress, Mohr's circle and its application to two dimensional analyses.

Module-II

Shear Force and Bending Moment: Shear force and Bending Moment diagram for cantilever, beam supported at ends, beams with overhangs. Point of contraflexure.

Stresses in beams: Pure bending, Theory of simple bending, Neutral layer- neutral axis, Stress distribution in beams, Flexure formula, Section modulus, Bending of symmetric member, Bending of composite sections, Normal and shear stresses in beams.

Module –III

Deflection Of Beams: Slope, Deflection and Radius of curvature, Cantilevers subjected to various types of load, Macaulay's method and Area moment method for deflection of Cantilever beam, Simply supported beam and Overhanging beam subjected to various types of loads, Relation between maximum. Bending and maximum deflection.

Module-IV

Torsion of Shafts: Theory of pure torsion, Polar modulus, Torsional Rigidity, angle of twist, Torsional stresses in a shafts, Power transmitted by a shaft, Stepped shafts, Composite shafts, Torsional resilience, shafts in series and shafts in parallel, Torsion of a tapering rod.

Springs: Leaf springs, Helical springs, open and closed coil, stress in spring wire, deflection of helical spring.

Module-V

Columns and Struts: stability of structures, Crushing load, Crippling load, Euler's formula for columns with different end conditions, Rankine's formula, Limitation of Euler's formula.

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Thin Cylinders and Spheres: Circumferential and Longitudinal stresses, Wire bound pipes, thin spherical shells.

Evaluation:

Evaluation will be continuous an integral part of the class followed by the final examination as well as through external assessment.

Reference:

1. Beer FP, Jonhson Mechanics of Materials, Sixth Edition,Mc Graw Hills.
2. Debarata Nag & Abhijet chanda: strength of material: Wiely.
3. Rattan; strength of materials, second edition Mc Graw Hills.
4. Nash William; Schaum's outline series; fourth Edition Strength of Materials; Mc graw Hills.
5. Singh Arbind K; Mechanics of solid; PHI
6. Sadhu Singh; strength of materials ; khanna pub.
7. R Subramannian, strength of materials OXFORD University press Third Edition.
8. S Ramamurthum, Strenght of materials, Dhanpat Rai.
9. Stephen Timoshenko; strength of materials part 1& 2 CBS pub.

Course outcomes:

At the completion of this course, students should be able to

CO1	Calculate stresses and strain in different structural members under uni-axial and combine loading.
CO2	Evaluate stresses in beam and shafts under various loading like torsion, pure bending etc.
CO3	Calculate deflection at any section for different types of beams.
CO4	Analyze stresses in the pressure vessel and critical load in the column

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2									
CO2	1	2	2									
CO3	2	2	3									
CO4	1	3	2	1								

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Mechanics of Materials- I Lab

List of experiments: (study and experiments on) (Can be modified/expanded further)

1. Tensile Strength testing of a given mild steel on UTM
2. Compressive Strength testing of a given specimen on UTM
3. Hardness testing of given specimen using Rockwell and Vickers/ Brinell testing
4. Shear test of a mild steel rod.
5. Bending test of a mild steel specimen.
6. Impact testing on Impact testing machine: - Charpy and Izod.
7. Study of Spring Test machine
8. Study of non destructive testing machine.
9. Study of Fatigue phenomenon and the fatigue failure of different part of fatigue testing machine.
10. Proof load determination for the leaf spring.

Course outcomes of Lab:

At the completion of this course, students should be able to

CO1	Find the yield strength, ultimate strength of mild steel specimen
CO2	Find resilience and toughness of steel material
CO3	Understand the different techniques of non destructive testing

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2										1
CO2	1	2	2									
CO3	1		2		1							1

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Bachelor of Technology (B.Tech.) III Semester (Mechanical Engineering)

COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
ME34	Manufacturing Process	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work	150	L	T	P	4
		70	20	10	30	20		3	-	2	

Course objective:

Students are able to explain and distinguish among various basic manufacturing processes like casting, metal forming, welding, rolling and press working along with practical applications.

Course Contents:

Module-I

Pattern Making: Types of pattern, Pattern and pattern making, pattern allowances; pattern design considerations, core and core boxes.

Casting: Types of casting process. Moulding and Foundry core sands and their properties, gating, runners, risers, solidification, defects and elimination, moulding machines, centrifugal casting, dye casting, shell moulding, Lost wax moulding; continuous casting, cupola description and operation.

Module-II

Welding: Types of welding, Gas welding method, gas flames, gas cutting, Electric arc welding, AC and DC welding machines and their characteristics, flux, electrodes, submerged arc welding, TIG & MIG welding, pressure welding, electrical resistance welding spot, seam and butt welding; Consumable estimation for weld length and size, Thermit chemical welding, brazing and soldering, welding defects & remedies. Safety precautions.

Module-III

Forging: Types of forging operations. Theory and application of forging processes, description of drop and horizontal forging machines.

Module-IV

Press working: Description and operation of processes, process of shearing, punching, piercing blanking, trimming, perfecting, notching, lancing, embossing, coining, bending, forging and drawing; press, types of presses, tool dies, die punch clearance, auxiliary equipment, safety devices, stock feeders, scrap cutters, forces, pressure and power requirements.

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Module-V

Rolling: Types of Rolling operations, stages of rolling for formation, General description of machines and process; rolling of structural section plates and sheets; hot and cold rolling techniques.

Evaluation:

Evaluation will be continuous an integral part of the class followed by the final examination as well as through external assessment.

References:

1. Anderson and Tetro; Shop Theory, Mc Graw Hills.
2. Kaushish JP; Manufacturing Processes; PHI Learning.
3. KalpakjianProducting Engineering, PEARSON Education.
4. Chapman; Workshop Technology.
5. Philip F Ostwald; Manufacturing Process &systems: John Wiley.
6. Raghuvanshi; Workshop Technology, Dhanpat Rai.
7. HajraChoudhary; Workshop Technology: Vol L..
8. Bhupendra Gupta, Manufacturing Process; Dhanpat Rai Publishing Co., New Delhi.

Course outcomes:

At the completion of this course, students should be able to

CO1	Understanding the general production processes like Pattern making, casting.
CO2	Compare various welding processes.
CO3	Explain forging and press working operations with applications.
CO4	Illustrate working principle of forming and rolling processes.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1									
CO2	1	2	2									
CO3		3	3	1								
CO4	1	2	2									

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Manufacturing Process Lab

List of Experiments: (Can be modified/expanded further)

1. Study of tools used for various manufacturing processes,(It includes application, use and live demonstration)
2. Hands on exercise on patternmaking (make any one type of wooden pattern using simple tools)
3. Study of Molding and Casting process.
4. Performance on Metal Casting of simple component.
5. Performance on welding of simple work piece (Example Arc and Resistance Welding)
6. Study of forging machine & demonstration of various operations of forging.
7. Study of mechanical, Hydraulic, Pneumatic presses.
8. Demonstration of process like; shearing punching, piercing, blanking, trimming, drawing, etc.
9. Study of rolling process and evaluation of power requirements.

Course outcomes: Laboratory

At the completion of this course, students should be able to

CO1	Distinguish among various casting processes.
CO2	Explain Mechanical working of Metals.
CO3	Able to apply welding process, press working and rolling process
CO4	Experiments with forging operations.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2							2			
CO2		2	1						2			
CO3	1	2	2									
CO4	1	2										

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Bachelor of Technology (B.Tech.) III Semester (Mechanical Engineering)

COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
ME35	Thermodynamics	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work	150	L	T	P	4
		70	20	10	30	20		3	-	2	

Course Objective:

To develop ability and gain insight into the process of problem-solving, with emphasis on thermodynamics specially in following manner

1. Apply conservation principles (mass and energy) to evaluate the performance of simple engineering systems and cycles,
2. Evaluate thermodynamic properties of simple homogeneous substances,
3. Analyze processes and cycles using the second law of thermodynamics to determine efficiency and performance,
4. Discuss the physical relevance of the numerical values for the solutions to specific engineering problems and the physical relevance of the problems in general;
5. Critically evaluate the validity of the numerical solutions for specific engineering problems.

Course Contents:

Module-I

Introduction & Basic Concepts: Fundamentals - System & Control volume, Property, State & Process, Cycle, Temperature, Types of equilibrium, Zeroth law of thermodynamics, Temperature scales, various thermometers, Heat & Work transfer.

Module-II

The First Law of Thermodynamics: Heat/work interaction in systems, First Law for Cyclic & Non-cyclic processes, Total energy, Various modes of energy, Internal energy and Enthalpy, First Law for Flow Processes, Steady state flow processes, Unsteady processes, Limitations of first law of thermodynamics.

Module-III

The Second Law of Thermodynamics: Second law-Kelvin-Planck and Clausius statements, Heat engine, Heat reservoir, Refrigerator, Heat pump, Thermal efficiency and COP, Reversible and irreversible processes, Carnot cycle, Internal and external irreversibility, Absolute temperature scale. Clausius inequality, Entropy, Entropy for solids, liquids, ideal gases undergoing various processes, Principle of increase of entropy, T-S diagrams, Irreversibility and Availability, Energy.

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Module –IV

Properties of Pure Substance: Pure Substance, Phase, Phase-transformations, Formation of steam, Properties of steam, PVT surface, HS, TS, PV, PH, TV diagram, Processes of vapor, Measurement of dryness fraction, Use of Steam tables and Mollier chart.

Module-V

Air Standard Cycles and Non-reactive Gas Mixture: Carnot, Otto, Diesel, Dual cycles and their comparison, Brayton Cycle, PVT relationship, Mixture of ideal gases, Properties of mixture of ideal gases-Internal energy, Enthalpy and Specific heat of gas mixtures.
Steam Tables, Mollier Charts & tables connected to reactive systems are allowed in Examination hall.

Evaluation:
Evaluation will be continuous and integral part of the class followed by the final examination

References:

1. P.K. Nag; Engineering Thermodynamics; Mc-Graw Hills Fifth Edition.
2. Cengal Y; Thermodynamics; Mc-GRAW Hills, Eight Edition.
3. Kross &potter Thermodynamics for Engineering CENGAGE Learning.
4. Moran, Shapiro, Boettner principles of Engineering Thermodynamics Wiley student edition.
5. P Chattopadhya, Engineering Thermodynamics second Edition, OXFORD University press.
6. Zemansky Heat & Thermodynamics, Eight Edition, Mc-Graw Hills India Education.
7. R Yadav applied Thermodynamics, Central Publishing house Allahabad.
8. Van Wylin & sontak, Thermodynamics by, Wiley Eastern.

Course outcomes:

At the completion of this course, students should be able to

CO1	Demonstrate of thermodynamics properties of fluid using standard tables & charts.
CO2	Illustrate the thermodynamics processes on P-v, T-S, and h-S diagrams.
CO3	Estimate of energy interaction of different thermodynamics system.
CO4	Analyze Otto, Diesel, and Dual air standard cycles.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1										
CO2	1	2										
CO3	1	2	1									
CO4	1	2										

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Thermodynamics Lab

List of Experiments: (Can be modified/expanded further)

1. Verification of first law of thermodynamics.
2. Study of low pressure boilers.
3. Study of Boiler mountings and Accessories.
4. Measurement of dryness fraction by throttling calorimeter
5. Measurement of dryness fraction by separating and throttling calorimeter.
6. Measurement of dryness fraction by separating and throttling calorimeter.
7. Study of 2 Stroke petrol engine.
8. Study of 4 stroke petrol engine.
9. Study of 2 stroke diesel engine.
10. Study of 4 stroke diesel engine.

Course outcomes of lab:

At the completion of this course, students should be able to

CO1	Demonstrate of thermodynamics properties of fluid using standard tables & charts.
CO2	Illustrate the thermodynamics processes on P-v, T-S, and h-S diagrams.
CO3	Estimate of energy interaction of different thermodynamics system.
CO4	Analyze Otto, Diesel, and Dual air standard cycles.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2		1								
CO2	1	2										
CO3	1		1									1
CO4	1	2		2								

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Bachelor of Technology (B.Tech.) IV Semester (Mechanical Engineering)

COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME41	Energy Conversion Systems	70	20	10	-	-	100	3	1	-	4

Course Objectives:

The purpose of this course is to introduce the undergraduate students with

1. To learn applications of energy conversion device to thermal power plant.
2. To provide an overview of steam boilers, condensers, steam nozzles their applications.
3. To perform calculations on related to designing of energy conversion devices.
4. Importance and components of cooling towers and heat exchangers.

Course Contents:

Module 1 Steam Generators (Boilers): Classification of boilers, Requirements of a good boiler, Conventional boilers, High-pressure boilers- Lamont, Benson, Loeffler and Velox steam generators, Fluidized bed boilers (FBB), Selection of boilers, Performance and rating of boilers, Equivalent evaporation, Boiler efficiency, Heat balance sheet, Heat losses in boiler plant, Combustion in boilers, Stoker firing system, Pulverized fuel firing system, Super critical boilers.

Module II Phase Change Cycles: Introduction, Classifications of vapour power cycles, Basic elements of steam power plant, Vapor Carnot cycle, its efficiency and limitations, Rankin cycle, its efficiency and assumptions, effect of boiler and Condenser pressure and superheat on efficiency, Modified Rankin cycle, Comparison of Rankine and Carnot cycle, Reheat cycle, Perfect regenerative cycle, its expression of efficiency, Ideal and actual regenerative cycle with single and multiple heaters, Regenerative-reheat cycle, Binary-vapor cycle, properties of binary working fluid, work done and efficiency calculations. Simple numerical problem on phase change cycles.

Module III Gas Dynamics: Introduction and Applications of Gas Dynamics, Concept from fluid mechanics, Continuity equation, Momentum equation, One dimensional gas dynamics, Isentropic condition, Speed of sound in fluid, One dimensional wave motion, Elastic waves, Mach number and its significance, Mach cone, Zone of action, Zone of silence, Stagnation state and properties, One-dimensional isentropic flow through variable area duct, Condition for maximum fluid flow, Effect of area ratio as a function of Mach number, Simple numerical problems on Gas Dynamics.

Module IV Air Compressors: Introduction, applications, and Classification of Air Compressors, Reciprocating Air Compressor, working, work done, power required, efficiency, for single and multistage stage compression, Comparison of single stage and multi stage compression, Two stage with intercooler,

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Condition for minimum work done in two stage. Rotary Compressors; working, classifications. Comparison of reciprocating and rotary compressors. Simple numerical problems on Air Compressors.

Module V (A) Steam Nozzles: Introduction and types, Flow of steam through nozzles, Effect of friction in nozzle efficiency, Condition for maximum discharge, Physical significance of critical pressure ratio, Super-saturated flow.

(B) Steam Condensers: Introduction, Objective, Classification of condensers, Comparison of jet and surface condensers, Air leakage and its effect on performance, back pressure and its effect on plant performance, Condenser efficiency and factors affecting, Thermal analysis of condenser, Simple numerical problems on Steam Condensers.

(C) Cooling Towers: Introduction, Function, Components and applications, Cooling tower materials, Classifications of cooling towers, Performance assessment of cooling towers, Energy efficiency opportunities, Best design practices for cooling tower.

(D) Heat Exchangers: Introduction and applications, Classification of heat exchangers.

Evaluation:

Evaluation will be continuous an integral part of the class followed by the final examination as well as through external assessment.

References:

1. Nag PK; Power plant Engineering; TMH
2 . Thermodynamics by Gordon J. Van Wylen
3. P.K.Nag; Basic and applied Thermodynamics; TMH
4. Ganesan; Gas turbines, TMH
5. Heat Engines by V.P. Vasandani& D. S. Kumar
6. R. Yadav Steam and Gas Turbines
7. R.Yadav Thermal Engg.
8. Kadambi& Manohar, An Introduction to Energy Conversion - Vol II. Energy conversion cycles.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Explain steam generation and its utilization to thermal power plant.
C02	Illustrate air compressors and phase change cycles.
C03	Apply the basic knowledge of thermodynamics to gas dynamics and steam nozzles.
CO4	Analyze heat exchanger and effects of its different parameters.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2		2		3								
CO3		2		3								
CO4		2		3								

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Energy Conversion System Lab

List of Experiments: (Can be modified/expanded further)

1. Study of Separating & Throttling calorimeter for measurement of dryness fraction.
2. Study of Benson Boiler.
3. Study of Lamont Boiler.
4. Study of Loeffler Boiler.
5. Study of Velox Boiler.
6. Study of Boiler Draught.
7. Study of Boiler Trial.
8. Study of Cooling Towers.
9. Study of Heat Exchangers
10. Study of Air Compressor.

