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

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प्रतिलिपिः–

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

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जबलपुर

EQUIVALENCE OF SUBJECTS OF DIFFERENT SCHEMES OF UNDER GRADUATE COURSES (B.Tech.)
OF Industrial & Production Engg.

S.No.	Schemes	Subject Code & Subject Name (Semester) Having Equivalence in Syllabus	Final Subject code & subject (after equivalence)
1	AICTE	IP303 Mechanics of Materials **B.Tech. III Sem.**	IP33 Mechanics of Materials **B.Tech. III Sem.**
	Scheme 2023	IP33 Mechanics of Materials **B.Tech. III Sem.**	
2	AICTE	IP304 Machine Drawing & CAD **B.Tech. III Sem.**	IP34 Machine Drawing & CAD **B.Tech. III Sem.**
	Scheme 2023	IP34 Machine Drawing & CAD **B.Tech. III Sem.**	
3	AICTE	IP305 Thermodynamics **B.Tech. III Sem.**	IP35 Thermodynamics **B.Tech. III Sem.**
	Scheme 2023	IP35 Thermodynamics **B.Tech. III Sem.**	
4	AICTE	IP401 Material Science & Metellurgy **B.Tech. IV Sem.**	IP44 Material Science & Metellurgy **B.Tech. IV Sem.**
	Scheme 2023	IP44 Material Science & Metellurgy **B.Tech. IV Sem.**	
5	AICTE	IP402 Production Process **B.Tech. IV Sem.**	IP42 Production Process **B.Tech. IV Sem.**
	Scheme 2023	IP42 Production Process **B.Tech. IV Sem.**	
6	AICTE	IP403 Theory of Mechanics & Mechanisms **B.Tech. IV Sem.**	IP43 Theory of Mechanics & Mechanisms **B.Tech. IV Sem.**
	Scheme 2023	IP43 Theory of Mechanics & Mechanisms **B.Tech. IV Sem.**	

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7	AICTE	IP404 Fluid Mechanics **B.Tech. IV Sem.**	IP55 Fluid Mechanics **B.Tech. V Sem.**
	Scheme 2023	IP55 Fluid Mechanics **B.Tech. V Sem.**	
8	AICTE	IP405 Machine Design **B.Tech. IV Sem.**	IP45 Machine Design **B.Tech. IV Sem.**
	Scheme 2023	IP45 Machine Design **B.Tech. IV Sem.**	
9	AICTE	BT521 Engineering Economics and Management **B.Tech. V Sem.**	BT52 Engineering Economics and Management **B.Tech. IV Sem.**
	Scheme 2023	BT52 Engineering Economics and Management **B.Tech. IV Sem.**	
10	AICTE	IP502A Metrology & Quality Control **B.Tech. V Sem.**	IP51A Metrology & Quality Control **B.Tech. V Sem.**
	Scheme 2023	IP51A Metrology & Quality Control **B.Tech. V Sem.**	
11	AICTE	IP503 Tool Engg. & Machine Tools **B.Tech. V Sem.**	IP52 Tool Engineering & Machine Tools **B.Tech. V Sem.**
	Scheme 2023	IP52 Tool Engineering & Machine Tools **B.Tech. V Sem.**	
12	AICTE	IP504 Metal Cutting Science **B.Tech. V Sem.**	IP53 Metal Cutting Science **B.Tech. V Sem.**
	Scheme 2023	IP53 Metal Cutting Science **B.Tech. V Sem.**	
13	AICTE	IP505 Work Study & Ergonomics **B.Tech. V Sem.**	IP54 Work Study and Ergonomics **B.Tech. V Sem.**
	Scheme 2023	IP54 Work Study and Ergonomics **B.Tech. V Sem.**	
14	AICTE	IP601A Operations Management **B.Tech. VI Sem.**	IP61A Operation Management **B.Tech. VI Sem.**
	Scheme 2023	IP61A Operation Management **B.Tech. VI Sem.**	

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15	AICTE	IP602A Applied Thermodynamics **B.Tech. VI Sem.**	IP62A Applied Thermodynamics **B.Tech. VI Sem.**
	Scheme 2023	IP62A Applied Thermodynamics **B.Tech. VI Sem.**	
16	AICTE	IP603 Operations Research **B.Tech. VI Sem.**	IP63 Operations Research **B.Tech. VI Sem.**
	Scheme 2023	IP63 Operations Research **B.Tech. VI Sem.**	
17	AICTE	IP604 Manufacturing Technology **B.Tech. VI Sem.**	IP64 Manufacturing Technology **B.Tech. VI Sem.**
	Scheme 2023	IP64 Manufacturing Technology **B.Tech. VI Sem.**	
18	AICTE	IP605 Turbo Machines **B.Tech. VI Sem.**	IP65 Turbo Machines **B.Tech. VI Sem.**
	Scheme 2023	IP65 Turbo Machines **B.Tech. VI Sem.**	
19	AICTE	IP701 Industrial Robotics & Mechatronics **B.Tech. VII Sem.**	IP73 Industrial Robotics & Mechatronics **B.Tech. VII Sem.**
	Scheme 2024	IP701M Industrial Robotics & Mechatronics **B.Tech. VII Sem.**	
	Scheme 2023	IP73 Industrial Robotics & Mechatronics **B.Tech. VII Sem.**	
20	AICTE	IP702 Industrial Engineering **B.Tech. VII Sem.**	IP75 Industrial Engineering **B.Tech. VII Sem.**
	Scheme 2024	IP702M Industrial Engineering **B.Tech. VII Sem.**	
	Scheme 2023	IP75 Industrial Engineering **B.Tech. VII Sem.**	
21	AICTE	IP703 Vibration & Maintenance Engineering **B.Tech. VII Sem.**	IP71A Vibration & Maintenance Engineering **B.Tech. VII Sem.**
	Scheme 2024	IP704M A Vibration & Maintenance Engineering **B.Tech. VII Sem.**	
	Scheme 2023	IP71A Vibration & Maintenance Engineering **B.Tech. VII Sem.**	

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22	AICTE	IP704A Material Managemnet & Product Design **B.Tech. VII Sem.**	IP705M A Material Managemnet & Product **B.Tech. VII Sem.**
	Scheme 2024	IP705M A Material Managemnet & Product **B.Tech. VII Sem.**	
23	AICTE	IP704B Manufacturing System Design **B.Tech. VII Sem.**	IP72D Manufacturing System Design **B.Tech. VII Sem.**
	Scheme 2024	IP705M B Manufacturing System Design **B.Tech. VII Sem.**	
	Scheme 2023	IP72D Manufacturing System Design **B.Tech. VII Sem.**	
24	AICTE	IP705A Advance Manufacturing Process **B.Tech. VII Sem.**	IP72A Advance Manufacturing Process **B.Tech. VII Sem.**
	Scheme 2024	IP703M Advance Manufacturing Process **B.Tech. VII Sem.**	
	Scheme 2023	IP72A Advance Manufacturing Process **B.Tech. VII Sem.**	
25	AICTE	IP705B Rapid Prototyping **B.Tech. VII Sem.**	IP72B Rapid Prototyping **B.Tech. VII Sem.**
	Scheme 2024	IP705M D Rapid Prototyping **B.Tech. VII Sem.**	
	Scheme 2023	IP72B Rapid Prototyping **B.Tech. VII Sem.**	
26	AICTE	IP705C Research Methodology and Optimization Techniques **B.Tech. VII Sem.**	IP72C Research Methodology **B.Tech. VII Sem.**
	Scheme 2023	IP72C Research Methodology **B.Tech. VII Sem.**	