Evaluation:

Evaluation will be continuous an integral part of the class followed by the final practical examination as well as through external assessment.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Explain steam generators and its selection and air compressors, working, types and applications.
C02	Evaluation of performance parameters of boilers.
C03	Explain the working of cooling tower and its performance.
CO4	Compare types of treat exchangers.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2		2	3									
CO3	1	2	3									
CO4		2	2									

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COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME42	Fluid Mechanics	70	20	10	30	20	150	3	-	2	4

Course Objective:

To be familiar with all the basic concepts of fluids and fluid flow phenomenon, conservation equations and their applications to fluid flow problems.

1. Determination of properties of fluid and their utility.
2. To understand the kinematic and dynamic behavior of fluid.
3. Determination of dimensionless numbers by applying mathematical techniques.
4. Determination of discharge through flow measuring instruments.
5. To understand the fluid flow behavior through pipes

Course Contents

Module 1: Fluid Statics: Basic concepts &properties of the fluid. Newtons law of viscosity, types of fluids, Pressure measurement by manometers and gauges, pressure variation in static fluid, Absolute and gauge pressure, total force and centre of pressure, hydraulic forces on submersed surfaces plan, inclined and curved surfaces; buoyancy, meta-center, Stability of floating and submerged bodies, Relative equilibrium.

Module 2: Kinematics of Flow: Types of flow-ideal & real, Lagrange and Eulerian methods of study of fluid, steady & unsteady, uniform & non-uniform, one, two and three dimensional flow, path lines, streak-lines, streamlines and stream tubes; continuity equation for one and three dimensional flow, rotational & ir-rotational flow, circulation, stagnation point, separation of flow, source, sink and combination of source-sink flow, velocity potential, stream function, flow net & its applications.

Module 3: Dynamics of Flow: Euler's equation of motion along a streamline and derivation of Bernoulli's equation, application of Bernoulli's equation, energy correction factor, linear momentum equation for steady flow; momentum correction factor. Fluid Measurements: Velocity measurement (Pitot tube, current meters etc.); flow measurement (orifices, nozzles, mouthpieces, orifice meter, nozzle meter, venturi-meter, weirs and notches).

Module 4: Dimensional Analysis: Dimensional analysis, dimensional homogeneity, use of Buckingham-pi theorem, calculation of dimensionless numbers, similarity laws and model investigations. Introduction to boundary layer, Boundary layer development on a flat plate and its characteristics - Boundary layer

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thickness, displacement thickness, momentum thickness, energy thickness. Momentum. equation for boundary layer by Von karman, drag on flat plate, boundary layer separation and its control. Aero-foil theory, lift and drag coefficients, streamlined and bluff bodies.

Module 5. Flow through Pipes: Reynolds experiment & Reynolds number, laminar & turbulent flow, Introduction to Navier Stoke's Equation, relation between shear & pressure gradient, laminar flow through circular pipes, friction factor, laminar flow between parallel plates, flow through pipes in series. and parallel, different types of head losses, friction factor and pressure drop.

Evaluation:

Evaluation will be continuous and integral part of the class as well through external assessment.

References:

1. Streeter VL, Wylie EB, Bedford KW; Fluid Mechanics; Mc Graw Hills
2. FOX, McDonald Pritchard, Fluid Mechanics Wiley students edition
3. White Fluid Mechanics; Mc Graw Hills
4. Cengal; Fluid Mechanics; Mc Graw Hills
5. R. Mohanty, Fluid Mechanics; PHI
6. KL Kumar Fluid Mechanics
7. Fluid Mechanics & hydraulic Machines, Modi & Seth
8. CS Jog, Fluid Mechanics Volume II CAMBRIDGE IIScSeries, Third Edition.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Define fluid properties.
C02	Explain the characteristics of fluid in static and dynamic conditions
C03	Apply the equations derived for static and dynamic conditions for flow measurement.
CO4	Demonstrate dimensional homogeneity and similarity between model and prototypes.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	2	2										
CO3	1	2	2									
CO4	2		2									

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Fluid Mechanics Lab

List of Experiments: (Can be modified/expanded further)

1. Determination of discharge of liquid flow in pipe by using orifice meter.
2. Determination of discharge of liquid through pipe by using venturimeter.
3. Determination of C_c, C_v, C_d of Orifices.
4. Determination of discharge of liquid flow in pipe through Mouth Piece.
5. Determination of discharge of liquid flow in pipe through V notches.
6. Determination of discharge of liquid flow in pipe through weirs.
7. Determination of discharge of liquid flow in pipe through sluice gate.
8. Reynolds experiment for demonstration of stream lines & turbulent flow.
9. Determination of friction factor of a pipe.
10. To determine the discharge of liquid through rotameter.

Evaluation:

Evaluation will be continuous an integral part of the class followed by the final practical examination as well as through external assessment.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Demonstrate devices like Orifice meter, Venturi meter, Nozzle meter, Rotameter etc.
C02	Examine different parameters of fluid through Orifice meter, Venturi meter, Mouth Piece, V notches, Weirs; Sluice gate, Rotameter etc.
C03	Analyze laminar flow and turbulent flow.
CO4	Analyze the experimental losses incurred in a pipe.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2										
CO2	2	2										
CO3		2	2									
CO4	1	3										

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COURSE CONTENTS w.e.f. July 2023

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME43	Machine Drawing & CAD	70	20	10	30	20	150	3	-	2	4

Course Objective:

To enable the students to prepare a detailed assembly drawing for machine components.

Course Contents:

Module 1: Drawing Conventions: IS codes, sectional views and sectioning, surface finish and tolerances representation of machine parts, Conventional representation of materials and machine components Rivet heads and Riveted joints, Welded joints, Drawing of Threaded fasteners, Limit, Tolerances and fits. **14 marks**

Module 2: Assembly Drawing: Assembly Machine Drawing, Basic concept of assembly drawing, bill of materials, drawing of different types of keys, Assembly drawing of Cotter and nuckle joints, Pedestal and footstep bearings. **21 marks**

Module 3: Drawing of Engine Parts: Steam Engine Parts: Crosshead for vertical and horizontal engine, Stuffing box for small and engines.

IC Engines Parts: Piston, piston rings, connecting rods for petrol and diesel engine, Eccentric

Lathe Machine Parts: Tool post and Tail Stock**. 21 marks.**

Module 4: CAD: Software and hardware required to produce CAD drawings, Software: operating systems; CAD software package (AutoCAD/AutoCAD/Inventor/Micro station/Catia/Pro/ENGINEER/Solid works, etc).

Minimum system requirements; Preparing & interpreting CAD drawing, orthographic projections; Commands: absolute/relative/polar coordinates; features e.g. line types, grids, snaps, circle, text, hatching, dimensioning, layers/levels, colour, viewing e. g. zoom, pan; inserting other drawings e g symbols, blocks; modifying e g copy, rotate, move, erase, scale, chamfer, fillet Interpret: determine properties of drawn objects e g list, distance, area, volume use CAD software to produce 2D & 3D assembly drawings and 3D views, 3D coordinate entry (x, y, z), wire frame drawing, 2D to 3D (thickness, extrusion); surface models. 14 marks

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Evaluation:

Evaluation will be continuous an integral part of the class as well through external assessment.

References:

1. Bhatt, ND; Machine Drawing; Charotar Publication.

2. KC Jain, Machine Drawing, PHI.

3. Singh A; Machine Drawing; TMH publication.

4. Narayana and Reddy; Machine Drawing, New age, Delhi.

5. Shigley JE et al; Mechanical Engineering Design, TMH

Course Outcomes:

At the completion of this course, students should be able to

CO1	Illustrate the Indian standards for machine drawing.
C02	Explain Fits and Tolerance in technical drawing.
C03	Draw assembly drawing of joints, couplings, machine elements, I.C. Engine parts and Lathe machine parts.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1										
CO2	2	2										
CO3	2	2										

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Machine Drawing & CAD Lab

List of Experiments: (Can be modified/expanded further)

1. Draw the part drawing of the IC Engine components.
2. Draw the assembly drawing of the IC Engine components.
3. Draw the assembly drawing and sectional view of Cotter joints,
4. Draw the assembly drawing and sectional view of knuckle joints.
5. Draw the assembly drawing and sectional view of Pedestal bearings.
6. Draw the assembly drawing and sectional view of footstep bearings.
7. Draw the assembly drawing and sectional view of Crosshead for vertical engine using CAD tools.
8. Draw the assembly drawing and sectional view of Crosshead for horizontal engine using CAD tools.

Evaluation:

Evaluation will be continuous an integral part of the class followed by the final practical examination as well as through external assessment.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Conventional representation of materials and machine components
C02	Basic concept of assembly drawing.
C03	IC Engines Parts, Lathe Machine Parts
CO4	CAD software to produce 2D & 3D assembly drawings and 3D views.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3		1								
CO2	2	2		1								
CO3	1	1										
CO4	1	2		1								

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COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
ME44	Kinematics of Machines	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work	150	L	T	P	4
		70	20	10	30	20		3	-	2	

Course Objective:

At the completion of course the students will be able:

1. To describe the working of different mechanism used in machines.
2. To find velocity and acceleration of links of different;
3. To know the working of different types of gears, gear trains and cams.
4. To know the applications of gyroscopic principle.
5. To know the working principles of belt, rope and chain drive.

Course Contents:

Module 1: Mechanisms and Machines: Links, Pairs, Chains, Structure, Mechanism, Machine, Equivalentlinkage, Degrees of freedom, Gruebler's & Kutzback's criterion, Inversions of four bar chain, Mechanism with lower pairs Pantograph, Straight line motion mechanisms, Davis and Ackermann's steering mechanisms, Hooke's joint, Numerical problems based on above topics.

Module 2: Motion Analysis: Plane motion, Absolute & Relative motion, Displacement, Velocity and Acceleration of a point, Velocity and Acceleration Analysis by Graphical & Analytical methods, Velocity of rubbing, Kennedy's Theorem, Acceleration polygon, Coriolis acceleration component, Klein's construction, Numerical problems based on above topics.

Module 3: Gears: Classification of gears, Helical, Spiral, Bevel and Spur Gear, Spur Gear Terminology, Law of gearing, Tooth profiles, velocity of sliding, Path of contact, Arc of contact, Contact Ratio, Interference and Undercutting, Conjugate action, Numerical problems based on above topics.
Gear Trains: Simple, compound, reverted and epi-cyclic gear trains. Velocity ratio and torque calculation in gear trains.

Module 4: Cams: Classification of Cams and Followers, Radial Cam Terminology, Analysis of Follower motion (uniform, modified uniform, simple harmonic, parabolic, cycloidal), Pressure Angle, Radius of Curvature, Cam Profile for radial and offset followers Synthesis of Cam Profile by Graphical Approach, Cams with Specified Contours.

Gyroscope: Gyroscopic Action in Machines, Angular Velocity and Acceleration, Gyroscopic torque/ couple, gyroscopic effect on Naval Ships, Stability of Two and Four Wheel Vehicles, Rigid disc at an angle fixed to a rotating shaft.

Module 5: Belt, Rope & Chain Drive: Types of Belts, Velocity ratio of a belt drive, Slip in belts, Length of open belt and crossed belt, Limiting ratio of belt-Tensions, Power transmitted by a belt, Centrifugal tension, Maximum tension in a belt, Condition for maximum power transmitted, Initial tension in a belt, Creep in belt, Applications of V-Belt. Rope and Chain drives.

Evaluation:

Evaluation will be continuous an integral part of the class followed by the final examination as well as through external assessment.

References:

1. Thomas Bevan; Theory of Machines; Pearson Education.
2. Rattan SS; Theory of machines; MC Graw Hills.
3. Ambekar AG; Mechanism and Machine Theory; PHI. Eastern Economy Edition 2015.
4. Uicker&Shigley, Theory of machines & Mechanism Second Edition Oxford University Press.
5. Rao JS and Dukkipati; Mechanism and Machine Theory; New Age Delhi.
6. Abdulla Shariff, Theory of Machines.
7. Theory of machines by R.K.Bansal.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Explain the kinematics of mechanism and their inversions.
C02	Design different types of gears and gear trains.
C03	Draw cam profile for different follower motions.
CO4	Analyze Gyroscopic effect on Naval ship and Stability of Two and Four Wheel Vehicles.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3		1								
CO2	2	2		1								
CO3	1	1										
CO4	1	2		1								

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Kinematics of Machines Lab

List of Experiments: (Can be modified/expanded further)

1. To finds out gyroscopic couple.
2. To find out velocity & acceleration of slider crank mechanism by Klin's Construction.
3. To find out velocity ratio of various gear trains.
4. To study of various types of belt drives & find out the velocity ratio of the drive.
5. To draw the cam profile.
6. Study of working models of various popular mechanisms like quick return mechanism etc.
7. To draw Involute profile of a gear by generating method.

Evaluation:

Evaluation will be continuous an integral part of the class followed by the final practical examination as well as through external assessment.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Verify the law of gyroscope and describe the working of different mechanism and their inversions.
C02	Draw velocity and acceleration of slider crank mechanism by Klein's Construction method.
C03	Calculate velocity ratio of various gear trains and various type of belt drives.
CO4	Draw cam profile and involute, profile of a gear by generating method.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3		1								
CO2	2	2		1								
CO3	1	1										
CO4	1	2		1								

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COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
ME45	Machine Design-I	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work	100	L	T	P	4
		70	20	10	-	-		3	1	-	

Course Objective:

To study the basic design Principle's and apply the principles to the design of various elements encountered in Mechanical machines and structures.

Course Contents:

Module 1: Mechanical Engineering Design - Design considerations, Design Procedure, Material selection Modes of failure, causes of stress concentration; stress concentration in tension, bending and torsion; reduction of stress concentration, theoretical stress concentration factor, notch sensitivity. Fatigue-Cyclic loading, endurance limit, S-N Curve, loading factor, size factor, surface factor. Stress concentration factor, Design consideration for fatigue, Goodman and modified Goodman's diagram, Soderberg equation, Gerber parabola, design for finite life, cumulative fatigue damage.

Module 2: Design of Fasteners: Design of cotter joints, Design of knuckle joints, Design of welded joints; Fillet and butt welds, Welded joint subjected to Bending moment, Welded joint subjected to Torsional moment, Design of riveted joints; Design of Longitudinal Butt joint for Boiler shell, Design of Circumferential Lap joint for Boiler shell, Eccentrically Loaded Riveted Joint, Design of bolted joints, Forms of threads, Trapezoidal threads.

Module 3: Shafts, Keys & Couplings: Design of shaft under combined bending, twisting and axial loading; shock and fatigue factors, design for rigidity; design of shaft subjected to dynamic load; design of hollow shafts.

Design of keys: Design of Square and Flat keys, Design of Kennedy key.

Module 4: Selection & Design of Bearings: Reynold's equation, stable and unstable operation, heat dissipation and thermal equilibrium, boundary lubrication, dimensionless numbers,

Design of joumal bearings,

Design of Rolling- element bearing: Types of rolling contact bearing, bearing friction and power loss, bearing life; Radial, thrust & axial loads; Static & dynamic load capacities; Selection of ball and roller bearings; lubrication and sealing.

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Module 5: Design of Springs: Types of springs, Terminology of Helical Spring, Design of helical compression and tension spring, Design of leaf spring and Torsion springs, Fatigue loading of springs, Surge in springs, Spiral springs, nipping of leaf spring.

Evaluation:

Evaluation will be continuous an integral part of the class as well through external assessment.

References:

1. Robert C Juvinal, Kurt M Marshek Machine Component design Wiley Student edition.
2. CS Sharma & Kamlesh Purohit, Design of machine elements PHI.
3. Sharma & Agarwal Machine design.
4. Pandya & Shah, Charottar.
5. JE Shingley Machine design Mc Graw Hills,
6. Gope PC, Machine Design, PHI Learning. 2015.
7. P Kannaiah, Machine Design, SCITECH.
8. Nortan RL, Machine Design, Pearson, Fifth Edition.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Illustrate modes of failure, fatigue and different factors used in design.
C02	Design various machine elements such ascotter joints, knuckle joints, welded joints, springs, bearings and shafts used in different machines.
C03	Analyzemachine components against combined bending, twisting and axial loading.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1									
CO2	3	2	2	1								
CO3	1	1	2	2								

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COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME51A	Instrumentation Measurement & Control	70	20	10	-	-	100	3	1	-	4

Course Objective:

1. Develop ability to understand basic concept of measurement system.
2. Develop ability to understand the mathematical modelling of measurement system.
3. Develop ability to analyze the errors in measurement system
4. Develop an ability to utilize control system
5. Appropriate selection of instruments

COURSE CONTENTS:

Module-I

Concepts of Measurement: Generalized measuring system, Classification of measuring instruments, Standards of measurements. Measurement errors: Types of error. Calibration of measuring instruments: Static calibration, dynamic calibration. Input-output configuration of measuring instrument and measurement system.

Module-II

Measuring Instrument Characteristics: Statics analysis data: Normal distribution curve and standard deviation. Least square regression analysis, Uncertainty analysis.

Static characteristics: Accuracy and Precision, Range and Span, Repeatability and Reproducibility, Drift sensitivity etc.

Dynamic characteristics: dynamic response: zero order, first order and second order system response.

Module-III

Temperature Measurement:-International practical temperature scale, types of temperature measuring instruments: Liquid in glass thermometers, Bimetallic Thermometers; pressure thermometers, Electrical resistance thermometry; Resistance Temperature Detectors. Thermocouples & thermocouple standards.

Pressure Measurement: Mechanical pressure gauges Low pressure and high pressure gauges: McLeod gauge, ionization gauges. Electrical pressure transducers: piezoelectric and photoelectric pressure transducer etc.

Module-IV

Strain, Force, Torque and Velocity Measurement: - Mechanical strain gauge, Resistance strain gauges,

Displacement measurement: Linear and variable differential transformers (LVDT), angular displacement.

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Velocity measurement: Linear and angular velocity.

Force measurement: Scale and balances.

Load cells: Piezoelectric load cells etc.

Torque measurement Methods.

Module-V

Introduction to control systems: Open loop and closed loop control systems. Block diagram of closed loop control system. Mathematical modelling of mechanical systems: fluid flow, hydraulic and thermal systems. Transfer function, steady state response analysis: First order systems, unit step and unit impulse response of first order systems, second-order systems. Hydraulic control.

Evaluation:

Evaluation will be continuous an integral part of the class followed by the final examination as well as through external assessment.

References:

1. Nakra and Chaudhry; instrumentation, Measurement and analysis; TMH
2. Figiola RS & Beasley DE; Theory and Design for Mechanical Measurements; 3e John Wiley
3. Katsuhiko Ogata; Modern Control Engineering, 4e Pearson Education, New Delhi
4. Gopal; Control Systems Principles and Design; Tata McGraw Hill, New Delhi.
5. Back-with and Buck; Mechanical Measurements.
6. Swhney; Metrology and Instrumentation.
7. A. K.Sawhney; Mechanical measurement and control, Dhanpat Rai Publications.
8. D.S- KUMAR; Mechanical measurement and control, Metropolitan Book Co. Pvt. Ltd.

Course Outcomes:

On the completion of this course, students should be able to

CO1	Define the basic concepts of measurement systems in instrumentation.
CO2	Discuss principles of mathematical modelling for measuring & control systems.
CO3	Analysis the errors and uncertainty in measurement system

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2		1									
CO2	2	1										
CO3	2	2	1									

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Instrumentation & Measurement Lab

- **List of Experiments: (Can be modified/expanded further)**

1. Study of liquid in glass thermometer.
2. Study of Bimetallic thermometer.
3. Study of radiation pyrometer.
4. Study of optical pyrometer.
5. Study of Bourdon tube pressure gauge.
6. Study of Potentiometer transducer.
7. Study of linear variable differential transducer (LVDT).
8. Study of Photoelectric transducer.
9. Study of Rotameter.
10. Study of Venturimeter.
11. Study of Orificemeter.
12. Study of open loop control system.
13. Study of closed loop control system.

Course Outcomes:

On the completion of this course, students should be able to

CO1	Define the basic concepts of measurement systems in instrumentation.
CO2	Discuss principles of mathematical modelling for measuring & control systems.
CO3	Analysis the errors and uncertainty in measurement system

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2		1									
CO2	2	1										
CO3	2	2	1									

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COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME52	Internal Combustion Engines	70	20	10	30	20	150	3	-	2	4

Course Objective:

1. To make students familiar with performance characteristics of I C engines.
2. To study the thermodynamics, combustion, heat transfer, friction and other factors affecting I. C engines performance.
3. To study conventional and modern system being used in I. C engines.
4. To study future fuels of engines.
5. To study different types of superchargers and supercharging methods.

COURSE CONTENTS:

MODLE I

Internal Combustion Engine: S.I. and C.I. engines of two and four stroke cycles, real cycle analysis of SI and CI engines, determination of engine dimensions, speed, fuel consumption, output, mean effective pressure, efficiency, factors effecting volumetric efficiency, heat balance, performance characteristics of SI and CI engines, cylinder arrangement, firing order, power balance for multi-cylinder engines, valve timing.

MODLE II

Combustion in SI engines: Flame development and propagation, ignition lag, effect of air density, temperature, engine speed, turbulence and ignition timings, physical and chemical aspects of detonation, effect of engine and fuel variables on knocking tendency, knock rating of volatile fuels, octane H.U.C.R., action of dopes, pre-ignition, its causes and remedy, salient features of various types of combustion chambers, valve timing and firing order.

Module-III

Combustion in C.I. Engines: Times base indicator diagrams and their study, various stages of combustion, delay period, diesel knock, octane number, knock inhibitors, salient features of various types of combustion chambers, fuel, ignition, cooling, exhaust and lubrication systems; Simple problems on fuel injection, various types of engines, their classification and salient features. Rotary I.C. engines, their principles of working.

Module- IV

I.C. Engine System: Fuels, ignition systems, cooling, exhaust/scavenging and lubrication system. Fuel metering in SI engine: Fuel injection in SI engine (MPFI & TBI). Theory of carburetion, simple problems on carburetion. Fuel metering in CI engines: Fuel injection in CI engine and simple problems, various types of

engines, their Classification and salient features. Fuels: Conventional fuels and alternate fuels, engine exhaust. Emission, carbon monoxide, unburnt hydro carbon, oxides of nitrogen, smoke, density, measurement and control, hydrogen as alternate fuel.

Module-V

Supercharging. Effect of altitude on mixture strength and output of S.I. engines, low and high pressure super charging, exhaust, gas turbo-charging, supercharging of two Stroke engines.

Evaluation:

Evaluation will be continuous an integral part Of the class followed by the final well as through external assessrnent.

References:

1. Ganeshan V; Internal Combustion engines; IMH
2. Mathur ML & Sharma RP; A. Course in IC engines; DhanpatRai
3. Gupta HN; Fundamentals Of IC Engines; PHI
4. Srinivasan S; Automotive Engines; TN'IH
5. Halderman JD and Mitchell CD; Automotive Engines theory and servicing; Pearson
6. DomKundwar; Internal Combustion Engines ; Dhanpat Rai Publications
7. Taylor GF; Internal Combustion Engines Theory & Practice; MIT Press
8. Richard Stone; Introduction to IC Engines; Society of Automotive Engr (Palgrave McMil Ian)

Course Outcomes:

At the completion of this course, students should be able to

CO1	Discuss the working of I.C. engine and various engine systems.
CO2	Analyze the performance of SI and CI engines.
CO3	Identify I.C. engines for different engineering applications.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2		1									
CO2	1		2									
CO3	2	2	2									

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Internal Combustion Engines Lab

List of Experiments: (Can be modified/expanded further)

1. Determination of Valve timing diagram for S.I. and C.I. four stroke engines.
2. To study the performance parameters of l.c. engines and draw Heat Balance sheet.
3. 3, Study of Battery Ignition system and magneto Ignition System.
4. Study of lubricating system in CI Engines.
5. Study of Fuel Injection system in SI Engine.
6. Study of Fuel Injection system in CI Engine.
7. Study of Carburettors.
8. Study of Diesel fuel pump and fuel injectors.
9. To find the indicated power on multi-cylinder petrol engine by Morse test.
10. Study of kirloskar diesel engine.

Course outcome of lab:

At the completion of this course, students should be able to of SI and CI engines,

CO1	Evaluate Performance parameters of SI and CI engines.
CO2	Explain various engine systems and their working.
CO3	Inspect and test engines for their performance.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1									
CO2	1		2									
CO3	2	2	1									

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COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME53	Turbo Machines	70	20	10	30	20	150	3	-	2	4

Course Objective:

During the course the student will be able to learn about:

1. Steam turbines and its application in thermal power plants
2. Gas turbines and its application in Gas Turbine power plants
3. Hydraulic Turbines and its application in Hydel power plants
4. pumps, compressors, blowers and fans and other equipments in power plants
5. Power Transmitting Turbo machines and hydraulic systems

Course Contents:

MODLE I

Steam Turbines: Classifications of steam turbines, principles of impulse and reaction machines.

Impulse Turbine: Impulse staging, velocity and pressure compounding, utilization factor, analysis for optimum utilization factor, Curtis and Rateau stage, velocity diagram, blade velocity coefficient, force, work done, blade efficiency, nozzle efficiency, gross stage efficiency, analysis for optimum efficiency, mass flow and blade height.

Reaction Turbine: Reactions staging, velocity diagram, Parson's stages, degree of reaction, nozzle efficiency, velocity coefficient, stator efficiency, carry over efficiency, stage efficiency, vane efficiency, conditions for optimum efficiency, speed ratio, axial thrust, reheat factor in turbines. Governing and performance characteristics of steam turbines.

MODLE II

Water Turbines: Classification, Pelton, Francis and Kaplan turbines, vector diagrams and work-done, Hydraulic, volumetric, mechanical and overall efficiencies, draft tubes, governing of water turbines.

Performance and Characteristics: Application Of dimensional analysis and similarity to water turbines, unit and specific quantities, selection of machines, Main and operating characteristics of the machines and cavitation.

MODULE III

Rotary Fans, Blowers And Compressors: Classification based on pressure rise, centrifugal and axial flow machines Centrifugal Blowers Vane shape, velocity triangle, degree of reactions, slip coefficient, size and speed of machine, vane shape and stresses, efficiency, characteristics, fan laws and characteristics.

Centrifugal Compressor: - Vector diagrams, work done, temp and pressure ratio, slip factor, work input factor, pressure coefficient, Dimensions of inlet eye, impeller and diffuser.

Axial Flow Compressors: - Vector diagrams: work done factor, temp and pressure ratio, degree of reaction, Dimensional' Analysis for plotting compressor surging and choking, Polytropic and isentropic efficiencies.

MODLE IV

Centrifugal Pumps: Classification, advantage over reciprocating type, definition of manometric head, gross head, static head, velocity diagram and work done, slip factor, efficiency and sources of inefficiency, minimum starting speed of pump, net positive suction head, priming and cavitation, unit and specific quantities, performance characteristics.

Power Transmitting Turbomachines: Fluid coupling and Torque converter, their torque ratio, speed ratio, slip and efficiency, velocity diagrams and characteristics.

MODLE V

Hydrostatic Systems: hydraulic intensifier, accumulator, press and crane.

Gas Turbines: Simple cycle, modification in Simple cycle, simple cycle with heat exchanger, with reheat, with intercooler, closed cycle gas turbine, practical gas turbine cycle, optimum pressure ratio for maximum specific work output and thermal efficiency in actual turbine cycle, effect of operating variables on thermal efficiency. Jet Propulsion: types, pulse jet, Ram jet, turbo jet, efficiency and horsepower of propulsion, flying unit.

Evaluation:

Evaluation will be continuous an integral part of the class followed by he final examination well as through external

References:

1. Venkanna BK; turbomachinery, PHI
2. . Shepherd DG; Turbo machinery
3. Csanday; Turbo machines.
4. Kadambi V Manohar Prasad; An introduction to EC Vol. Ill-Turbo machinery; Wiley Eastern Delhi
5. Bansal R. K; Fluid Mechanics & Fluid Machines;
6. Rogers Cohen & Sarvan Multo Gas Turbine Theory
7. Kearton W. J; Steam Turbine: Theory & Practice.
8. S. J. k. Jain; gas turbine theory and jet propulsion.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Illustrate the working of different types of turbo machines.
CO2	Classify the engineering applications of different turbo machines.
CO3	Estimate the performance parameter of turbo machines.
CO4	Design the Turbo machines for specified parameters.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1									
CO2	1	1										

CO3	1		2	2								
CO4	2	2	1									

Turbo Machines Lab

List of Experiments: (Can be modified/expanded further)

1. Performance analysis and plotting main characteristic curves of pelton turbine.
2. Performance analysis and plotting operating characteristic curves of peltcn turbine.
3. Performance analysis and plotting main characteristic curves of reaction turbine.
4. Performance analysis and plotting operating characteristic curves of reaction turbine.
5. Performance analysis and plotting main characteristics curves of centrifugal pump.
6. Performance analysis and plotting operating characteristic curves of centrifugal pump.
7. Performance analysis of centrifugal blower.

Lab Course Outcomes:

At the completion of this course, students should be able to-

CO1	Determine the performance and their operating characteristics of different types of turbines.
CO2	Elaborate the characteristic curves and its applications of different types of turbines.
CO3	Estimate the working parameters of pumps.
CO4	Develop the concept of characteristic curves and use of power Transmitting Turbo Machines.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1											
CO2	1	2										
CO3	2	3										
CO4	1	2	3	2								

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COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
ME54	Dynamics of machines	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work	150	L	T	P	4
		70	20	10	30	20		3	-	2	

Course objective:

At the completion of the course the students will be able:

1. To determine the velocity and acceleration of piston in a reciprocating engine mechanism and calculation of flywheel rim dimensions.
2. To illustrate the working of speed control mechanisms.
3. To demonstrate the concepts of balancing of rotors of heavy machines.
4. To distinguish the principles of clutches, brakes and dynamometers and calculate the brake power.

Course Contents:

Module-I

Dynamics of Engine Mechanism: Displacement, velocity and acceleration of piston; turning moment on crankshaft, turning moment diagram; fluctuation of crankshaft Speed, analysis of flywheel.

Module-II

Governor Mechanisms: Types of governors, characteristics of centrifugal governors, gravity and spring controlled centrifugal governors, hunting of centrifugal governors, effort and power of governor.

Module-III

Balancing of Inertia Forces and Moments in Machines: Balancing of rotating masses, two plane balancing. Determination of balancing masses (graphical and analytical methods). Balancing of rotor. Balancing of reciprocating masses.

Module-IV

Friction: Frictional torque in pivots and collars by uniform pressure and uniform wear rate criteria.
Friction Clutches: Single plate clutch and multi plate clutch, Cone clutch.

Module-V

Brakes: Band brake, block brakes, Internal expanding shoe brakes.
Dynamometer: Different types and their applications.

Evaluation:

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Evaluation will be continuous an integral part of the class followed by the final examination as well as through external assessment.

References:

1. Ambekar, AG; Mechanism and Machine Theory, PHI
2. Rattan SS; Theory of machines; TMH
3. Sharma and Purohit; of Machine elements; PHI
4. Bevan; Theory of machines;
5. Ghosh and Theory Of Mechanisms and Machines; Affiliated East-West press, Delhi
6. Norton RL; kinematics and dynamics of machinery; TMH
7. Grover; Mechanical Vibrations/
8. Balaney, Theory of Machines
9. Theory of Vibrations by Thomson
10. Theory of machines through solved problems by J .S.RAO.

Course Outcomes:

At the completion of this Course, students should be able to-

CO1	Illustrate the working of flywheel, governor, clutch, brake and dynamometer.
CO2	Examine the turning moment diagrams, characteristic curve of governors, unbalanced forces and couple, failure of clutches and brakes.
CO3	Assess the motion of piston, hunting, effort and power of governor, balancing masses, frictional torque.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2										
CO2	2	3		1								
CO3	1	2										

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Dynamics of machines Lab

List of Experiments: (Can be modified/expanded further)

1. Study of various models of governors.
2. To study working of different types of brakes using models.
3. To study working of friction clutches using models
4. To study working of different types of dynamometer.
5. To study static and dynamic balancing machines.

Course Outcomes:

At the completion of this Course, students should be able to-

CO1	Illustrate the working of flywheel, governor, clutch, brake and dynamometer.
CO2	Examine the turning moment diagrams, characteristic curve of governors, unbalanced forces and couple, failure of clutches and brakes.
CO3	Assess the motion of piston, hunting, effort and power of governor, balancing masses, frictional torque.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2										
CO2	2	3		1								
CO3	1	2										

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COURSE CONTENTS w.e.f. July 2023

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
BT53	Entrepreneurship & Management Concepts	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work	100	L	T	P	4
		70	20	10	-	-		3	1	-	

Course Objective:

To familiarize .the students with the concepts and applications of Management, Marketing Productivity & Entrepreneurship in competitive world.