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27	AICTE	IP801 Computer Integrated Manufacturing **B.Tech. VIII Sem.**	IP81A Computer Integrated Manufacturing **B.Tech. VIII Sem.**
	Scheme 2024	IP801M A Computer Integrated Manufacturing **B.Tech. VIII Sem.**	
	Scheme 2023	IP81A Computer Integrated Manufacturing **B.Tech. VIII Sem.**	
28	AICTE	IP802 Computer Aided Design **B.Tech. VIII Sem.**	IP74 Computer Aided Design **B.Tech. VII Sem.**
	Scheme 2024	IP802M C Computer Aided Design **B.Tech. VIII Sem.**	
	Scheme 2023	IP74 Computer Aided Design **B.Tech. VII Sem.**	
29	AICTE	IP803A Entrepreneurship & Management Concept **B.Tech. VIII Sem.**	IP82A Entrepreneurship & Management **B.Tech. VIII Sem.**
	Scheme 2024	IP802M A Entrepreneurship & Management **B.Tech. VIII Sem.**	
	Scheme 2023	IP82A Entrepreneurship & Management **B.Tech. VIII Sem.**	
30	AICTE	IP803B Industrial Psychology & Human Behaviour **B.Tech. VIII Sem.**	IP81C Industrial Psychology & Human Behaviour **B.Tech. VIII Sem.**
	Scheme 2024	IP801M C Industrial Psychology & Human Behaviour **B.Tech. VIII Sem.**	
	Scheme 2023	IP81C Industrial Psychology & Human Behaviour **B.Tech. VIII Sem.**	
31	AICTE	IP803C Finite Element Methods **B.Tech. VIII Sem.**	IP81D Finite Element Methods **B.Tech. VIII Sem.**
	Scheme 2024	IP801M D Finite Element Methods **B.Tech. VIII Sem.**	
	Scheme 2023	IP81D Finite Element Methods **B.Tech. VIII Sem.**	
32	AICTE	IP804A Management Information System **B.Tech. VIII Sem.**	IP81B Management Information System **B.Tech. VIII Sem.**
	Scheme 2024	IP801M B Management Information System **B.Tech. VIII Sem.**	
	Scheme 2023	IP81B Management Information System **B.Tech. VIII Sem.**	

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33	AICTE	IP804B Work Design and Ergonomics **B.Tech. VIII Sem.**	IP82 B Work Design and Ergonomics **B.Tech. VIII Sem.**
	Scheme 2024	IP802M B Work Design and Ergonomics **B.Tech. VIII Sem.**	
	Scheme 2023	IP82 B Work Design and Ergonomics **B.Tech. VIII Sem.**	
34	AICTE	IP804C Concurrent Product Design **B.Tech. VIII Sem.**	IP82 D Concurrent Product Design **B.Tech. VIII Sem.**
	Scheme 2024	IP802M D Concurrent Product Design **B.Tech. VIII Sem.**	
	Scheme 2023	IP82 D Concurrent Product Design **B.Tech. VIII Sem.**	
35	Scheme 2024	IP704M B Project Management **B.Tech. VII Sem.**	IP71B Project Management **B.Tech. VII Sem.**
	Scheme 2023	IP71B Project Management **B.Tech. VII Sem.**	
36	Scheme 2024	IP704M C Automobile Engineering **B.Tech. VII Sem.**	IP71C Automobile Engineering **B.Tech. VII Sem.**
	Scheme 2023	IP71C Automobile Engineering **B.Tech. VII Sem.**	
37	Scheme 2024	IP704M D Computer Aided Production Planning **B.Tech. VII Sem.**	IP71D Computer Aided Production Planning **B.Tech. VII Sem.**
	Scheme 2023	IP71D Computer Aided Production Planning **B.Tech. VII Sem.**	

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Bachelor of Technology (B.Tech.) III Semester (Industrial & Production Engineering)

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

Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
IP33	Mechanics of Materials	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 calculate the stresses and strain of different members of machines.
- To draw shear force and bending moment diagram for various types of beams with different loadings.
- To apply theories of failures to different materials and loading conditions.
- To study torsion and stresses of shafts.

Course Content:

MECHANICS OF MATERIALS
(IP33)

Module-I: Mechanical Properties of Materials: Ductility, malleability, hardness, toughness, fatigue, creep, behavior of materials under tension, compression, bending, shear, ductile and brittle materials, failure of MS and CI in tension and torsion, ductile and brittle failures.

Stress and strain: stresses in members of a structure, axial loading, normal stress, shear stress, bearing stress, analysis of simple structures, stress on oblique plane under axial loading, stepped rods, members in series and parallel, stress strain diagram, Hooke's law, modulus of elasticity, elastic and plastic behavior of materials, deformation under axial loading, statically indeterminate problems, stress due to temperature, Poisson's ratio, Bulk modulus, shear strain, relation among elastic constants, residual stress, fiber reinforced composite materials.

Module-II: Transformation of stress and strain, principal stresses, normal and shear stress, Mohr's circle and its application to two-dimensional analysis, Shear force and BM diagram for various types of loading, stresses in thin-walled pressure vessel.

Module-III: Bending: pure bending, symmetric member, deformation, and stress, bending of composite sections, eccentric axial loading, beams of unsymmetrical sections, shear stresses in beams, distribution of shear stresses. Deflection of beams, moment area method,

Module-IV: Torsion in shafts: stresses in a shaft, deformation in circular shaft, angle of twist, stepped hollow, thin walled-hollow transmission shafts, transmission shaft under combined bending and torsion; Leaf springs; helical springs, open and closed coil, stress in spring wire, deflection of helical spring, springs in series and parallel.

Module-V: Theories of failures: maximum normal stress & shear stress theory; maximum normal and shear strain energy theory; maximum distortion energy theory; application of theories to different materials and loading conditions Columns: stability of structures, Euler's formula for columns with different end conditions, Rankin's formula.

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References:

1. Beer FP, Johnson ER, Dewolf JT: Mechanics of Materials; TMH
2. Rattan; Strength of materials; TMH
3. Nash William; Schaum's Outline of Strength of Materials; TMH.
4. Negi; strength of materials; TMH
5. Singh Arbind K; Mechanics of Solids; PHI
6. Strength of Materials, Sadhu Singh,
7. Kamal K and Ghai RC; Advanced Mechanics of Materials; Khanna Pub.