COURSE CONTENTS:

Module-I

System Concepts: Types, definition & characteristics; supra & subsystems, key component; boundary interface complexity; feedback (pull) & feed (push) controls, open flexible-adaptive system, computer as closed system, law of requisite variety; system coupling, stresses and entropy; functional & cross functional system; Steven Alters' nine element work system model and its comparison with IPO (input-processing-output) model, structure and performance of work systems leading to customer delight.

Module-II

Management: Importance, definition and schools of theories, knowledge driven learning organization and e-business; environment, uncertainty and adaptability; corporate culture, difficulties and levels of planning, BCG matrix, SWOT analysis, steps in decision making,, structured and unstructured decision; dimensions of organizations, size/specialization, behaviour formalization, authority centralization, departmentalization, span and line of control, technology and Minzberg organization typology, line, staff & matrix organization, coordination by task forces business process reengineering and process of change management, HR planning placement and training, NTIS; attitude.- 2nd personality trait, overlap and differences between leader & manager, leadership grid, motivation, Maslow's need hierarchy and Herzberg two factor theory, expectation theory, learning process, team work and stress management.

Module-III

Marketing: Importance, definition, core concepts of need want and demand, exchange & relationships, product value, cost and satisfaction- (goods and services) marketing environment; selling, marketing and marketing concepts; four P's, product, price, placement, promotion; consumer, business and industrial market, market targeting, advertising, publicity, CRM and market research.

Finance: Nature and scope, forms of business ownerships, balance sheet, profit and loss account, fund flow arid cash flow statements, breakeven point (BEP) and financial ratio analysis, pay-back period, NPV and capital budgeting.

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Module-IV

Productivity and Operations: Productivity, standard of living and happiness, types Of productivity, operations (goods and services) Vs project management, production processes and layouts, steps in method improvement, time measurement, rating and various allowances; standard time and its utility, predetermined motion and time method, product and process specifications, TQM, cost of quality, introduction to-lean manufacturing (JIT), QED, TPM & six sigma quality.

Module-V

Entrepreneurship: Definition and concepts, characteristics, comparison with manager, classifications theories of entrepreneur, socio, economic, cultural and psychological; entrepreneur traits and behavior, roles in economic growth, employment, social stability, export promotion and Indigenization, creating a venture, opportunity analysis cornpetitive and technical factors, sources of filnds, entrepreneur development program. Sustainability of entrepreneurship, sustainable product, sustainability & operations management.

Evaluation:

Evaluation will be continuous and integral part of the class followed by the final examination.

References:

1. Daft R; The new era of management; Cengage.
2. Bhat Anil, Arya kumar; Management: Principles,Processes and Practices; Oxford higheredu.
3. Davis & Olson; Management Information System; TMH.
4. Steven Alter; Information systems, Pearson, vv.vw.stevenalter.com
5. Kotler P; Marketing management; 6- Khan, Jain; Financial Management; 7- ILO; Work study;ILO.
6. Mohanty SK; Fundamental of Entrepreneurship; PHI.

Course Outcomes:
At the completion of this course, students should be able to

CO1	Illustrate the concepts of Work system model.
CO2	Analyze the concepts & theories of management applied to the Entrepreneurship.
CO3	Estimate capital budget and market research for a given product/service.
CO4	Evaluate productivity rating and various allowances; standard time in work

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2		1									
CO2	2	2		1								
CO3	2	2		1								
CO4	2		1	1								

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COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME61A	Mechanics of Materials-II	70	20	10	-	-	100	3	1	-	4

Course Objective:

During the course the student will be able to learn about:

1. The theory of elasticity including strain/displacement and Hooke 's law relationships.
2. Analyze solid mechanics problems using classical methods and energy methods.
3. Obtain stresses and deflections of beams on elastic foundations

Course Contents:

Module 1: Strain Energy or Resilience:

Strain Energy- Elastic, plastic and rigid members, Stresses due to different types of axial loading, Gradually applied loads, Impact loads, Deflection of beam using strain energy method, Strain energy stored due to bending, The first theorem of Castigliano and its applications, Laminated Springs or Leaf springs.

Module 2: Conjugate Beam Method, Propped Cantilevers and Beams:

Conjugate Beam Method: Deflection and slope of simply supported beam (point load at the centre, carrying an eccentric point load), Relation between actual beam and conjugate beam. Propped Cantilever And Beam: Shear force and Bending moment for a propped cantilever carrying (point load at the centre and propped at the free end, uniformly distributed load and propped at free end).

Module 3: Fixed Beam and Continuous Beam:

Relation between the free B.M. diagram and the fixed B.M. diagrams, Slope and deflection, Effect of sinking of supports, Fixed beam subjected to couple, Degree of fixity, Advantages and disadvantages of fixed beam, Clapeyron's theorem of three moments, Column Analogy method.

Module: 4: Thick Cylindrical Shells:

Introduction, Stresses in a thick cylindrical shell, Lamme's equation, Hoop stresses and radial pressure distribution, Stresses in Compound thick cylinders, Thick spherical shells.

Module 5: Theories of Failures:

Maximum normal stress theory; maximum shear stress theory, Principal stress theory; Maximum normal and shear strain energy theory; Maximum distortion energy theory; Application of theories to different materials and loading conditions.

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Evaluation

Evaluation will be continuous an integral of the class as well through external assessment.

References:

l. Beer FP, Johnson Mechanics of Materials, Sixth Edition; MC Graw Hills.

2. Stephen Timoshenko; Strength of materials;partlÆ2; CBS Pub.

3. Singh Arbind K; Mechanics of Solids; PHI

4. R Subramannian, Strength of materials OXFORD University press, Third Edition.

5. Egor P. Popov; Engineering Mechanics of Solids; PHI

6. S Ramamurthum, Strength of materials,Dhanpat Rai.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Estimate strain energy stored due to bending.
C02	Calculate Shear force, Bending moment, Slope and deflection in Beams.
C03	Analyze stresses in thick cylinders and spheres.
CO4	Design elements of machine, structure and members by using different theories of failures.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2									
CO2	2	1	2									
CO3	2	1	2									
CO4	1	2	3									

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Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME61C	Finite Element Method	70	20	10	-	-	100	3	1	-	4

Course Objectives:

During the course the student will be able to learn about:

1. The fundamental concepts of the theory of the finite element method.
2. The use of the basic finite elements for structural applications using truss, beam, frame, and plane element.

Course Contents:

Module 1: Introduction

Structural analysis, objectives, static, Dynamic and kinematics analyses, Skeletal and continuum structures, Modelling of infinite Degree of freedom(D.O.F.) system into finite D.O.F. system, Basic steps in finite element problem formulation, General applicability of the method.

Module 2: Element Types and Characteristics

Discretization of the domain, Basic element shapes, Aspect ratio, Shape functions, generalized co-ordinates and nodal shape functions. ID bar and beam elements, 2D rectangular and triangular elements, Axisymmetirc elements.

Module 3: Assembly of Elements and Matrices

Concept of element assembly, Global and local Co-ordinate systems, Band width and its effects, Banded and skyline assembly, Boundary conditions, Solution of simultaneous equations, Gaussian elimination and Choleksy decomposition methods, Numerical integration, ID and 2D applications.

Module 4: Higher Order and ISO-parametric Elements

One dimensional quadratic and cubic elements, Use of natural Co-ordinate system, Area Co- ordinate system, continuity and convergence requirements, 2D rectangular and triangular requirement.

Module 5: Static & Dynamic Analysis

Analysis of trusses and frames, Analysis of machine subassemblies, Use commercial software packages, Advantages and limitations Hamilton's principle, Derivation of equilibrium, Consistent and lumped mass matrices, Derivation, of mass matrices for ID elements, Determination of natural frequencies and mode shapes, Use of commercial software packages.

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References:

1. Rao, S.S., The Finite Element Method in Engineering, 2nd ed., Peragamon Press, Oxford.
2. Robert, D Cook. David, S. Ma[kins, and Michael E. Plesha, Concepts and Application of Finite Element Analysis 3rd ed, John Wiley.
3. Chandrupatla, TR. anBelegundu, A.D., Introduction to Finite Elements in Engineering, Prentice Hall of India Pvt. Ltd.
4. Zienkiewicz O C, The Finite Element Method, 3rd ed, Tata McGraw Hill.

Evaluation

Evaluation will be continuous and integral part of the class well through external assessment.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Make use of finite element method to solve simple problems from Structural & Dynamic domain.
C02	Develop the concept of various elements and their characteristics.
C03	Create element and global stiffness, displacement and force matrices for ID abd 2D FEA.
CO4	Apply the finite element analysis using available commercial FEA tools.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1										
CO2	2				1							
CO3	1	2										
CO4	2		2		3							

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Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
ME62A	Power Plant Engineering	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work	100	L	T	P	4
		70	20	10	-	-		3	1	-	

Course Objective:

1. Understanding the process of converting various renewable energy sources to electric power, Layout of renewable energy power plant and their advantages and limitations.
2. Understand layout of working principle of fossil thermal power plant. & co-generation system, including coal handling system, pulverization of coal, steam generation system, steam turbine, condenser, cooling tower and control systems.
3. Understand the layout of nuclear plant, nuclear fuels & chain reactions, components and working principle of different types of nuclear power plants.
4. Understand the layout of hydroelectric power plant with plant components, hydrologv- hydrographs, flow duration curve, mass curve & power control systems.
5. Understand the power plant economics, estimate the prediction loads, and factors.

Course Contents:

Module 1: Renewable Energy Power Plants:

Introduction to methods of converting various energy sources of electric power, direct conversion methods renewable energy sources, solar, Wind, tidal, geothermal, bio- thermal, biogas and hybrid energy systems, fuel cells, thermoelectric modules, MHD-Converter.

Module 2: Fossil Fuel Steam Stations:

Basic principles Of station design, recent trends in turbine and boiler sizes and Steam conditions, plant design and layout, outdoor and indoor plant, system components, fuel handling burning systems, feed water treatment plant, condensing plant and circulating water systems, cooling towers, turbine room and auxiliary plant equipment, instrumentation, testing and plant heat balance. Combined cycle power generation, heat recovery steam generator, co-generation plant.

Module 3: Nuclear power Station:

Importance of nuclear power development in the world and Indian context, Review of atomic structure and radio activity, binding energy concept, fission and fusion reaction. Fissionable and fertile materials, thermal neutron fission, important fuels. Moderators and coolants, Types of pressurized water reactor, boiling water reactor, breeder reactor, CANDU reactor, gas cooled reactor.

Module 4: Hydro-Power Station:

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Classification Of hydroelectric power plant, introduction to hydrology, plant layout, hydro plant auxiliaries, cost of plant, life of plant, hydro power control, electrical and mechanical components, comparison of hydro power station with thermal power station, automatic and remote control of power plant, safety measures and preventive maintenance of hydro power plant, calculation of available hydro power.

Module 5: Power Station Economies:

Estimation and prediction of load. Maximum demand, load factor, diversity factor, plant factor and their influence on plant design, operation and economics; comparison of hydro and nuclear power plants typical cost structures, simple problems on cost analysis, economic performance and tariffs, interconnected system and their advantages, elements of load dispatch in interconnected systems.

References:

1. Nag PR; Power plant Engg; TMH
2. Al-Wakil MM; Power plant Technology; TMH
3. Sharma PC; Power plant Engg; Kataria and sons. Delhi
4. Domkundwar; power Plant Engg; Dhanpatrai.* sons,
5. Rajput RK; A text book of Power plant Engg.;Laxmi Publications.
6. Yadav R; Stearn and turbipe and power plant engg by

Course Outcomes:

At the completion of this course, students should be able to

CO1	Define the procedure of site selection for power plant and able to know the procedure to convert renewable fossil fuel energy, nuclear energy & fluid energy into electric power
C02	Explain function of different mechanism of power plant like fuel handling, its combustion , Utilization of potential of energy to convert in power by using mechanical and electrical equipments
C03	To draw the layout of power plant like renewable energy based , fossil fuel based, hydro and nuclear based power plants.
CO4	Estimate the power plant load, maximum demand, load factors, diversity factor, plant factor and their influence on plant design, operation and economics.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1										
CO2		2	1									
CO3		1	2									
CO4		1	2									

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Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
ME62B	Intellectual Property Right	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work	100	L	T	P	4
		70	20	10	-	-		3	1	-	

Course Objective:

During the course the student will be able to learn about:

1. Concepts of Intellectual property Rights & Copyright issues.
2. Patent, Trade Marks, Designs & GI terminologies.
3. Contemporary Issues & Enforcement of IPR

Course Contents:

Module 1: Introduction

Introduction and Justifications of IPR, Nature of IP, Major forms of IP- Copyright, Patent, Trademarks Designs, Geographic indication, layout design of Semiconductors, Plant varieties, Concept & Meaning of Intellectual Property.

Major international documents relating to the protection of IP - Berne Convention, Paris Convention, TRIPS. The World Intellectual Property Organization (WIPO).

Module 2: Copyright

Meaning and historical development of copyright, Subject matter, Ownership of copyright, Term of copyright, Rights of owner, Economic Rights, Moral Rights. Assignment and licence of rights, Infringement of c6pyright, Exceptions of infringement, Remedies, Civil, Criminal, Administrative, Registration Procedure.

Module 3: Patents

Meaning and historical development. Criteria for obtaining patents, Non patentable inventions, Procedure for registration, Term of patent, Rights of patentee, Compulsory license, Revocation, Infringement of patents, Exceptions to infringement, Remedies, Patent office and Appellate Board.

Module 4:- Trade Marks, Designs & GI

Trade Marks: Functions of marks, Procedure for registration, Rights of holder, Assignment and licensing of marks, Infringement, Trade Marks Registry and Appellate Board.

Designs: Meaning and evolution of design protection, Registration, Term of protection, Rights of holder, unregistered designs.

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Geographical Indication: Meaning and evolution of GI, Difference between GI and Trade Marks, Registration, Rights, Authorised user.

Module 5: Contemporary Issues & Enforcement of IPR

IPR & sustainable development, The Impact of Internet on IPR. IPR Issues in biotechnology, Ecommerce and IPR issues, Licensing and enforcing IPR, Case studies in IPR

References:

1. P. Narayanan, Intellectual Property Law, Eastern Law House.
2. Neeraj Pandey and Khushdeep Dharni, Intellectual Property Rights, PHI, 2014.
3. N.S Gopalakrishnan ard T,G, Agitha, Principles Of Intellectual property, Eastern Book Co. Lucknow, 2009.
4. Anandpadmanabhan, Enforcement of Intellectual Property, Lexis NevisButterworths, Nagpur, 2012.
5. Managing Intellectual Property the Strategic Imperative, Vinod V. Sople, PHI.
6. PrabuddhaGRnguli, "Intellectual Property Rights" Mcgraw Hill Education, 2016.

Evaluation

Evaluation will be continuous an integral part of the class as well through external assessment.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Outline the concept of Intellectual Property Rights & Copyright issues.
C02	Assess patent, Trade Marks, Designs & GI terminology and terms.
C03	Discuss Contemporary Issues & Enforcement of IPR.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1					1		3				1
CO2	1			1		1		2				1
CO3	1					1		2				1

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Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME62C	Automotive Fuels & Emission	70	20	10	-	-	100	3	1	-	4

Course Objective:

During the course the student will be able to learn about:

1. Different types of automobile fuels.
2. The characteristics of different automobile fuels.
3. The effect of different automobile fuels on emission.
4. The Norms on emissions and different emission standards.

Course Content:

Module 1: Introduction Automobile Fuels:

Classification of Automobile alternative fuels(liquid, gaseous, hydrogen, LPG, CNG, Biogas etc J, Desirable characteristics of SI & CI engine alternative fuels, Rating of SI & CI engine fuels, Introduction to alternate energy sources. Like EV, hybrid, fuel cell and solar cars. Merits and demerits of various alternate fuels.

Module 2: Liquid alternative fuels:

Vegetable Oils: Various vegetable oils for automobile engines, esterification, performance in engines, performance and emission characteristics, bio diesel and its characteristics. Alcohols: Properties as engine fuel, alcohols and gasoline blends, performance in automobile engine, methanol and gasoline blends.

Module 3: Biogas:

Introduction to Biogas system, Process during gas formation, Factors affecting biogas formation. Usage of Biogas in SI engine & CI engine, Properties of Natural gas, Hydrogen gas, LPG & CNG as engine fuels, storage and handling, performance and safety aspects to all gaseous fuel, metering systems.

Module 4: Automobile emissions:

Types of automobile emissions, emission characteristics, formation of automobile emissions, mechanism of HC , CO and NO in SI engine, exhaust emission and factors affecting the emission, evaporative emission, crankcase emission, lead emission CI engine emissions: formation of smoke, factors affecting the smoke formation, unburned hydrocarbons, carbon monoxide, oxides of nitrogen, smog and comparison of diesel and petrol emissions.

Module 5: Emissions Norms & Measurement:

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Emission norms as per Bharat Standard up to BS - IV and procedures for confirmation on production. Demerits of automobile emission to environment. Types Of Catalytic Conversion, measurement Techniques Emission Standards and Test Procedure NDIR, FID, Chemiluminescent analyzers, Gas Chromatograph, smoke meters, emission standards.

References:

1. J B. Heywood. Internal combustion Engines, Wiley
2. Ganeshan V; Internal Combustion engines; TMH
3. Mathur M L & Sharma RP; A. Course in IC engines; DhanpatRai
4. R Yadav, Internal Combustion Engines
5. Halderman JD and Mitchell CD; Automotive Engines theory and servicing;' Pearson
6. DomKundwar, Internal Combustion Engines; Dhanpat Rai publications
7. Taylor GF; Internal Combustion Engines Theory & Practice; MIT press
8. Richard Stone; Introduction to IC Engines; Society of Automotive Engineering (Palgrave MC Mill an)

Course Outcomes:

At the completion of this course, students should be able to

CO1	Define different types of fuel.
C02	Differentiate Different types of automobile fuels.
C03	Analyse the emissions of different automobile fuels.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1										
CO2	1	2	1									
CO3	1	1	2									

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COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME63	Heat & Mass Transfer	70	20	10	30	20	150	3	-	2	4

Course Objective:

1. Understand the application of various experimental modes of heat transfer i.e. conduction convection, radiation and solve problems related to heat transfer and learn about critical thickness of insulation.
2. Extend the conduction and convection laws in extended surfaces and solve unsteady state heat transfer problems applied to various applications.
3. Categories the free and forced convection processes and utilizes empirical relations for laminar and turbulent flow.
4. Solve heat exchanger problems using LMTD and NTU methods with the help of heat transfer data book and learn the basics of mass transfer.
5. Understand boiling and condensation phenomena and the laws ofradiation and solve problem related to radiation heat transfer for black body and gray body.

COURSE CONTENTS:

Module 1: Basic Concepts: Modes of heat transfer, Stefan Boltzman's law; Fourier's law, thermal resistance and conductance, analogy between flow of heat and electricity, combined heat transfer process;

Conduction: Fourier heat conduction equation, its form in rectangular, Cylindrical and spherical coordinates, thermal diffusivity, linear one dimensional steady state conduction through a slab, tubes, spherical shells and composite structures, electrical analogies, critical- insulation-thickness for pipes, effect of variable thermal conductivity.

Module 2: Extended surfaces (fins): Heat transfer from a straight and annular fin (plate) for a uniform cross section; error in measurement of temperature in. a thermometer well, fin efficiency, fin effectiveness, applications; Unsteady heat conduction: Transient and periodic conduction, heating and cooling of bodies with known temperatures distribution, systems with infinite thermal conductivity, response of thermocouples.

Module 3: Convection: Introduction, free and forced convection; principle of dimensional analysis, Buckingham theorem, publication three-dimensional analysis of free land forced convection, empirical correlations for laminar and turbulent flow over flat plate and tubular geometry; calculation of convective heat transfer coefficient using data book.

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Module 4: Heat exchangers: Types- parallel flow, counter flow; evaporator an condensers, overall heat transfers coefficient. Fouling factors, log-mean temperature difference (lmtd), method of heat-exchanger analysis, effectiveness of heat exchanger, NTU method;

Mass transfer: Fick's law-molar diffusion, diffusion coefficient, analogy with heat transfer, diffusion of vapour in a stationary medium.

Module 5: Thermal radiation: Nature of radiation, emissive power, absorption, transmission, reflection and emission of radiation, Planck's distribution law, radiation from area between black and gray surfaces, shape analogical electrical network, radiation Shields.

Boiling and condensation: Film wise and drop wise condensation; Nusselt theory for film wise condensation on a vertical plate and its modification for horizontal tubes; boiling heat transfer phenomenon, regimes of boiling, boiling correlations.

References:

1. Sukhatme SP; Heat and mass transfer; University Press Hyderabad.
2. Holman JP; Heat transfer; TMH
3. Dutta Binay K; Heat Transfer; PHI
4. Kumar DS; Heat and mass transfer; SK Kataria and Sons Delhi
5. Kreith; Heat transfer,
6. Sachdeva RC; Fundamentals of engineering heat and mass transfer,.
7. Gupta & Prakash; Engineering heat transfer,

Evaluation:

Evaluation will be continuous an integral part of the class as well through external assessment.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Illustrate- the real time applications of fluid, solid medium and radiation heat transfer.
C02	Utilize the knowledge of design skills of heat transfer problems for different boundary conditions
C03	Examine the real time applications of heat transfer equipments under different conditions
CO4	Estimate the heat transfer rate for various complex conditions

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1										
CO2	2		2									
CO3	1	2										
CO4	3	2										

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Heat & Mass Transfer Lab

List of Experiments: (Can be modified/expanded further)

1. Conduction through a rod to determine thermal conductivity of material.
2. Forced and free convection over circular cylinder.
3. Free convection from extended surfaces.
4. Parallel flow and counter flow heat exchanger effectiveness and heat transfer rate.
5. Calibration of thermocouple.
6. Experimental determination of Stefen-Boltzman constant

Course Outcomes:

At the completion of this course, students should be able to

CO1	Analyze conduction, convection and radiation heat transfer processes
C02	Illustrate the working of various heat transfer equipments

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1										
CO2	2		2									

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COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
ME64	Metal Cutting & Machine Tools	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work	150	L	T	P	4
		70	20	10	30	20		3	-	2	

Course Objective:

During the course the student will be able to learn about:

1. The course provides students with fundamental knowledge and principles in material removal processes.
2. The fundamentals of machining processes and machine tools.
3. Importance of metal cutting parameters.

Course Contents:

Module 1:

Lathe: Classification of machine tools and their basic components; lathe. specification, components & accessories, various operations on lathes, capstan & turret lathes, tool layout, methods of thread production, machining time, single point cutting tools, tool signature and nomenclature.

Module 2:

Grinding: Types of grinding machines, surface, cylindrical and internal grinding, grinding wheels, specifications, wheel turning and dressing without eccentricity, centre-less grinding.

Module 3:

Milling: Vertical, horizontal and universal type machines, specifications and classifications of milling machines, universal dividing head plain and different indexing, gear cutting, milling cutters.

Drilling & Broaching: Fixed spindle, radial and universal drilling machines, drilling time, broaching principle, broaches and broaching machines.

Module 4:

Shapers: Classification and specifications, principle parts, Quick return mechanism, shaper operations, speed feed, depth of cut, machining time. Surface qualities, equipment used for rating surfaces, rms. CLA value, causes for surface irregularities.

Gear Cutting: Die casting, methods of forming gears, generating process, Gear shaping, gear shaving, gear grinding, gear testing.

Module 5:

Tool Wear, Tool Life and Machinability: Tool wear mechanisms, Types of tool damage during cutting, Wear and chipping characteristics of different tool materials, Tool wear equations, tool failure criteria, Tool life equations, Effect of process parameters on Tool life, Tool life testing, Machinability Surface finish and surface integrity.

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References:

1. Rao PN; Manufacturing Technolod vol 11; TMH.
2. HazraChadhary, Workshop Tech-Il; Media promoter Pub.
3. Lindberg RA; Processes and Materials of Manuåcturing; PHI.
4. Raghuvanshi;BS; Work shop technology Vol-I, II; dhanpat Rai Delhi.
5. Alciatori DG, Histand MB; Introduction to Mechatronics and Measurernent System; TMH.
6. HMT; P ; Oduction Processes; TMR

Evaluation

Evaluation Will be continuous an integral part Of the class as well through external assessment.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Classify conventional machine tools and their components.
C02	Demonstrate working and operations of machine tools such as lathe, milling and grinding machines.
C03	Analyze and Estimation of Tool Wear, its variables and tool life.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			1	2	1	1						1
CO2				1	1	1						
CO3				2	2		1					

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Metal Cutting & Machine Tools Lab

List of Experiments: (Can be modified/expanded further)

1. To make a job on lathe machine with all operations like turning, step turning, thread cutting and knurling.
2. Study of center less grinding machine/ tool and Cutter type grinding machine.
3. Study of horizontal/ universal milling machine, dividing head and indexing mechanism of it.
4. To cut a spur gear on milling machine using rapid indexing method.
5. Study of radial drilling machine and preparing a job on it.
6. To study a sapping machine to learn about working of quick return mechanism.

Course Outcomes: Metal Cutting & Machine Tools Lab:

At the completion of this course, students should be able to

CO1	Learn to build a job on lathe machine.
C02	Experiments with Grinding machine and operations.
C03	Illustrate the working and operations of milling machine.
CO4	Demonstration of shaper machines and operations.
CO5	Analyze Tool wear, its variables and estimation of tool life.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2		1	1	1	1					1
CO2			1	1		1			1			
CO3			1	2	2		1	1				
CO4			2	1		1		1	1			1
CO5	1	1	2	2	1	2	1		2	1	1	2

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COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME65	Industrial Engineering	70	20	10	30	20	150	3	-	2	4

Course Objective:

1. To be familiar with production, planning and inventory control techniques used in industrial engineering.
2. TO calculate the activity and project scheduling cost using PERT and CPM techniques.
3. To perform an analysis for inventory and product quality control.
4. To understand the industrial legislation, design of plant layout and work study.

Course Contents:

Module 1: Production, Planning and Control:

Definition and importance, types of production: job, batch & mass production, routing, scheduling, dispatching and follow up. Forecasting elements, time series, regression, causal and Delphi methods. Break even analysis and Gantt Chart, Project scheduling, application of CPM and PERT techniques, Analysis and control of project cost in CPM and PERT, simple numerical problems.

Module 2: Inventory Control:

Definition, types of inventory - Codification and standardization ABC analysis, Economic ordering quantity Procurement cost, carrying charges, lead time, re-order point, simple problems. Definitions, types of inspection and procedure Statistical quality control - Basic theory of quality control, Process capability Control charts for variables - and R, relationship between control limits and specification limits. Control chart for fraction defective (p), control chart for number of defects

Module 3: Job Evaluation and Wage Plans & Industrial Legislation:

Objective, Methods of job evaluation, job evaluation procedure, merit rating (Performance appraisal), method of merit rating, wage and wage incentive plans. Need for Industrial legislation, Factories act 1948, Industrial dispute act 1947, The Indian trade unions act 1926, and Industrial employment act 1946, Payment of wage act 1936, Workmen compensation act 1923, Payment of bonus act 1965, and Employees provident fund scheme.

Module 4: Work Study:

Definition, advantages and procedure of work-study. Difference between production and productivity, Factors to improve productivity. Method Study: - Definition, objectives and procedure of method study. Symbols, flow process chart (man-machine and material), flow diagram, machine chart,, two hand chart critical examination. Developing a new method Principles of motion economy. Iherblig symbols, SIMO

chart simple problems. Work Measurement -time study, definition, principle and method of time study Stop watch study - number of reading, calculation of basic time, rating techniques, normal time, allowances, and standard time Simple numerical problems. Work Sampling - Definition, method, advantages and disadvantage of work sampling Applications.

Module 5: Plant Location and Layout:

Definition, factors affecting the site selection of plant, Factor affecting plant layout Types of layout: process, product, combination and fixed position layout Techniques in making layout-Flow diagram, templates, distance volume matrix, travel chart Line balancing, and workstation. Material Handling: principles of economic material handling Hoisting equipment - forklift truck, Cranes- mobile motor cranes, overhead cranes, travelling bridges crane and Derrick crane. Whiler crane Conveying equipment - Package conveyors, gravity roller conveyors, screw conveyors, flight or scraper conveyors, bucket conveyors, bucket elevators, belt conveyors, and pneumatic conveyors.

References:

1. SeetharamaL.Narasimhan, Dennis W.McLeavey, Peter J.Billington, "Production Planning And Inventory Control" , PHI, 2nd Edition, 2002.
2. Norman Gaither, Greg Frazier, Operations Management, Thomson Learning, 9th Edition, 2002.
3. Monks J G, "Operations Management", McGraw Hill, 1997.
4. Panneerselvam. R, Production and operations Management,PHI,2005
5. Lee J.Krajewski, Larry P.Ritzman, "Operations Management Strategy and Analysis", PHI, 6th Editiom 2003.
6. Kenneth R.Baker, "Introduction to Sequencing and John Wiley & Sons, New York; 2000.
7. Dilip R SzW"Tndustrial PWS Puhli±uigcompany. Boston. 1997.

Evaluation:

Evaluation will be continuous an integral part of the class as well through external assessment.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Define basic concept of industrial engineering and their importance.
C02	Discuss Various Inventory Control Models, Plant layout, work study methods and Industrial Legislations.
C03	Calculate the activity and project scheduling cost using PERT and CPM techniques.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		1									
CO2	2	1										
CO3	2	2	1									

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Industrial Engineering Lab

List of Experiments: (Can be modified/expanded further)

1. P-chart for fraction defectives.
2. C- chart for number of defectives. (constant sample size)
3. Operating characteristic curve of single sampling attributes plan.
4. Test for normality of sample means. (Normal distribution)
5. Test for normality of sample means. (Universal distribution rectangular)
6. X and R – charts & process capability.
7. Pin board study experiment.
8. Tread mill exercise
9. Rating practice using pack of cards.
10. To draw two handed process chart for bolt, washer & nut assembly.
11. Multiple activity chart (or) man machine chart.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Define basic concept of industrial engineering and their importance.
C02	Discuss Various Inventory Control Models, Plant layout, work study methods and Industrial Legislations.
C03	Calculate the activity and project scheduling cost using PERT and CPM techniques.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		1									
CO2	2	1										
CO3	2	2	1									

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COURSE CONTENTS w.e.f. July 2023

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME71A	Operation Research & Supply Chain	70	20	10	-	-	100	3	1	-	4

Course Objective:

The student will be made to learn.

1. To be familiar with all the OR Techniques and optimization methods.
2. To understand the role of logistics in the supply chain within a focal firm as well as between organisations linked within a given supply chain network.
3. To be familiar with various inventory control techniques.
4. Students will get a clear idea of the decision making and meta-heuristic algorithm.

Course Content:

Module-I

Linear system and distribution models: Mathematical formulation of linear systems by LP, solution of LP for two variables, Simplex method, special cases of LP- transportation and assignment model and their graphical solution, Vogels Approximation Method (VAM) or penalty method, cell evaluation degeneracy, basics Of SW Lindo, Tora, Excel.

Module-II

Supply chain (SCM): Definition, importance, expenditure and opportunities in SCM; integration of inbound, outbound logistics and manufacturing to SCM, flow of material money and information, difficulties in SCM due to local v/s system wide (global) optimization and uncertainties in demand and transportation; Bull-whip effect; customer value; IT, info-sharing and strategic partnerships; plant and warehouse-network configuration; supply contracts and revenue sharing; outsourcing; transportation, cross docking and distribution, forecasting models in SCM; coordination and leadership issues; change of purchasing role and vendor rating, variability from multiple suppliers.

Module-III

Inventory models: Necessity of inventory in process and safety stock, problem of excess inventory and cycle time, JIT/ Lean Mfg.; basics of inventory models with deterministic demand, Classical EOQ Model, ABC, VED and other analysis based on shelf life, movement, size, MRP technique and calculations, lot sizing in MRP, linking MRP with JIT; evolution of MRP to ERP to SCM and e-business.

Module-IV

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(a) Waiting Line Models: Introduction, Input process, service mechanism, Queue discipline, single server (WW1), average length and average time calculations, optimum service rate; basic multiple server models (MIM/s)

(b) Competitive strategy: concept and terminology, assumptions, pure and mixed strategies, two-person zero sum games, saddle point, dominance, graphical, algebraic and LP methods for solving game theory problems.

Module-V:

(a) Network Analysis: Project Planning, Scheduling and Controlling; Project management; Network Techniques and its role in project management, Network logics, Fulkerson's Law, Merits and Demerits of AON Diagrams; Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Determination of critical path, Float/Slack.

(b) Meta-heuristics: Definition of heuristic and meta-heuristic algorithms; introduction to Tabu search, Simulated Annealing and Genetic algorithms and solution of travelling salesman, non- linear optimization problems.