List of experiments (Expendable):

1. Standard tensile test on MS and CI test specimen
2. Direct/ cross Shear test on MS and CI specimen
3. Transverse bending test on wooden beams to obtain modulus of rupture
4. Fatigue test
5. Brinell Hardness tests
6. Vicker hardness test
7. Izod/Charpy impact test

Course Outcomes:

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

CO1	Calculate stresses and strain in different members of the materials.
CO2	Draw Shear force and Bending moment diagram for different types of beams with different loadings.
CO3	Find out deflection deformation and stress for different types of beams
CO4	Calculate torsion and stresses of shafts.
CO5	Calculate critical load by apply Euler's theory and Rankine's formula for column and strut.

Mapping of 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	0	0	2	1	1	0	1	1	1
CO2	2	2	1	1	1	0	0	1	0	1	0	1
CO3	2	1	1	1	1	0	0	1	0	1	1	1
CO4	3	3	2	2	2	2	1	0	1	1	1	1
CO5	2	1	2	2	1	2	1	0	1	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						
IP34	Machine Drawing & CAD	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 enable the students to prepare a detailed assembly drawing for machine components.
- To provide knowledge of CAD software for 2D and 3D modeling, basic design concepts

MACHINE DRAWING & CAD
(IP34)

MODULE I:

Drawing conventions, drawing and dimensioning IS codes, sectional views and sectioning, surface finish and tolerances, representation of machine parts such as external and internal threads, slotted heads, square ends, and flat radial ribs, slotted shaft, splined shafts, bearings, springs, gears. Rivet heads and riveted joints, types of welded joints and representation.

MODULE II

Assembly Machine Drawing: Basic concept, plotting technique, assembly and blow up of parts, bill of materials, product data. Cotter and knuckle joints, pedestal and footstep bearings, crosshead, stuffing box, IC engines parts- piston and connecting rods, lath machine parts.

MODULE III

CAD software for 2D and 3D modeling, basic design concepts, design process, stages/phases in design, flowchart, problem formulation, design considerations (strength, manufacturing, maintenance, energy, environment, economics and safety), design for recycle and reuse, design and safety factors for steady and variable loads, impact and fatigue considerations, reliability and optimization, standardization in design.

MODULE IV

Design of components subject to static loads: Riveted joints, welded joints, threaded joints, pin, knuckle, and cotter joints.

References:

1. Bhat, ND; Machine Drawing; Charotar
2. Singh A; Machine Drawing; TMH
3. Narayana and Reddy; Machine Drawing; New age, Delhi.
4. Agarwal and Agrawal; Engineering Drawing; TMH
5. Shigley JE et al; Mechanical Engineering Design, TMH
6. Kulkarni SG; Machine Design; TMH
7. Mubeen and Mubeen; Machine Design.

List of Experiments (Expendable):

1. Introduction to Compute Aided Drafting software for 2D and 3D Modeling
2. Computer Aided Drafting of simple machine parts
3. 3D Modeling of simple solid shapes
4. Design and drawing of parts contained in the syllabus

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Course Outcomes:

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

CO1	Understand Indian standard for machine drawing.
CO2	Understand Fits and Tolerance in technical drawing.
CO3	Draw assembly drawing of joints, couplings, and machine elements.
CO4	Draw assembly drawing of I.C. Engine parts and Lathe machine parts.

Mapping of 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	1	0	1	2	1	0	1	1	2
CO2	2	2	2	1	1	1	2	1	0	2	1	2
CO3	3	2	2	2	1	0	1	1	1	3	2	2
CO4	3	2	3	2	1	0	1	1	2	3	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						
IP35	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 understand laws of thermodynamics and their applications
- To know heat engine, heat reservoir, entropy, entropy change
- To understand Real gas, its deviation with ideal gas Maxwell relations and their applications
- To understand Pure Substance, phase, phase-transformations use of steam table and Mollier chart
- To know working of Air standard cycles, Carnot, Otto, Diesel, Dual cycles

Course Contents:

THERMODYNAMICS
(IP35)

Module -I: Basic concepts: Concept of an ideal gas, gas laws, Zeroth law of thermodynamics, Avogadro's hypothesis, heat, and work transfer. First law of thermodynamics- Statement of first law of thermodynamics, first law applied to closed system, first law applied to a closed system undergoing a cycle, processes analysis of closed system, flow process, flow energy, steady flow process, relations for flow processes, and limitations of first law of thermodynamics.

Module-II: Second law of thermodynamics, heat engine, heat reservoir, refrigerator, heat pump, COP, EPR, available energy, Carnot's theorem, Carnot's cycle, efficiency of Carnot's cycle, statement of second law reversible and irreversible processes, consequence of second law, entropy, entropy change for ideal gas, T-S diagrams, availability, and irreversibility. Gibbs and Helmholtz functions.

Module-III: Real gas, deviation with ideal gas, Vander-wall's equation, evaluation of its constants, limitations of the equation. The law of corresponding states compressibility factor, generalized compressibility chart, P-V-T surface of a Real gas, thermodynamics relations, Maxwell relations and their applications.

Module-IV: 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 table and Mollier chart.

Module-V

Air standard cycles, Carnot, Otto, Diesel, Dual cycles, and their comparison, two stroke and four stroke engines, Brayton cycle, non-reactive gas mixture, PVT relationship, mixture of ideal gases, properties of mixture of ideal gases, internal energy, enthalpy and specific heat of gas mixtures, enthalpy of gas-mixtures

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References:

1. P.K. Nag; Engineering Thermodynamics; TMH
2. Van GJ; Thermodynamics; John Wylen
3. Cengel Y; Thermodynamics; TMH
4. Arora CP; Thermodynamics; TMH
5. Engineering Thermodynamics by Omkar Singh New Age International.
6. Engineering Thermodynamics by Ratha Krishanan PHI India Pvt. Ltd.
7. Engineering Thermodynamics by M. Achuthan, PHI India.

List of Experiments (Expendable):

1. To find mechanical equivalent of heat using Joule's apparatus
2. To study working of impulse and reaction steam turbine by models.
3. To study working of Gas turbines by models and to identify various processes of Brayton Cycle.
4. To calculate COP of vapor compression refrigeration system and to plot on T-s, p-H diagrams.
5. To plot specific fuel consumption versus rpm diagrams for diesel and petrol engines

Course Outcomes:

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

CO1	Analyze the laws of thermodynamics, and their applications
CO2	Explain working of heat engine, heat reservoir, entropy, entropy change.
CO3	Explain Real gas, its deviation with ideal gas Maxwell relations and their applications.
CO4	Analyze Pure Substance, phase, phase-transformations use of steam table and Mollier chart
CO5	Understand working of Air standard cycles, Carnot, Otto, Diesel, Dual cycles

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	1	0	2	1	2	0	1	2
CO2	3	3	2	1	1	0	0	0	1	1	1	2
CO3	2	3	1	1	2	1	1	1	0	0	1	2
CO4	2	3	0	1	1	1	1	0	1	1	0	2
CO5	2	2	2	1	1	0	0	1	0	0	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						
IP44	Material Science & Metallurgy	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 study the Properties of Materials and Heat treatment.

Course content:

Material Science & Metallurgy
(IP44)

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: Plastic 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 III: 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.

Module IV: Heat Treatment of Alloys Principles of Heat Treatment of Steel: TTT curves heat treating processes, normalizing, annealing spheroidizing, hardening, tempering, case hardening, austempering, mar-tempering, precipitation hardening process with reference to Al, Cu alloys

Module V: Properties of Material: Creep Fatigue etc., Introduction to cast iron and steel, Non-Ferrous metals base alloys, Bronze, Brasses, Duralumin, and Bearing Metals. Plastics, Composites, and ceramics: Various types of plastics, their properties and selection. Plastic molding technology, FRP, GRP resins adhesive, elastomers, and their application. Powder Metallurgy: Property and Applications of Powder Metallurgy, Various process, and methods of making products by powder Metallurgy techniques.

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 and Marikani; Material science; TMH
5. Sriniwasan R; Engineering materials and Metallurgy; TMH
6. Navneet Gupta, Material Science & Engineering, Dhanpat Rai.
7. B. K. Agrawal, Introduction to Engineering Materials, TMH.

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Material Science & Metallurgy Lab

List of Experiment (Expendable):

1. To study micro-structures of metals/alloys.
2. To study crystal structure of a given specimen.
3. To study crystal imperfections in a given specimen.
4. To study heat treatment process (Hardening & tempering) of steel specimen.
5. To study the properties of various types of plastic.
6. To study Bravais lattices with the help of model.

Course Outcomes:

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

CO1	Understand Crystal Atoms of Solid.
CO2	Understand Plastic Deformation of Metals.
CO3	Understand Alloy Formation and Binary Diagram.
CO4	Understand Heat Treatment of Alloys Principles of Heat Treatment of Steel.
CO5	Understand Properties of Material.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Corse Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	1	2	2	1	0	3	1	2
CO2	2	2	3	2	2	2	2	1	1	3	2	2
CO3	2	2	3	3	2	2	1	1	0	2	2	2
CO4	1	2	3	2	3	2	2	0	1	3	2	2
CO5	2	2	3	3	2	2	1	0	1	3	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						
IP42	Production 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:

- To describe crucible furnaces, gating system.
- To describe Solidification and Special casting process.
- To know the process of Metal Forming: Nature of plastic deformation working of different types of gears,
- To know Forging, Extrusion, Wire drawing process
- To know grinding, balancing, dressing and truing, honing, Lapping, super finishing operations.

Course content:

PRODUCTION PROCES
(IP42)

Module-1: Melting Practices Cupola, capacity of a cupola, cupola operation, zones of cupola, cupola Efficiency, melting furnaces for non-ferrous metals, classification of crucible furnaces, gating system, pouring basin, sprue, runner, gates, types of gates, riser, gating design, numerical simulation, main consideration in design and position of risers, types of risers, feeder location and shapes use of exothermic materials, use of chills.

Module-I1: Solidification and Special casting process: Solidification of casting, permanent mould Casting, slush casting, die casting, centrifugal casting, investment casting, continuous casting, casting defects and their remedies, cleaning of castings, repair of casting, inspection of casting. Solid modeling of castings.

Module-1II: Metal Forming: Nature of plastic deformation, stress-strain relation in elastic and plastic deformation, concept of flow stress, deformation mechanism, hot and cold working, rolling principal, rolling stand arrangement, roll passes, breakdown passes, roll pass sequence, analysis of rolling

Module-1V: Abrasive processes: Grinding wheel, specification, characteristics, abrasive types, grinding operations, cylindrical grinding, surface grinding, Centre less grinding, form grinding, internal cylindrical grinding, wheel balancing, dressing and truing, honing, Lapping, super finishing, polishing, and buffing

Module-V: Forging, Extrusion, and other Processes: Forging operations, forging design, drop forging die design, die inserts. Extrusion- principle, forward and backward extrusion, extrusion analysis, impact extrusion, hydrostatic Extrusion, extruding tubes. Wire drawing- Rod and tube drawing, tube making, swaging, drawing analysis.

References:

1. Rao P.N; Manufacturing Technology-foundry, forming; TMH Publishing House
2. Ravi B; Metal casting- CAD and Analysis; PHI Publishing House
3. Jain P.L; principles of foundry technology; TMH Publishing House
4. Hennie & Roshanthall; Metal casting; McGraw Hill New York
5. Chambell J.S; Manufacturing Science; McGraw Hill New York

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List of experiments (Expendable):

1. Study of molding and casting process.
2. make any one type of wooden pattern using simple tool.
3. Study of forging machine and demonstration various operation of forging.
4. Study of rolling process.
5. To perform grinding operations.
6. Study of crucible furnace.
7. Study of various extrusion process.

Course Outcomes:

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

CO1	To work with crucible furnaces, gating system.
CO2	To describe Solidification and Special casting process.
CO3	To express the process of Metal Forming: Nature of plastic deformation working of different type of gears
CO4	To understand Forging, Extrusion, Wire drawing process
CO5	To explain grinding, balancing, dressing and truing, honing, Lapping, super finishing operations.

Mapping of 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	0	2	1	1	0	2	0	0	1
CO2	1	2	2	1	1	0	1	0	1	0	0	0
CO3	1	0	1	2	2	0	0	0	1	0	0	0
CO4	1	1	2	2	2	2	1	0	0	0	0	0
CO5	1	3	2	3	1	1	0	0	0	0	0	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						
IP43	Theory of Machines& Mechanisms	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 describe the working of different mechanism used in machines.
- To find velocity and acceleration of links of different mechanism.
- To know the working of different types of gears, gear trains and cams.
- To know the applications of gyroscopic principle.
- To know the working principles of belt, rope and chain drive.

Course content:

THEORY OF MACHINE & MECHANISM
(IP43)

Module I

Mechanisms and Machines: Mechanism, machine, planer mechanisms, kinematic pairs, kinematic chains and their classification, degrees of freedom, Grubler's criterion, kinematic inversions of four bar mechanism and slider crank mechanism, equivalent linkages, straight line motion mechanisms, pantograph, Davis and Ackermann's steering mechanisms,

Module II

kinematic analysis of planer mechanisms using graphical techniques, relative velocity method, instantaneous center method and its application, Kennedy's theorem, Coriolis component of acceleration.

Module III

Governors: Types, porter, proell, hartnell, wilson-hartnell, effort and power, controlling force controlling force, sensitiveness, hunting, isochronisms, and stability of governors. Fly wheel, turning moment diagram, energy stored.