Evaluation:

Evaluation will be continuous and integral part of the class as well as through external assessment.

References:

1. Hillier FS and Liberman GJ; Introduction to Operations Research concept and cases; TMH
2. Simchi-Levi, Kerninsky; Designing and managing the supply chain; TMH.
3. Srinivasan G; Quantitative Models In Operations and SCM; PHI Learning
4. 4, Mohanty RP and Deshmukh SG; Supply Chain Management; Wiley India
5. Taha H; Operations research; PHI
6. Sen RP; Operations Research-Algorithms and Applications; PHI Learning
7. Sharma JR; Operations Research; Macmillan
8. Ravindran, Philips and Solberg; Operations research; Wiley India
9. Vollman, Berry et al; Manufacturing planning and control for SCM; TMH.
10. Bowersox DJ, Closs DJ, Cooper MB; Supply Chain LogistiMgt; TMH
11. Burt ON, Dobler DW, StarlingSL; World Class SCM; TMH
12. Bronson R;Theory and problems of OR; Schaum Series; TMH
13. George Hadley; Linear programming; Addison Wesley

Course Out Comes:

Upon successful completion of this Course the Student will be able to:

CO1	Formulate linear programming problems.
CO2	Elaborate optimum solution of transportation problems and forecasting in supply chain.
CO3	Determine average queue length and waiting time of queuing models
CO4	Estimate optimum inventory and cost in inventory models.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1								

CO2	1		3									
CO3	1	1		1								1
CO4	2	1	1									

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Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME71B	Automobile Engineering	70	20	10	-	-	100	3	1	-	4

Course Objective:

The students will be made to learn.

1. The anatomy of the automobile in general.
2. The location and importance of each part of automobile.
3. The functioning of the engine and its accessories, gear box, clutch, brakes, steering, axles and wheels, suspension, frame, springs and other connections.
4. The effect of automobile emissions on environment and how to control pollution.

Course Contents:

Module-I: Chassis & Body Engineering:

Types, Technical details of commercial vehicles, types of chassis, layout, types of frames, testing of frames for bending & torsion on unutilized body frame, vehicle body and their construction, driver's visibility and methods for improvement, safety aspects of vehicles, vehicle aerodynamics, optimization of body shape, driver's cab design, body materials, location of engine, front wheel and rear wheel drive, four wheel drive.

Module-II: Steering System:

Front axle beam, stub axle, front wheel assembly, Wheel Alignment, principles of types of wheel alignment, front wheel geometry viz. camber, Kingpin inclination, castor, toe-in and toe-out, condition for true rolling motion, centre point steering, directional stability of vehicles, steering gear, power steering, slip angle, cornering power, over steer & under steer, gyroscopic effect on steering gears.

Module-III: Transmission System:

Function and types of clutches, single plate, multi-plate clutch, roller &spring clutch, clutch lining and bonding, double declutching, types of gear boxes, synchronizer, gear materials, determination of gear ratio for vehicles, gear box performance at different vehicle speed, automatic transmission, torque converters, fluid coupling, principle of hydrostatic drive, propeller shaft, constant velocity universal joints, differential gear box, rear axle construction, Introduction to Electric and Hybrid Power train.

Module-IV: Suspension system:

Basic suspension movements, Dependent and Independent Suspension, Independent front & rear suspension, shock absorber, type of springs: leaf spring. coil spring, air spring, torsion bar, location of shackles, power calculations, resistance to vehicle motion during acceleration and breaking, power & torque curve, torque &

mechanical efficiency at different vehicle speeds, weight transfer, braking systems, dise theory, mechanical, hydraulic & pneumatic power brake systems, performance, self-energization, air-bleeding of hydraulic brakes, types of wheels and tyres, tyre specifications, construction and material properties of tyres & tubes.

Module-V: Electrical and Control Systems:

Storage battery, construction and operation of lead acid battery, testing of battery, principle of operation of starting mechanism, different drive systems, starter relay switch, regulator electric fuel gauge, fuel pump, horn, wiper, lighting system, head light dazzling, signaling devices, battery operated vehicles, choppers, importance of maintenance, scheduled and unscheduled maintenance, wheel alignment, trouble Shooting probable causes & remedies of various systems, microprocessor based control system for automobile, intelligent automobile control systems. Emission standards and pollution control: Indian standards for automotive vehicles-Bharat I, II, III, IV, Euro I to Euro VI norms, fuel. Quality standards, environmental management systems for automotive vehicles, catalytic converters, fuel additives, and modern trends in automotive engine efficiency and emission control.

References:

1. Crouse, Automotive Mechanics TMH
2. Srinivasan S; Automotive Engines TMH
3. Gupta H N; Internal Combustion Engines; PHI
4. Joseph Heitner; Automotive Mechanics, Principles and Practices, CBS Publication
5. Kripal Singh; Automotive Engineering, Khanna Publication
6. Newton and Steeds, Automotive Engineering
7. Emission standards from BIS and Euro-I to Euro-VI

Course Outcomes:

At the completion of this course, students should be able to

CO1	Enlist the major parts of an Automobile.
C02	Analyze the steering, transmission, suspension, electrical and control systems of an Automobile.
C03	Explain the environmental implications of automobile emissions.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1										
CO2	2	2	1									
CO3	2		1				1					

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Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME71C	Gas Dynamics and Jet Propulsions	70	20	10	-	-	100	3	1	-	4

Course Objective:

1. Understanding the gas dynamics and of turbo engine fundamentals.
2. Understanding the diffusers and nozzles
3. Understanding the basic principle of jet propulsion and thermodynamic cycles.

Course Content:

Module-I:

Gas Dynamics of Passive Components of Turbo Engines: Fundamentals Of gas dynamics, Energy equation for a non-flow process - Energy equation for a flow process - The adiabatic energy equation - Momentum Equation - Moment of Momentum equation - Stagnation Velocity Of Sound - Stagnation Pressure - Stagnation Density - Stagnation State - Velocity of sound - Critical states — Mach number - Critical Mach number - Various regions of flow.

Module-II:

Analysis of Diffusers and Nozzles: Introduction - Study of Intakes for Subsonic and supersonic engines - Comparison of isentropic and adiabatic processes —Mach number variation - Area ratio as function of Mach numbers - Impulse function - Mass flow rates - Flow through nozzles - Flow through diffusers - Effect of friction - Analysis of intakes for engines - intakes with normal shock — oblique shocks - Study of special nozzles and diffusers.

Module-III:

Study of Compressors: Design and Analysis of compressors - Classification - analysis of centrifugal compressors - velocity triangles -design of impellers and diffusers - analysis of axial flow compressor - analysis of stage - characterization of stage - design of multistage axial flow compressor — Performances analysis of centrifugal and axial flow compressors.

Gas Dynamics of Combustors: Stoichiometry of combustion - calculation air-fuel ratio — gas dynamics of combustors.

Module-IV:

Propulsion Aircraft Propulsion - introduction - Early aircraft engines - Types of aircraft engines - Reciprocating internal combustion engines - Gas turbine engines - Turbo jet engine - Turbo fan engine -

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Turbo- prop engine.Aircraft propulsion theory: thrust, thrust power, propulsive and overall efficiencies - Problems.

Module-V:

Thermodynamic Analysis of Ideal Propulsion Cycles Thermodynamic analysis of turbojet engine - Study of subsonic and engine models - Identification and Selection of optimal parameters. Need for further development - Analysis of Turbojet with after burner. Thermodynamic analysis of turbofan engine - Study of subsonic and supersonic systems - Identification and selection of optimal operational parameters. Design of fuel efficient engines - Mixed flow turbo fan engine - Analysis of Turbofan with after burner. Thermodynamic analysis of turbo-prop engine — Identification and selection of optimal operational parameters.

Evaluation:
Evaluation will be continuous and integral part of the class as well as through external assessment.

References:

1. Nag PK; Power plant Engineering; TMH
2. Thermodynamics by Gordon J. Van Wylen
3. P .K.Nag; Basic and applied Thermodynamics; TMH
4. G anesan; Gas turbines; TMH
5. Heat Engines by V.P. Vasandani& D. S. Kumar
6. R. Yadav Steam and Gas Turbines
7. R. Yadav Thermal Engg.
8. Kadambi & Manohar; an Introduction to Energy Conversion — Vol II. Energy conversion cycles

Course Outcomes:
At the completion of this course, students should be able to

CO1	Explain steam generation and its utilization to thermal power plant.
CO2	Illustrate air compressors and phase change cycles.
CO3	Apply the basic knowledge of thermodynamics to gas dynamics and steam nozzles.
CO4	Analyze heat exchanger and effects of its different parameters.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	1	2	3									
CO3	1	2	3									
CO4	1	2	3									

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COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
ME72A	Renewable Energy Systems	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work	100	L	T	P	4
		70	20	10	-	-		3	1	-	

Course Objective:

1. Understanding the solar thermal conversion techniques and photovoltaic conversion of solar energy.
2. Understanding the wind energy conversion systems and wind characteristics curves.
3. Understanding the Biomass conversion systems: biochemical, chemical and thermo chemical
4. Understanding the Principle of ocean, Geothermal, Hydrogen energy conversion system and Fuel cells.

Course Content:

Module-I: SOLAR ENERGY CONVERSION SYSTEMS

Solar Radiation: Introduction to solar energy, Extra-terrestrial and terrestrial, solar constant, radiation measuring instruments. Solar collector, Types of solar collector. Working principle of flat plate solar collector and concentrating solar collector. Modifications in solar collector. Construction and working principle of solar water heater, solar dryer, solar still, Solar cooling and solar refrigeration. Solar photovoltaic: Principle of photovoltaic conversion system, Construction of PV Cell, Module, Penal, Array, Applications of PVC system.

Module-II: WIND ENERGY CONVERSION SYSTEMS

Metrology of wind: wind and its potential, wind speed distribution, windspeed statistics. Weibull, Rayleigh and Normal distribution of wind. Measurement of wind data, Principle of wind energy conversion system; Classification of WECS, advantages and disadvantages of wind energy conversion system. Discuss the design parameters of wind mill. Characteristics Curves of wind turbine, Application Of wind energy.

Module-III: BIOMASS CONVERSION SYSTEMS

Biomass and its production, Classifications of biomass and its potential, physicochemical characteristics of biomass, Biomass conversion techniques: anaerobic digestion, fermentation, chemical reduction, etc. Biogas production mechanism, Types of digesters, biogas plant parameters, manure-utilization and manure values. Thermal gasification of biomass. Biomass Gasification: working principle and its types, Construction and working principle of gasification.

Module-IV: HYDRO POWERCONVERSION SYSTEMS:

Overview of micro, mini and small hydro-power system, potential Of hydropower system, Site selection criteria of hydro power systems, working principle of hydro power conversion system, advantages and limitations of hydro-power system. Ocean thermal Energy. Principle of ocean thermal energy conversion

system, Ocean wave energy and ocean wave energy conversion system. Tidal energy and its conversion system.

Module-V: GEOTHERMAL, HYDROGEN & FUEL CELLS ENERGY:

Origin of geothermal resources, Type of geothermal energy deposits, advantages and disadvantages of geothermal energy system.

Hydrogen energy: Hydrogen production methods, storage, transportation& utilization.

Fuel Cells: Principle of operation of a fuel cell, classifications, advantages and disadvantages of fuel cell.

Evaluation:

Evaluation will be continuous and integral part of the class as well as through external assessment.

References:

1. Kothari, Singal&Rajan; Renewable Energy Sources and Emerging Technologies, PHI Leam
2. Khan, B H, Non Conventional Energy, TMH.
3. Sukhatme S.P. and Nayak, Solar Energy, Principles of Thermal Collection and Storage, TMH.
4. Tiwari and Ghosal, Renewable Energy Resources: basic principle & application, NarosaPubl
5. Koteswara Rao, Energy Resources, Conventional & Non-Conventional, BSP Publication.
6. Chetan Singh Solanki, Solar Photovoltaics: Fundamental, technologies and Application, PHI L
7. AbbasiTanseem and Abbasi SA; Renewable Energy Sources; PHI Leaming
8. Ravindranath NH and Hall DO, Biomass, Energy and Environment, Oxford University Press.
9. Duffie and Beckman, Solar Engineering of Thermal Process, Wiley
10. Nikolai, Khartchenko; Green Power; Tech Book Intemational
11. Tester, Sustainable Energy-Choosing Among Options, PHI Leaming.
12. Godfrey Boyle, Renewable Energy: Power for a sustainable future, Oxford OUP.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Able to develop the concept of energy conversion systems.
CO2	Develop the models of energy conversion systems..
CO3	Estimation of the energy potential at the site.
CO4	Modify & the energy conversion systems for better performance

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3	1								
CO2	1	2	2									
CO3	1	2	2									
CO4	1	1	1									

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COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
ME72B	Product Design	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work	100	L	T	P	4
		70	20	10	-	-		3	1	-	

Course objective:

1. Confidence in your own abilities to create a new product.
2. Awareness Of the role of multiple functions in creating a new product (e.g. marketing, finance, industrial design, engineering, production).
3. Ability to coordinate multiple, interdisciplinary tasks in order to achieve a common objective.

Course Content:

Module-I

Basic concepts of engineering products' drawings. Software's applications for preparation of drawings, designs and animations.

Module-Il

Creativity, Concept generation — Intuitive / Rational and as per customers choice amongst alternatives. Needs and wants. Products' specifications and product architecture.

Module-Ill

A brief review of engineering materials and their properties. Concepts of tribology — Friction, Wear and Lubrication

Module-IV

Basic concepts of limits, fits and tolerances in individual components and assemblies. A brief review of process planning, Jigs, Fixtures, manufacturing methods and shop floor practices. Review of drawings and design from industrial and manufacturing aspects. A brief review of quality assessment and control

Module- V

Basic concepts of ergonomics and related proportions. Value Engineering and Value analysis, cost analysis, market impact and feedback data from market to designer. The product life cycle. Intellectual property rights/ Patent procedures and governments' support for export/import substitutions.

References:

1. K. T. Ulrich and S.D.Eppinger," Product design and development".
2. G.E.Dieter, Engineering Design.
3. Product design — Otto, Wood,

Course Outcomes:

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At the completion of this course, students should be able to

CO1	Create 2D & 3D drawing with the help of CAD software.
CO2	Elaborate a set of tools and methods for product design and development.
CO3	Discuss the role of multiple functions in creating a new product (e.g. marketing, finance, industrial design, ergonomics, and production).

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3	1								
CO2	1	2	2									
CO3	1	2	2									

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Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME72C	Artificial Intelligence	70	20	10	-	-	100	3	1	-	4

Course Objective:

1. Understanding the artificial intelligence techniques.
2. Understanding the State space search.
3. Understanding the knowledge of Representation Predicate Logic.

Course Content:

Module-I

Scope of Al Games theorem, natural language processing, vision and speech processing, robotics, expert systems, Al techniques- search knowledge, abstraction.

Module-II

Problem solving State space search; Production systems, search space control: depth first, breadth-first search, heuristic search - hill climbing, best-first search, branch and bound. Problem Reduction, Constraint Satisfaction End, Means-End Analysis

Module-III

Knowledge Representation Predicate Logic: unification, modus pones, resolution, dependency directed backtracking. Rule based Systems: forward reasoning, conflict resolution, backward reasoning, use of no backtracks. Structured Knowledge Representation: semantic net slots, exceptions and default frames, conceptual dependency, scripts.

Module-IV

Handling uncertainty and learning: Non-monotonic reasoning, probabilistic reasoning, use of certainty factors, fuzzy logic, Concept of learning, learning automation, genetic algorithm, learning by inductions, neural network.

Module-V

Robotics: Robot Classification, Robot Specification, notation Direct and Inverse Kinematics: Co-ordinates Frames, Rotations, and Homogeneous Coordinates.

Reference Text books-

1. E. Rich and K. Knight, "Artificial intelligence", MH, 2nd ed., 1992.
2. N.J. Nilsson, "Principles of Al", Narosa Publ. House, 2000.
3. Robin R Murphy, Introduction to Al Robotics PHI Publication, 2000
4. D. W. Patterson, "Introduction to Al and Expert Systems", PHI, 1992.