Gears: Classification of gears, nomenclature, involutes and cycloidal tooth profile properties, synthesis of tooth profile for spur gears, tooth system, conjugate action, velocity of sliding, arc of contact, path of contact, contact ratio, interference and undercutting, helical, spiral, bevel and worm gears.

Module IV

Gears: Classification of gears, nomenclature, involutes and cycloidal tooth profile properties, synthesis of tooth profile for spur gears, tooth system, conjugate action, velocity of sliding, arc of contact, path of contact, contact ratio, interference and undercutting, helical, spiral, bevel and worm gears.

Gear Trains: Simple, compound, epicyclic gear trains; determination of gear speeds using vector, analytical and tabular method; torque calculations in simple, compound and epicyclic gear trains.

Module V

Cams: Classification of followers and cams, radial cam nomenclature, analysis of follower motion (uniform, modified uniform, simple harmonic, parabolic, cycloidal), pressure angle, radius of curvature, synthesis of cam profile by graphical approach, cams with specified contours

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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.

References:

1. Rattan SS; Theory of machines; TMH
2. Ambekar AG; Mechanism and Machine Theory; PHI.
3. Sharma CS; Purohit K; Theory of Mechanism and Machines; PHI.
4. Thomas Bevan; Theory of Machines; CBS PUB Delhi.
5. Rao JS and Dukkipati; Mechanism and Machine Theory; New Age Delhi.
6. Dr.Jagdish Lal; Theory of Machines; Metropolitan Book Co; Delhi –
7. Ghosh, A,.Mallik,AK; Theory of Mechanisms & Machines, 2e,; Affiliated East West Press, Delhi.

List of experiments (Expandable)

1. To study all inversions of four-bar mechanisms using models
2. Draw velocity and acceleration polygons of all moving link joints in slider crank mechanism
3. Determination of velocity and acceleration in above using method of graphical differentiation
4. To study working of differential gear mechanism.
5. To study working of sun and planet epicycle gear train mechanism using models
6. To plot fall and rise of the follower versus angular displacement of cam and vice versa.
7. Study of universal gyroscope
8. Analytical determination of velocity and acceleration in simple mechanism using Roven's Method.

Course Outcomes:

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

CO1	Describe the working of different mechanisms and their inversions.
CO2	Draw velocity and acceleration of different links of a mechanism using different methods.
CO3	Design different types of gears and gear trains.
CO4	Draw cam profile for different follower motions.
CO5	Analyze Gyroscopic effect on Naval ship and Stability of Two- and Four-Wheel Vehicles.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1	1	1	1	0	2	1	2
CO2	3	2	2	2	1	0	0	2	1	3	1	1
CO3	2	2	3	2	2	2	2	1	2	1	2	3
CO4	1	2	2	3	1	0	0	2	1	3	1	1
CO5	1	1	3	3	2	1	2	1	2	2	3	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						
IP55	Fluid Mechanics	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work	100	L	T	P	4
		70	20	10	-	-		3	1	-	

Course Objective

- To introduce and explain fundamentals of Fluid Mechanics and fluid properties.
- To give fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows
- To provide knowledge of Euler's equation Bernoulli's equation and their application.
- To explain velocity measurement, flow measurement.
- Introduction of laminar & turbulent flow, Reynolds experiment & Reynolds number.

FLUID MECHANICS
(IP55)

Module-I: Review of Fluid Properties: Engineering Modules of measurement, mass, density, specific weight, volume and gravity, surface tension, capillarity, viscosity, bulk modulus of elasticity, pressure and vapor pressure. Fluid Static's: Pressure at a point, pressure variation in static fluid, Absolute and gauge pressure, manometers, Forces on plane and curved surfaces (Problems on gravity dams and tainter gates); buoyant force, Stability of floating and submerged bodies, Relative equilibrium.

Module-II: Kinematics of Flow: Types of flow-ideal & real, 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 & irrotational flow, circulation, stagnation point, separation of flow, sources & sinks, velocity potential, stream function, flow nets their utility & method of drawing flow nets.

Module-III: 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. The moment of momentum equation, forces on fixed and moving vanes and other applications.

Flow Measurements: Velocity measurement (Pitot tube, Prandtl tube, current meters etc.), flow measurement (orifices, nozzles, mouth pieces, orifice meter, nozzle meter, venture-meter, weirs and notches).

Module-IV: Dimensional Analysis and Dynamic Similitude: Dimensional analysis, dimensional homogeneity, use of Buckingham-pi theorem, calculation of dimensionless numbers, similarity laws, specific model investigations (submerged bodies, partially submerged bodies, weirs, spillways, rotodynamic machines etc.)

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Module-V : Laminar Flow: Introduction to laminar & turbulent flow, Reynolds experiment & Reynolds number, relation between shear & pressure gradient, laminar flow through circular pipes, laminar flow between parallel plates, laminar flow through porous media, Stokes law, lubrication principles.

References:

1. Modi & Seth; Fluid Mechanics; Standard Book House, Delhi
2. Som and Biswas; Fluid Mechnics and machinery; TMH
3. Cengal; Fluid Mechanics; TMH
4. White ; Fluid Mechanics ; TMH
5. JNIK DAKE; Essential of Engg Hyd; Afrikan Network & Sc Instt. (ANSTI)
6. Franiss JRD; A Text Book of fluid Mech. for Engg. Student
7. R Mohanty; Fluid Mechanics; PHI

Course Outcomes:

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

CO1	Explain fundamentals of Fluid Mechanics and fluid properties..
CO2	Derive Euler's Equation of motion and Deduce Bernoulli's equation.
CO3	Distinguish the types of flows.
CO4	Find velocity measurement by using Pitot tube, Prandtl tube, current meters.
CO5	Find flow measurement bu using orifices, nozzles, mouth pieces, orifice meter, nozzle mete venture-meter, weirs and notches.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1	1	1	1	0	1	1	2
CO2	3	2	2	2	1	0	0	0	1	1	1	1
CO3	2	2	3	2	2	2	2	1	2	1	2	3
CO4	1	2	2	3	1	0	0	0	1	3	1	1
CO5	1	1	3	3	2	1	2	1	2	2	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	
IP45	Machine Design	70	20	10	-	-	100	3	1	-	4

Course Objective:

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

Course content:

MACHINE DESIGN
(IP45)

Module I:

Stress concentration and fatigue: Causes of stress concentration, stress concentration in tension, bending and torsion, reduction of stress concentration, theoretical stress concentration factor, notch sensitivity, fatigue stress concentration factor, cyclic loading, endurance limit, S-N Curve, loading factor, size factor, surface factor. Design consideration for fatigue, Goodman and modified Goodman's diagram, soderberg equation, Gerber parabola, design for finite life, cumulative fatigue damage factor.

Module II:

Shafts: 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 keys and shaft couplings.

Module III:

Design of Bearings: Sliding Bearing, hydrodynamics lubrication, mechanical aspects of bearing design, lubricants, journal bearing design, rolling element bearings.

Module IV:

Brakes & Clutches: Materials for friction surface, uniform pressure and uniform wear theories.
Design of friction clutches: Disk, plate clutches, cone & centrifugal clutches.
Design of brakes: Rope, band & block brake, Internal expending brakes, Disk brakes.

Module V:

Design of Power screws types, screw drives, efficiency, stresses in power screws, design procedure and calculation.

References:

1. Shigley J.E; Machine Design; TMH
2. Sharma and Purohit; Design of Machine elements; PHI
3. Wentzell Timothy H; Machine Design; Cengage learning
4. Mubeen; Machine Design; Khanna Publisher
5. Ganesh Babu K and Srithar k; Design of Machine Elements; TMH
6. Sharma & Agrawal; Machine Design; Kataria & sons
7. Maleev; Machine Design.

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Course Outcomes:

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

CO1	Understand modes of failure, fatigue and different factors used in design.
CO2	Design cotter joints, knuckle joints and welded joints used in different machines.
CO3	Design shafts under combined bending, twisting and axial loading.
CO4	Select bearing for given conditions using design procedure.
CO5	Design different types of Power screws.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Corse Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	1	2	2	1	0	3	1	2
CO2	2	2	3	2	2	2	2	1	1	3	2	2
CO3	2	2	3	3	2	2	1	1	0	2	2	2
CO4	1	2	3	2	3	2	2	0	1	3	2	2
CO5	2	2	3	3	2	2	1	0	1	3	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	
BT-52	Engineering Economics and Management	70	20	10	-	-	100	3	1	-	4

Module -I

Introduction to Engineering Economics and Managerial Economics Concept of Efficiency, Theory of Demand , Elasticity of Demand, Supply and Law of Supply indifference Curves, Budget Line; Welfare Analysis, Scope of Managerial Economics, Techniques and Applications of Managerial Economics.

Module -II

Market Structure Perfect Competitions Imperfect - Monopolistic: Oligopoly, duopoly sorbent features of price determination and various market conditions. Demand Forecasting and cost Estimation Characteristics of Forecasts, Forecasting Horizons, Steps to Forecasting, Forecasting Methods, Seasonal Adjustments, Forecasting Performance Measures, Cost Estimation, Elements of cost, Computation of Material Variances Break - Even Analysis.

Module -III

Introduction: Concept, Development, application and scope of Industrial Management. Productivity: Definition, measurement, productivity index, types of production system, Industrial Ownership.

Module -IV

Management Aspects, Functions of Management, Project Management, Value Engineering, Project Evaluation, Work simplification — process charts and flow diagrams, Production Planning, Decision Making.

Module -V

Inventory Control: Inventory, Cost, Deterministic Models Quality Control: Process control, SQC, Control charts, Single, Double and Sequential Sampling, Introduction to TQM.

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TEXT BOOKS:

1. Principles of Management by Tripathy and Reddy
2. Mechanical estimation and costing, T.R. Banga& S.C. Sharma, 17th edition 2015
3. Engineering Economy, Riggs J.L. McGraw Hill, 2002
4. Engineering Economy, Thuesen H.G. PHI , 2002

REFERENCE BOOKS:

1. Management Fundamentals- Concepts, Application, Skill Development - RobersLusier - Thomson

Course Outcomes-

After the completion of this course student will be able to-

CO1	Understand the key management concepts, principles and contribution by different Management thinkers.
CO2	Analyze and design organization for effective management.
CO3	Application of modem management techniques.

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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						
IP51 A	Metrology & Quality Control	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work	100	L	T	P	4
		70	20	10	-	-		3	1	-	

Course Objective:
To learn about various measurement techniques and equipment.

Course content:

METROLOGY & QUALITY CONTROL
(IP51 A)

Module 1

General concept of measurement: Definition-standards of measurement, Errors in measurement, Limit-gauging, various systems of limits, Fits and tolerance, Interchangeability, Tolerance analysis in manufacturing and assembly, ISI, and ISO system. Basic principles and design of standards of measuring gauges, Types of gauges and their design, Taylors Principal, Accuracy and precision, Calibration of instruments, Principals of light interference, Interferometer, Measurement and calibration, Tolerance analysis in manufacturing and assembly.

Module 2

Linear and angular measurements: Slip gauges, Micrometers, Dial gauges, Surface plates, Comparators Mechanical, Electrical, Pneumatic, and optical comparators, Angular measuring instruments-Sine bar, Angle gauges, Sprit level, Autocollimators, Clinometers, Measurement of straightness, flatness, squareness, roundness, and symmetry Inspection of screw threads and gears.

Module 3

Measurement of surface finish and measuring machines: Surface Finish-Definitions, types of surface texture, Surface roughness measurement methods, Visual inspection, Surface roughness blocks, Averaging Instruments, Profile-meters, Pneumatics and replica, Measurement of run out and concentricity, Length bar measuring machine, Optical projection, Comparators, Tool makers microscope, Inspection of Screw threads and gears, Measurement of straightness, flatness, roundness, squareness, and symmetry.

Module 4

Statistical Process Control: Basic Discrete and Continuous distributions, Measures of central tendency, Variability and shapes, Sampling, Size and Central value theorem, Control chart structure, Process plotting and stability, Study of out-of-control evidences, Defect detection and prevention, Use of control charts in evaluating past, present and future trends; Variables and Attributes, Concept of Control Charts, Types of Control Charts, Control Charts for Attributes, p Chart, np Chart, c Chart u Chart, Control Charts for Variables x Chart, R Chart.

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Module 5

Process Capability and Sampling Plans: Introduction, Variation in Process, Types of Variations, Factors Contributing Variations, Analysis of Process Capability, Acceptance sampling, Advantages and limitations of sampling inspection, Sampling methods, Single, Double and Multiple sampling plan, Operating Characteristic curve, Producer Risk and consumer Risk. Quality indices for acceptance sampling plans, Average outgoing quality limit (AOQL), Characteristics of OC curve, Characteristics of good sampling plan.

References:

1. ASTE. Handbook of Industrial Metrology. PHI Publications.
2. Jain. R.K. Engineering Metrology. Khanna Publications.
3. Gupta. I.C. A Text book of Engineering Metrology. Dhanpat Rai and Sons.
4. Galye. G.N. Metrology for Engineers. Elbs Publications.
5. Rajput. R.K. Engineering Metrology and Instrumentation. S.K. Kataria & Sons.