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5. R. J. Schalkoff, "Artificial Intelligence - an Engineering Approach", McGraw Hill Int. Ed., Singapore, 1992.
6. George Lugar, .Al-Structures and Strategies for and Strategies for Complex Problem solving, 4/e, 2002 Pearson Educations.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Al Games theorem,
C02	Problem solving State space search.
C03	Handling uncertainty and learning and Robotics.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2									
CO2	1	2	1	1								
CO3	1	2	3	3	3	1						

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Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME74	Vibration & Noise Control	70	20	10	30	20	150	3	-	2	4

Course Objective

1. Learn the basic concepts and principles of vibration in mechanical systems.
2. Learn the fundamental damped free and undamped free vibration.
3. Learn the basic principle of noise engineering.

Course Contents:

Module-I:

Fundamental Aspects of Vibrations: Vibration, main causes, advantages and disadvantages; engineering applications of vibration and noise; vector method of representing harmonic motion; characteristics of vibration, harmonic analysis and beats phenomenon, work done by harmonic forces on harmonic motion; periodic, non-harmonic functions- Fourier series analysis; evaluation of coefficients of Fourier series;
Elements of vibratory system: Lumped and distributed parameter systems.

Undamped free Vibrations: Derivation of differential equation of motion: the energy method, the method based on Newton's second law of motion, and Rayleigh's method. Solution of differential equation of motion: Natural frequency of vibration. Systems involving angular oscillations: the compound pendulum.

Module-II:

Damped Free Vibrations: Viscous damping: coefficient of damping; damping ratio; under damped, over damped and critically damped systems; logarithmic decrement; frequency of damped free vibration; Coulomb or dry friction damping; frequency, decay rate and comparison of viscous and Coulomb damping; solid and structural damping; slip or interfacial damping.

Module-III:

Harmonically excited Vibration: One degree of freedom- forced harmonic vibration; vector representation of forces; excitation due to rotating and reciprocating unbalance; vibration Isolation, force and motion transmissibility; absolute and relative motion of mass (Seismic Instruments). Whirling Motion and Critical Speed: Whirling motion and Critical speed: Definitions and significance. Critical —speed of a vertical, light —flexible shaft with single rotor: with and without damping. Critical Speed of a shaft carrying multiple discs (without damping), Secondary critical speed.

Module-IV:

Systems with Two Degrees of Freedom: Un-damped free vibration of 2 d.o.f and principal modes of vibration; torsion vibrations; Forced, Un-damped vibrations with harmonic excitation; Coordinate coupling; Dynamic vibration absorber; torsion Vibration Absorber; Pendulum type of dynamic vibration.

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Module-V:

Noise Engineering —Subjective response of sound: Frequency and sound dependent human response; the decibel scale; relationship between, sound pressure level (SPL), sound power level and sound intensity scale; relationship between addition, subtraction and averaging, sound spectra and Octave band analysis; loudness; weighting networks; equivalent sound level, auditory effects of noise; hazardous noise, exposure due to machines and equipment's; hearing conservation and damage risk criteria, daily noise doze.

Noise Sources, Isolation and Control: Major sources of noise on road and in industries, noise due to construction equipment's and domestic appliances, industrial noise control, strategies- noise control at source (with or without sound enclosures), noise control along the path (with or without partitions and acoustic barriers); noise control at the receiver, ear defenders, earplugs, semi-insert protectors.

Evaluation:

Evaluation will be continuous and integral part of the class as well as through external assessment.

References:

1. Ambekar A.G., 'Mechanical Vibrations and Noise Engineering' , PHI.
2. Meirovitch Leonard,'Element of Vibration Analysis', TMH.
3. Dukikipati R V, Srinivas J,'Text book of Mechanical Vibrations' , PHI.
4. Kelly SG and kudari SK,'Mechanical Vibrations' ,Schaum Series, TMH.
5. Thomson , W.T., 'Theory of Vibration with Applications', C.B.S Pub & distributors .
6. Singiresu Rao, 'Mechanical Vibrations', Pearson Education.
7. G.K. Grover, 'Mechanical Vibration', Nem chand and Bross , Roorkee.

Course Outcomes:

At the completion of this course, students should be able to-

CO1	Analyze Undamped and Damped free vibration systems.
CO2	Evaluate the two Degrees of Freedom.
CO3	Explain Whirling motion and critical speed in Harmonically excited Vibration.
CO4	Evaluate sound pressure level (SPL), sound power level and sound intensity.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1								
CO2	1	1	2									
CO3	1	1	2									
CO4	1	1	2		1							

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Vibration & Noise Control Lab

List of Experiments: (Can be modified/expanded further)

1. To find out effect of load on natural frequency of vibrations of a lever pin supported at one end carrying adjustable load on a vertical screwed bar and spring supported at some intermediate point (i) When the dead weight of rods is neglected and (ii) when their dead weight is taken into account .
2. To find out frequency of damped free vibration and rate of decay of vibration-amplitude in the system.
3. To find out natural frequency and damped free frequency of a torsion pendulum and, hence to find out coefficient of damping of the oil;
4. To observe the phenomenon of 'whirl' in a horizontal light shaft and to determine the critical speed of the shaft.
5. To observe the mode shapes of a spring-connected, double pendulum and hence to demonstrate the phenomenon of beats.
6. To demonstrate the principle of tuned Undamped Dynamic Vibration Absorber and to determine the effect of mass-ratio (of main and auxiliary mass) on the spread of the resulting natural frequencies;
7. To take measurements of sound Pressure Level (SPL) and to carry out octave band analysis of a machine using Noise Level Meter.

Evaluation:

Evaluation will be continuous and integral part of the class followed by the final practical examination as well as through external assessment

Course Outcomes:
At the completion of this course, students should be able to-

CO1	Analyze Undamped and Damped free vibration
CO2	Evaluate the two Degrees of Freedom
CO3	Explain whirling motion and critical speed in Harmonically excited Vibration.
CO4	Evaluate sound pressure level (SPL), sound power level and sound intensity

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1								
CO2	1	1	2									
CO3	1	1	2									
CO4	1	1	2		1							

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Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME75	Refrigeration & Air Conditioning	70	20	10	30	20	150	3	-	2	4

Course: Objective

1. Learn the basic concepts and principles of refrigeration and air conditioning.
2. Learn the fundamental analysis methodology of refrigeration.
3. Learn the basic process and systems of air conditioning.
4. Will apply the course knowledge to do a design project of HV AC system.

Course Contents:

Module-I

Introduction: Principles and methods of refrigeration freezing; mixture cooling by gas reversible expansion, throttling, Joule Thomson effect and reverse Carnot cycle; unit of refrigeration, coefficient of vortex tube & thermoelectric refrigeration, adiabatic demagnetization; air refrigeration cycles- Joule's cycle Boot-strap cycle, reduced ambient cycle and regenerative cooling cycles.

Module-II

Vapour compression system: Vapor compression cycle, p-h and t-s diagrams, deviations from theoretical cycle, sub-cooling and super heating, effects of condenser and evaporator pressure on cop; multi-pressure system: removal of flash gas, multiple expansion & compression with flash inter cooling; low temperature refrigeration: production of low temperatures, cascade system, dry ice, production of dry ice, air liquefaction system,,

Module-III

(a) **Vapour absorption system:** Theoretical and practical systems such as aqua-ammonia, Electrolux & other systems;

(b) **Steam jet refrigeration:** Principles and working, simple cycle of operation, description and working of simple system,

(c) **Refrigerants:** nomenclature & classification, desirable properties, common refrigeration, comparative study, leak detection methods, environment friendly refrigerants and refrigerant mixtures, brine and its properties

Module-IV

Psychometric: Calculation of psychrometric properties of air by table and charts; psychrometric processes: sensible heating and cooling, evaporative cooling, cooling and dehumidification, heating and humidification, mixing of air stream, sensible heat factor; principle of air conditioning, requirements of comfort air

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conditioning, ventilation standards, infiltrated air load, fresh air load human comfort, effective temperature & chart, heat production & regulation of human body,

Module-V

Air conditioning: Calculation of summer & winter air conditioning load, bypass factor of coil, calculation of supply air rate & its condition, sensible heat factor, grand sensible heat factor, effective sensible heat factor, dehumidified air quantity. Problems on cooling load calculation. Air distribution and ventilation systems Evaluation: Evaluation will be continuous and integral part of the class as well as through external assessment.

References:

I. Arora CP: Refrigeration and Air Conditioning; TMH
2. Sapali SN; Refrigeration and Air Conditioning; PHI.
3. Anantha Narayan; Basic Refrigeration and Air conditioning; TMH
4. Manohar Prasad; Refrigeration and Air Conditioning; New Age Pub
5. Ameen; Refrigeration and Air Conditioning; PHI
6. pita; Air conditioning Principles and systems: an energy approach; PHI
7. Stoecker W.F, Jones J; Refrigeration and Air conditioning; McGH, Singapore
8. Jordan RC and Priester GB Refrigeration and Air Conditioning, PHI USA

Course Outcomes:

At the completion of this course, students should be able to

CO1	Explain the principle les and methods of refrigeration.
CO2	Evaluation of VCRS and vapour absorption systems and applications.
CO3	Analyze psychrometric properties and processes.
CO4	Elaborate the heating and cooling load for a given AC system.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1		2									
CO2	1	3	1									
CO3	1	2	2									
CO4	1	2	1	2								

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Refrigeration & Air Conditioning Lab

List of Experiments: (Can be modified/expanded further)

1. General Study of vapor compression refrigeration system.
2. General Study of Ice Plant
3. General Study and working of cold storage
4. General Study Trane Air Condition (Package Type).
5. General Study of Electrolux Refrigeration
6. General Study One tone Thermax refrigeration unit.
7. General Study of Water cooler
8. General Study of Psychrometers (Absorption type)
9. General Study of Leak Detectors (Halide Torch).
10. General Study and working of Gas charging Rig.
11. General Study of window Air Conditioner.
12. General Study and working of Vapor compression Air conditioning Test rig.
13. Experimentation on Cold Storage of Calculate COP & Heat Loss.
14. Experimentation on Vapor compression Air Conditioning test rig.
15. Changing of Refrigerant by using Gas Charging Kit.

Evaluation:

Evaluation will be continuous and integral part of the class followed by the final practical examination as well as through external assessment

Course Outcomes: (Lab)

At the completion of this course, students should be able to

CO1	Explain the principle les and methods of refrigeration.
CO2	Analyze the Electrolux Refrigeration system and Psychrometric processes.
CO3	Elaborate the working of Gas charging Rig.
CO4	Formulate the problem and solution of window AC.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1		2									
CO2	1	2	1	1								
CO3	1	2	2									
CO4	1	2	1	2								

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Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME73	Machine Design -II	70	20	10	30	20	150	3	-	2	4

Course Objective

1. Understand the design concepts of belt, rope and chain drives.
2. Able to design different types of gears.
3. Able to design I.C. Engine components, different types of couplings and power screw.

Course Contents:

Module-I: Design of Belt, Rope and Chain Drives:

Methods of power transmission, design of flat belt drive and V-belt drive; Design of chain drives, roller chain and its selection; Design of rope drives.

Module-II: Spur and Helical Gears:

Force analysis of gear tooth, AGMA Bending stress equation and AGMA Contact stress equation, modes of failure, beam strength, Lewis equation, form factor, formative gear and virtual number of teeth; Gear materials; Surface strength and wear of teeth; strength against wear, Design of straight tooth spur gear and Helical Gears.

Module-III: Bevel Gears:

Application of bevel gear, formative gear and virtual number of teeth; Force analysis; Lewis equation for bevel gears; Strength against wear; Design of bevel gear.

Module-IV: Design of I.C. Engine Components:

General design considerations in IC engines; design of cylinder; design of piston and piston-rings; design of connecting rod; design of crankshaft.

Module-V: Design of Miscellaneous Components:

Design of Flanged coupling; Rigid coupling and Flexible coupling, Design of Pressure vessels subjected to internal pressure, Design of power screw.

References:

1. Shigley J.E.; Machine Design; TMH
2. BhandariVB; Design of Machine Elments; TMH
3. Sharma CS and Purohit K; Design of Machine Elements; PHI Learning.

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4. Hall and Somani; Machine Design; Schaum Series; TMH

5. Wentzell TH; Machine Design; Cegage Learning

6. Sharma & Agrawal; Machine Design; Katson

7. Kulkarni SG; Machine Design; TMH

8. Abdul Mubeen; Machine Design; Khanna Publishers

9. Juvinall RC, Marshek KM; Fundamentals of Machine Component Design; Wiley

10. Norton R; Design Of Machinery; TMH

11. P.C.Gope- Machine Design

Note: PSG Design data book and/or Mahadevan and Reddy's Mechanical design data book are to be provided/ permitted in exam hall (duly verified by authority)

Course Outcomes:

At the completion of this course, students should be able to

CO1	Analyze belt, rope and chain drives.
C02	Select different types of transmission elements.
C03	Examine I.C. Engine components (cylinder, piston, piston rings, connecting rod and crank shaft)

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2									
CO2	1	2	1	1								
CO3	1	2	3	3	3	1						

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Machine Design –II Lab

List of Experiments: (Can be modified/expanded further)

1. Design of belt, rope and chain drives.
2. Design of spur and helical gear.
3. Design of bevel gears.
4. Design of I. C. Engine components.
5. Design of miscellaneous components.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Design the various different machine components.
C02	Select the various machine components for desired output.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2									
CO2	1	2	1	1								

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COURSE CONTENTS w.e.f. July 2024

Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
ME704MA	Industrial Robotics	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work	100	L	T	P	4
		70	20	10	-	-		3	1	-	

Course Objective:

1. Introduction and need of industrial robots.
2. End Effectors and Drive systems industrial robots
3. Understanding the basic principle Sensors.
4. Understanding the basic principle robotics programming

Course Content:

Module-I

Introduction: Need and importance, basic concepts, structure and classification of industrial robots, terminology of robot motion, motion characteristics, resolution, accuracy, repeatability, robot applications.

Module-II

End Effectors and Drive systems: Drive systems for robots, salient features and comparison, different types of end effectors and applications.

Module-III

Sensors: Sensor evaluation and selection Piezoelectric sensors linear position and displacement sensing, revolvers, encoders, velocity measurement, proximity, tactile, compliance and range sensing. Image Processing and object recognition.

Module-IV

Robot Programming: Teaching of robots, manual, walk through, teach pendant, off line programming concepts and languages, applications.

Module-V

Safety and Economy of Robots: Work cycle time analysis, economics and effectiveness of robots, safety systems and devices, concepts of testing methods and acceptance rule for industrial robot.

Evaluation:

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Evaluation will be continuous an integral part of the class as well through external assessment.

References:

1. Nagrath IJ and Mittal RK; Robotics and Control; TMH
2. GrooverM.P,Weiss M, Nagel,OdreyNG; Industrial Robotics-The Appl; TMH
3. Groover M.p; CAM and Automation; PHI Leaming
4. Spong Mark and Vidyasagar; Robot Modelling and control; Wiley India
5. Yoshikava; Foundations of Robotics- analysis and Control; PHI Learning;
6. Murphy; Introduction to Al Robotics; PHI Learning
7. FU KS, Gonzalez RC, Lee CSG; Robotics Control, sensing; TMH
8. Shimon, K; Handbook of Industrial Robots; John Wiley & Sons,
9. Bhupendra Gupta, A text book of Industrial Robotics: Dhanpat Rai Publishing company, New Delhi.
10. GhosalAshitava; Robotics Fundamental concepts and analysis; Oxford
11. Saha S; Introduction to Robotics; TMH I I. Yu Kozyhev; Industrial Robots Handbook; MI

Course Outcomes:

At the completion of this course, students should be able to-

CO1	Illustrate the concept of robot and its motion characteristics.
CO2	Identify different types of end effectors and drive systems required for specific applications.
CO3	Explain the working of various types of sensors and their applications.
CO4	Develop programming principles and languages for a robot control system.