Course Outcomes:

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

CO1	calculate fits and Tolerance.
CO2	use linear and angular measuring instruments.
CO3	understand surface roughness measurement methods.
CO4	evaluate control charts for variables and attributes.
CO5	prepare Single, Double and Multiple sampling plan,

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	1	3	1	1	0	0	0	0	1
CO2	1	0	1	2	3	1	0	0	0	0	0	0
CO3	0	0	1	2	2	0	1	1	0	0	0	0
CO4	0	2	2	1	3	1	0	1	1	0	0	1
CO5	1	1	2	2	2	2	1	0	2	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						
IP52	Tool Engineering & 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:

- Provide knowledge about Basic Features and Kinematics of Machine Tools.
- Explain design of metal working tools.
- Explain principle and Design of jigs and fixtures.
- Explain Gear generation process Gear finishing process.
- Mould Design and Acceptance Tests.

Course content:

TOOL ENGINEERING & MACHINE TOOLS
(IP52)

Module 1: Basic Features and Kinematics of Machine Tools: Features of basic machine tools, Construction and operation, types of machine tools, Machine tools motion, and transmission-rotation in to rotation, Rotation in to translation, Kinematical-structures of machine tools, Elementary, Complex and compound structure.

Module 2: Design of Metal Working Tools: Design of press working tools, Press working terminology, Types of press working dies, Principle of metal shearing in press working operation, Design of Shearing, Piercing and Blanking dies, Press tool shearing operations, Bending, Forming and Drawing dies, Embossing, Coining and Spinning operations, Metal working defects.

Module 3: Design of jigs and fixtures: Principles of Jigs and Fixture Design, Locating and Clamping, Principles of location, Locating devices, Mean Locators or centralizers, Types of clamping devices, Strap clamps, Hinged clamps, C clamps, Quick acting clamps, Elements of Jigs, Types of Jigs, Drilling jigs, Types of drilling jigs, Milling Fixture, Elements of Milling Fixtures, Classification of Milling Fixtures, Turning Fixtures, Grinding and Broaching Fixture, Materials for Jigs and Fixtures, Usefulness of Jigs and Fixtures.

Module 4: Gear Cutting: Gear generation process: Gear Shaping, Gear Hobbing, Gear finishing process: Gear Shaving, Gear Burnishing, Gear Grinding, Gear Lapping, Gear Honing.
Broaching: Broaching machines, Broach terminology, Types of Broaches, Method of Broaching. **Thread production methods**: Thread chasing, Thread Rolling, Die Threading, Thread Tapping, Thread Milling, Thread Grinding.

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Module 5: Polymer and Composites: Introduction, Plastic processing, Injection, Compression and Blow moulding, Extrusion, calendaring and thermoforming, moulding of composites, Dies and mould design for plastics and rubber parts.

Powder Metallurgy: Production of metal powders, Compacting and Sintering.

Mould Design and Acceptance Tests: Common Instruments used in alignment tests, Test procedures, Installation and Leveling, Testing the quality of Grinding and Bearing surfaces, Testing the main Spindle for running, Axial slip, Alignment between two axes, Parallism between an axis and a surface.

References:

1. Mehta. N.K. Machine Tool Design and Numerical Control. TMH. Publications.
2. Sen. G.C., Bhattacharya. A., Principles of Machine Tools. New Central Book Publications.
3. Donaldson. Tool Design. TMH. Publication.
4. Jain. K.C. A Text Book of Production Engineering PHI. Publication.
5. Juneja, Sekhon & Seth. Fundamentals of Metal Cutting and Machine Tools. New Age Publications.
6. Sharma. P.C. Production Engineering. S. chand Publications.

TOOL ENGINEERING & MACHINE TOOLS LAB

List of Experiments (Expendable):

1. Draw Kinematical-structures of machine tools.
2. To study Complex and compound structure of machine tools.
3. To study Principle of metal shearing in press working operations.
4. Design of Shearing, Piercing and Blanking dies.
5. Jigs and Fixture Design.
6. To study Gear generation process.
7. To study various Performance parameters of Thread generation methods.
8. To study various methods of Powder Metallurgy

Course Outcomes:

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

CO1	Explain about Basic Features and Kinematics of Machine Tools.
CO2	Design metal working tools.
CO3	Design jigs and fixtures.
CO4	Explain Gear generation process Gear finishing process.
CO5	To do Mould Design and Acceptance Tests

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	1	1	0	0	1	0	1	1
CO2	2	2	3	0	3	1	0	1	0	1	0	1
CO3	1	1	3	1	3	0	1	0	0	0	0	1
CO4	1	1	0	0	3	0	0	0	0	0	0	1
CO5	1	0	3	1	3	0	0	0	0	0	0	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						
IP53	Metal Cutting Science	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 learn about various machine tools and their applications

Course content:

METAL CUTTING SCIENCE
(IP53)

Module 1: Principles of metal cutting: Geometry of single pointed cutting tools, types of cutting tool, tool signature & nomenclature, Orthogonal and Oblique cutting, Measurement of cutting force, Merchant circle and force analysis of single point orthogonal cutting, cutting tool material, Mechanism of cutting and chip formation, Types of chips, Tool Failure.

Module 2: Tool Life and Thermal aspect of cutting: Heat distribution, Shear plane temperature in orthogonal cutting, Determination of tool temperature, Tool life equation, Effect of process parameters on tool life, Tool life tests, Mechanism of tool wear, Types of tool wear, Economics of Machining Process, Machinability.

Module 3: Cutting Fluids: Types of Cutting Fluid, Composition of Cutting Fluid, Selection of Cutting Fluids, Method of applying cutting fluid, Benefits,
Lathe: Lathe- specification, Components & accessories, various operations on lathes, Lathe parameters, Cutting speed, Depth of cut, Capstan & Turret lathes, tool layout, Machining time calculation, Methods of Screw production.

Module 4: Milling: Working principle, classification, Specification, Accessories & Attachment, Milling Cutters, Elements of plain milling cutter, up milling and down milling, Thread milling, Universal dividing head, Indexing Methods: Direct Indexing, Plain or Simple Indexing, Compound Indexing, Differential Indexing, Angular Indexing, Machining time calculation.

Module 5: Shapers: Classification and Specifications, Principal parts, Quick return mechanism, Shaper operations, Cutting speed, Feed, Depth of cut, Machining time calculation.
Drilling: Classification & specification of Drilling Machines, Work holding and Tool holding devices, Drilling Machine Operations, Machining time.

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References:

1. Groover MP; Fundamentals of modern manufacturing; Wiley India
2. Kaushish JP; Manufacturing processes; PHI
3. Boothroyd G, Knight WA; Fundamentals of machining and machine tools; CRC-Taylor and francis
4. Munoz J and Oswald PF; Manufacturing processes and systems; Wiley India;
5. Boston; Metal Processing.
6. Hazra Chowdhary; Workshop Technology. II
7. Lindberg – Materials & Processes of Manufacture.
8. Work shop technology by Raghuvanshi-Vol-II
9. Production Processes by HMT

Metal cutting science Lab

List of experiments (Expendable):

1 To make a job on lathe machine with operations like turning, step turning drilling, thread cutting and knurling.
2 Study of drilling machine and prepare a job on it.
3 To prepare job on milling machine.
4.To study of shaper machine to learn about working of quick return mechanism.
5 study of tool wear and tool life.
6.to study of cutting fluids.