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1				1							1
CO2	1		2	2								
CO3	1	1	2	1								
CO4	1	2	2	2								

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Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME705MC	Internet of Things	70	20	10	-	-	100	3	1	-	4

Module-I –

INTRODUCTION Internet of Things Promises-Definition- Scope-Sensors for loT Applications-Structure of loT-IoT Map Device

Module-II

SEVEN GENERATIONS OF IOT SENSORS TO APPEAR Industrial sensors Description & Characteristics-First Generation Generation - Description & Characteristics-Advanced Description & Characteristics-Integrated IoT Sensors Characteristics-Polytronics Systems - Description & Description & Characteristics-Sensors Swarm Description & Characteristics-Printed Electronics Description & Characteristics-IoT Generation Roadmap

Module-III-

TECHNOLOGICAL ANALYSIS Wireless Sensor Structure-Energy Storage Module- Power Management Module-RF Module-Sensing Module

Module-IV –

IOT DEVELOPMENT EXAMPLES ACOEM Eagle-EnOcean Push Button - NEST Sensor-Ninja Blocks-Focus on Wearable Electronics

Module-

V-PREPARING IOT PROJECTS Creating the sensor project - Preparing Raspberry Pi- Clayster libraries HardwareInteracting with the hardware Interfacing the hardware- Internal representation of sensor values Persisting data External representation of sensor values Exporting sensor data Creating the actuator project-Hardware Interfacing the hardware- Creating a controller - Representing sensor values - Parsing sensor data - Calculating control states Creating a camera Hardware -Accessing the serial port on Raspberry Pi

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Interfacing the hardware - Creating persistent default settings Adding configurable properties - Persisting the settings - Working with the current settings - Initializing the camera

REFERENCES

1. Dr. Guillaume Girardin, Antoine Bonnabel, Dr. Eric Mounier, 'Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014-2024', Yole Développement Copyrights,2014

2. Peter Waher, "Learning Internet of Things', Packt Publishing, 2015Market

3. Editors Ovidiu Vermesan Peter Friess, Internet of Things-From Research and Innovation to market.

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Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
ME81A	Computer Integrated Manufacturing	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work	100	L	T	P	4
		70	20	10	-	-		3	1	-	

Course Objective:
To provide knowledge and details of the means of computer aided manufacturing and various functions supporting the automated manufacturing.

Course Contents:

Module-I
Introduction: Introduction to manufacturing systems and their performance analysis; Introduction to automation; Introduction to computer integrated manufacturing (CIM).

Module-II
Numerical Control (NC): Introduction, numerical control – its growth and development, components of NC system, input devices, control systems – point to point, straight cut, and continuous path NC, open loop and closed loop NC systems, NC interpolations – linear, circular, helical, parabolic and cubic interpolation, applications of NC systems, merits and demerits.

Module-III
Extensions of NC: Concepts of computer numerical control (CNC), machining center, and direct numerical control (DNC), and their advantages.

Module-IV
Robotics: Robot anatomy and related attributes, robot control systems – limited sequence, playback with point to point, playback with continuous and intelligent control; End effectors – gripper, tools; Sensors in robotics – tactile sensors, proximity, optical sensors and machine vision; Applications of industrial robots, robot programming.

Module-V
Material Handling and Storage: Overview of material handling equipments, automated material handling equipments – AGVs, conveyor systems, performance analysis of material handling systems, automated material storage systems – ASRS and carousel storage, analysis of automated storage systems.
Manufacturing Support Functions: Introduction to group technology (GT), computer aided process planning (CAPP), material requirement planning (MRP), capacity planning, scheduling etc.

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References of Books:

1. Groover, M. P., "Automation, Production systems and Computer Integrated Manufacturing", 3rd 2007 Ed., Prentice-Hall.
2. Singh, N., "Systems Approach to Computer Integrated Design and Manufacturing", John Wiley & Sons. 1996
3. Chang,T.-C., Wysk,R. A. and Wang, H.-P. "Computer Aided Manufacturing", 3rd 2005 Ed., Prentice Hall.
4. Rembold,U., Nnaji,B. O. and Storr A., "Computer Integrated Manufacturing", Addison Wesley. 1994
5. Besant,C. B. and Lui,C. W. K., "Computer Aided Design and Manufacture", Ellis Horwood Ltd. 1991
6. Rao,P. N., Tiwari,N. K. and Kundra,T.K., "Computer Aided Manufacturing", Tata McGraw Hill. 1993
7. Koren, Y. "Computer Control of Manufacturing Systems", McGraw Hill. 1983
8. Lynch, M., "Computer Numerical Control for Machining", McGraw-Hill. 1992
9. Sava,M. and Pusztai,J., "Computer Numerical Control Programming", Prentice Hall. 1990

Expected outcome of course:

Possible outcomes of course are ability to:

CO1	Understand fundamental of CNC machines
CO2	Understand concept behind CNC and DNC.
CO3	Application and working of robots in CNC
CO4	Understand automated material handling equipments and group technology (GT), computer aided process planning (CAPP).

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3		1							
CO2	1	2	2		2							
CO3	1	1	2								1	
CO4											1	

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Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME81B	Tribology	70	20	10	-	-	100	3	1	-	4

Course Objective:

To study the basic principles governing the tribology and apply them to reduce friction and wear in mechanical machines and structures.

Course Contents:

Module-I: Introduction, history of tribology, early scientific studies of friction, wearand lubrication. Tribo-Surface preparations and characteristics. Surface contacts, Hertz contact stresses, residual stress, surface fatigue, creep, stress relaxation, fracture mechanics, elastic, viscoelastic and plastic behavior of materials. Choice of materials.

Module-II: Friction, laws of friction, rolling/sliding friction, theory of adhesion and abrasion, different mechanisms of friction, stick slip characteristics, interface temperature, thermal analysis, Molecular mechanical theory of friction, operating conditions and system parameters, calculations of coefficient of friction, design of friction devices.

Module-III: Wear, different types of wear mechanisms, adhesive, abrasive impact, percussion erosion, fretting wear calculations of wear rate, two body/ three body wear, wear prevention, wear of metal cutting and metal forming tools, wear mapping of materials, cavitation, surface fatigue, corrosion, performance levels classifications and specifications of lubricants

Module-IV: Lubrication, lubricants and additives, composition and properties of lubricants, maintenance of oil and emulsions, industrial hygiene aspects, technical regulations for lubricants, boundary/ mixed and fluid film lubrication, industrial methods of lubrications, SAE,BIS, ASTM, IP, DIN Standards, oil testing's, wear and chemistry of lubricants.

Module-V: Nano tribology, Instrumental tests, Bearings, clutches and brakes, commonly used bearing materials, and properties of typical bearing materials, slide units, dynamic seals, Automobile applications, machine tools/ press machines applications. Other applications and case studies.

Evaluation:

Evaluation will be continuous an integral part of the class as well through external assessment.

References:

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1. Principles and applications of tribology, Bharat Bhushan, John Wiley& sons, ISBN O47I 594075.
2. Tribology,, - lubrication ,friction and wear, I V Kragelsky and V VAlisin, Mir publication, ISBN 186058288s.
3. Applied Tribology,M MKhonsari and E. R. Booser, John Wiley, ISBN 0471283029.

Tutorial topics:

1. Testing equipments of tribology.
2. Various industrial applications of tribology.
3. NEMS and MEMS applications
4. Solid, liquid and mist/ gas lubricants.
5. Surface coatings.
6. Chemical analysis of materials
7. Various simulations
8. AFM/ FFM , SFA, STM, studies.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Infer the basic principles governing the wear, friction and lubrication.
C02	Examine the different mechanisms of friction and develop friction devices
C03	Illustrate the various modes of lubrication.
CO4	Analyze various mechanical machines and structures against wear and friction.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1									
CO2	1	2	2	1								
CO3	2		1									
CO4	1	2	2	2								

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Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME81C	Advance Machining Processes	70	20	10	-	-	100	3	1	-	4

Course Objectives:

1. Understand the fundamentals and technologies used in different advance machining processes.
2. Apply the characteristics and applications of the product obtained using advanced manufacturing processes.
3. Compare different advance machining processes.

Course Contents:

Module-I: Mechanical processes: Process selection, mechanics of cutting, metal removal rate, cutting tool system design, ultrasonic machining, abrasive jet machining, water jet machining, effect of parameters and variables, applications and limitations, recent developments in mechanical processes.

Module-II: Electrochemical and chemical metal removal processes: Electrochemical machining [ECM], elements of ECM, power source and control system, electrolytes, tool work system, chemistry of the process, tool design and metal removal rate, process faults, material removal and surface finish, electrochemical grinding, electrochemical deburring, electrochemical honing, chemical machining.

Module-III: **Thermal metal removal processes:** Electric discharge machining [EDM], spark erosion, mechanism of metal removal, spark erosion generator, electrode feed control, vibrating electrode system, dielectric fluid, flushing, accuracy, plasma are machining [PAM], non thermal generation of plasma, mechanisms and parameters, equipments, electron beam machining [EBM], generation and control of electron beam, theory and process capabilities, neutral particle etching, laser beam machining, hot machining, methods of local heating toollie and production rate.

Module-IV: Rapid prototyping fabrication methods: Fundamentals, Technologies, Applications, Principle sand working of 3D printing, subtractive v/s additive manufacturing process, VAT photopolymerization, material and binder jetting, continuous liquid inter phase production, direct metal laser sintering.

Module-v: Technologies of micro fabrication: Types of micro system devices, Industrial applications, micro fabrication processes, LIGA process Technologies of nano fabrication, importance of size, scanning probe microscope, carbon Buckyballs and nano tubes, nano fabrication processes.

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References:

1. Mikell P. Groover, Fundamentals of Modem Manufacturing, Wiley India, ISBN 9788126523016
2. Pandey P.C, Shan H.S., Modern Machining Processes, Tata McGraw Hill,ISBN 0070965188
3. Lal G.K,Gupta V, Reddy N.V., Narosa Publishing House,ISBN 8173197091
4. CMTI Handbook

Course Outcomes:

At the completion of this course, students should be able to

CO1	Explain the fundamentals and technologies used in different advance machining DTOCESSES
C02	Predict the characteristics and applications of the product obtained using advanced manufacturing processes.
C03	Compare different advance machining processes.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1									2
CO2	2		2	1	3							1
CO3	3	2		1	1							1

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Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work		L	T	P	
ME82A	Energy Conservation & Audit	70	20	10	-	-	100	3	1	-	4

Course Objective

1. Understand the concepts of energy management and conservation.
2. Able to conduct energy audit and report.
3. Concepts of Energy policy its purpose and formation.
4. Able to do Electrical Energy Management in different electrical systems.

Course Contents:

Module-I

Energy Management: Concept of energy management, energy demand and supply, economic analysis; Duties and responsibilities of energy managers. Energy Conservation: Basic concept, energy conservation in Household, Transportation, Agricultural, service and Industrial sectors, Lighting, HAVC.

Module-II

Energy Audit: Definition, need and types of energy audit; Energy management (Audit) approach: Understanding energy cost, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirement; Fuel & energy substitution; Energy audit instruments; Energy conservation Act; Duties and responsibilities of energy manager and auditors.

Module-III

Material Energy Balance: Facility as an energy system; Method for preparing process flow; material and energy balance diagrams. Energy Action Planning: Key elements, force field analysis; Energy policy purpose, perspective, content, formulation, rectification

Module-IV

Monitoring and Targeting: Definition monitoring & targeting: Data and information analysis. Electrical Energy Management: energy conservation in motors, pumps and fan systems; energy efficient motors.

Module-V

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Thermal Energy Management: Energy conservation in boilers, steam turbine and industrial heating system; Application of FBC; Cogeneration and waste heat recovery; Thermal insulation; Heat exchangers and heat pump; Building Energy Management.

References:

1. Murphy &Mckay, Energy Management, BSP Books Pvt. Ltd.
2. Smith CB; Energy Management Principle, Pergamon Press, New york.
3. Rajan GG, Optimising Energy Efficiency in Industry, TMH.
4. Callaghan P O, Energy Management, McGraw-Hill Book Company.
5. Amit Kumar Tyagi, Handbook on Energy Audit and Management, Tata Research Institute. Energy.
6. Bureau of Energy Efficiency, Study material for energy Managers and Auditors: Paper I to V.
7. Hamies; Energy Auditing and conservation: Method, Measurement..., Hemisphere, Washington.
8. Witty, Larry C, Industrial Enegy Management Utilisation, Hemisphere Publishers, Washington
9. Kreith & Goswami, Energy management and Conservation Handbook, CRC Press

Course Outcomes:

At the completion of this course, students should be able to

CO1	Understand the concepts of energy conservation, management and energy efficiency.
C02	Explain energy audit and preparation of report.
C03	Examine Energy Management in different electrical/thermal systems.
CO4	Built Material and energy balance diagram and its significance.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1					1					
CO2		2	3									
CO3					1						2	
CO4		2	3									

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Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
ME82B	Quality Management	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work	100	L	T	P	4
		70	20	10	-	-		3	1	-	

Course Objective:

To impart awareness regarding quality, its importance, measurement and applications in design, manufacturing and final inspection of product.

Course Contents:

Module-I

Introduction: Different definitions, dimensions, and aspects of quality; Traditional and modern views of quality control; Different Philosophies by quality Gurus, seven basic and new quality control tools.

Module-II

Statistical Process Control: Theory and applications of control charts, controls charts for variables: charts for averages, ranges, and standard deviation, control charts for attributes: p and c charts, fraction defective and number of defects per unit, different adaptations of control charts, manufacturing process variability, manufacturing process capability and tolerances.

Module-III

Acceptance Sampling: Concept of acceptance sampling, sampling by attributes: single and double sampling plans; Construction and use of OC curves.

Module-IV

Total Quality Management: Concept and philosophy, scope, applications, implementation, quality function deployment, six sigma, process capability, just-in-time philosophy, quality circles, quality system and Introduction to ISO 9000 and ISO 14000.

Module-V

Reliability: Concept and definition, measurement and test of reliability, design for reliability, concepts of maintainability and availability.

References:

1. Grant,E., and Leavenworth, R., "Statistical Quality Control", McGraw-Hill 1996
2. Mitra, A., "Fundamentals of Quality Control and Improvement", John Wiley & Sons, Inc, 2008
3. Juran,J.M., "Quality Control Handbook", McGraw-Hill 1988
4. Besterfield, D.H., Besterfield – Michna, C., Besterfield, G., and Besterfield-Sacre,M., "Total Quality Management",Pearson Education 1999
5. Montgomery, D.C.,"Introduction to Statistical Quality Control",JohnWiley & Sons Inc. 1996

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Expected outcome of course:

Possible outcomes of course are ability to:

CO1	Understand various dimensions and aspect of quality
CO2	Understand Theory and applications of control charts
CO3	Understand the fundamental concept acceptance sapling & OC curve
CO4	Implement six sigma & Understand just-in-time philosophy

Mapping of the course outcomes (COs) with program outcomes (Pos):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												

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Subject Code	Subject name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
ME82C	Management Information System	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab Work	100	L	T	P	4
		70	20	10	-	-		3	1	-	

Course Objective:

The objective of this course is to introduce the students to the managerial issues relating to information systems, its role in organization, support for decision-making and how information technology can be leveraged to provide business value.

Course Contents:

Module-I: Introduction to MIS

The meaning and use MIS, System View of Business, Process of MIS, Development of MIS within the organization, Management Process, Information Needs, System Approach in Planning Organizing and Controlling MIS. The role of internet- Internet and Web.

Module-II: Data and Information

Introduction, data and information- measuring data, information as a resource, information in organizational functions, types of information technology, types of information systems- transaction processing systems-management information systems

Module-III: Competing with IT

Introduction, The competitive environment of business partnering for mutual benefit- bargaining power of suppliers-bargaining power of buyers and customers-barriers to entry-threat of substitutes-industry regulations, Using IT for competing-competing on low cost-competing on differentiation.

Module-IV: Electronic Commerce

Introduction, E-commerce Technology, doing business over internet- networks-electronic data interchange (EDI)-online payment technology- Mobile commerce- ecommerce-portals- search engines-direct selling-auctions- aggregators, E-business.

Module-V: Decision Support Systems

Introduction, Characteristics and Objectives, Role of Decision Support Systems and its applications, Components of Decision support Systems, Data Subsystem, Model Subsystem, and User-interface, Group decision support systems (GDSS), Expert systems, Executive Information. Systems and its integration with

DSS, Decision-making: Concept, Process, Simon's model, Information System support for Decision Making Phases, Decision making under assumed certainty, risk and uncertainty. Analytics and Business Intelligence-BI techniques.

References

1. James, A. O'Brien, Introduction to Information Systems, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2005.
2. Efraim Turban, Jay E. Aronson and Ting-Peng Liang, Decision Support Systems and Intelligent Systems, Prentice-Hall of India, New Delhi, 7th Edition, 2004.
3. George M. Marakas, Decision Support Systems, Prentice-Hall of India, New Delhi, 2002.
4. Kenneth C. Laudon and Jane P. Laudon, Management Information Systems, Prentice-Hall of India, New Delhi, 9th Edition, 2006.

Evaluation

Evaluation will be continuous an integral part of the class as well through external assessment.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Demonstrate working of MIS within the organization.
C02	Implementation and integration of Data and Information technologies with MIS.
C03	Analyze and Estimation of improvement in results using MIS and Decision Support Systems.

Mapping of the course outcomes (COs) with program outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			1	2	1	1						
CO2				1	1	1						
CO3			2		2		2					

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