Course Outcomes:

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

CO1	Learn to build a job on lathe machine.
CO2	Method of applying cutting fluid.
CO3	Understand the working and operations of milling machine.
CO4	Knowledge of shaper machines and operations.
CO5	Analyze Tool Wear, its variables and estimation of tool life.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	0	1	1	2	1	1	1	0	0	0	0	1
CO2	0	0	1	1	1	1	0	0	0	0	0	0
CO3	0	0	1	2	2	0	1	1	0	0	0	0
CO4	0	0	2	1	0	1	0	1	1	0	0	1
CO5	1	1	2	2	1	2	1	0	2	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						
IP54	Work Study & Ergonomics	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 be familiar with work study procedure and its application
- To learn about human factor engineering.
- To learn about basiç procedure of method study.
- To be familiar with Job Evaluation process and Merit Rating.

Course content:

WORK STUDY & ERGONOMICS
(IP54)

MODULE I

Work Study: Purpose of Work Study, Objectives, Procedure, and Applications of Work Study, , the human factor in the application of Work Study, The influence of working condition on work study.

Human Factor Engineering: Objective of Ergonomics, Applications of Ergonomics, Man-Machine System, Characteristics of Man-Machine System, Classification of Man-Machine System, Working environment, Workplace design.

MODULE II

Method study: Method Study definition and objective of Method Study, Basic procedure, Process Analysis, Process Chart Symbol. Selection of job, Various Recording techniques like Outline Process Charts, Flow Process Charts, Man Machine Charts, Two handed Process Charts, String diagram, Flow diagram, Multiple activity chart, Simo, Cyclographs and Chrono-cyclographs, Critical examination, Development, Installation and Maintenance of improved method, Principles of Motion Economy ,Therbligs, Micro motion study, Memo motion study.

MODULE III

Work Measurement: Introduction & Definition, Objectives and basic procedure of Work Measurement, Time study, basic procedure, equipments needed, Methods of Measuring time, Selection of jobs, Breaking a job into Elements, Numbers of Observations, Performance Rating, Rating Procedure Allowances, Calculation of Standard Time, Predetermined motion time system (PMTS), Method time measurement (MTM).

MODULE IV

Job Evaluation and Merit Rating: Concept and objectives of Job Evaluation and Merit Rating, Job Evaluation Methods, Different Methods of Merit Rating.

Wage Incentive Plans: Requirement, Objectives of Wage Incentive Plans, Types of Wage Incentive Plans.

Work Sampling: Basic procedure, determining time standards by Work Sampling, Procedure for selecting random observations, Work Sampling errors.

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MODULE V

Display Systems and Controls: Display- Types of display, Visual display, Quantitative display, Qualitative display, Representational display, Alphanumeric display, Types of controls, Selection of control, Control resistance, Relationship between controls and displays, Use of anthropometric data.

Reference:

1. ILO; work-study; International Labor Organization
2. Barrnes RM; Motion and Time Study, Wiley pub
3. Currie RM; Work study; BIM publications
4. Megaw ED; Contemporary ergonomics; Taylor & Fracis
5. Mynard; Hand book of Industrial Engineering.

WORK STUDY & ERGONOMICS LAB

List Of Experiments (Expendable):

1. Preparation of two-handed process chart.
2. Preparation of Multiple Activity chart.
3. Preparation of flow process charts on activities in Workshop/ Laboratory/Office.
4. To conduct time study of the bulb holder assembly operation for the existing method.
5. Determination of time standard for a given job using stopwatch time-study.
6. Preparation of man-machine charts for an existing setup and development of an improved process.
7. Determination of time by MTM.

Course Outcomes:

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

CO1	Understand work study procedure application and its objective.
CO2	Able to prepare flow process chart, Man Machine Charts, Two handed Process Charts, String diagram, Flow diagram
CO3	Understand Job Evaluation and Wage Plans & Industrial Legislation.
CO4	Use Applications of work Measurement and work sampling.
CO5	To carry out micro motion and memo motion analysis.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	2	1	0	0	1	0	1	0
CO2	1	3	2	1	2	3	0	1	0	1	0	0
CO3	1	2	1	1	2	1	1	0	0	0	0	1
CO4	1	2	2	1	2	2	0	0	0	0	0	0
CO5	1	1	1	1	2	3	0	0	0	0	0	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						
IP61A	Operations 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 be familiar with Scope and Significance of Operations Management.
- To provide the knowledge to select plant location and Design of various plant layout.
- To provide the knowledge about product design and development
- To be familiar with methods of forecasting.
- To explain production planning and economic analysis.

Course content:

OPERATIONS MANAGEMENT
(IP61A)

Module 1.

Operations Management: Overview, Definition, Scope and Significance, Systems View of Operations Management, Factors of Production, Resource productivity, Productivity.

Plant Location: Issues in plant location, Plant Location Methods, Factor – Rating Systems, Transportation method, Centroid Method, Break Even Analysis, Plant Layout objectives, Types of layouts: Process layout, Systematic Layout Planning, Computerized Layout Techniques, Product Layout: Assembly line balancing, Cellular Layout, Fixed Position Layout.

Module 2

Product Design and Development: Stages in Product development, Product life cycle, Product Development Process: Generic process and its Variants, Designing for the Customer: Quality Function Deployment, House of Quality, Product analysis, Standardization, Simplification, diversification and Modular design, Measurement of Product Development Performance, Concurrent Engineering.

Module 3

Forecasting: Need of forecasting, Costs of Forecasting, Methods of Forecasting, Delphi technique, Nominal Group Technique, Simple moving average, weighted moving average, Exponential Smoothing, Linear Regression method, Forecasting error its sources and measurement.

Operation Scheduling and Control: Functions of Scheduling and Control, Production Scheduling, Machine Loading, Sequencing, Dispatching, Expediting.

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Module 4

Production Planning: Introduction to Aggregate Production Planning and Master Scheduling, Materials Requirement Planning (MRP), MRP Structure and Output, Applications. Manufacturing Resource Planning (MRP II), Just-In-Time production System, Waste and waste elimination, Kanban System and Conwip shop floor control, Kaizan.

Module 5

Economic Analysis: Capital budgeting, meaning and significance, types of capital expenditure, analysis, interest and present value concept, depreciation, Capital investment evaluation techniques - pay back period, Rate of return on investment, Net Present value method, Internal rate of return method.

Reference Books:

1. Elements of Production Planning & Control by Eilon McMillan
2. Production and Operations Management by R.Mayer, McGraw Hill
3. Production and Operations Management by Buffa, McGraw Hill]
4. Product Design and Process Engineering by Niebel and Draper, McGraw Hill
5. Operations Management, Schaum's Outlines, TMH
6. Operations Management by Richard B. Chase, McGraw Hill
7. Production and Operations Management by Adam & Ebert, PHI.

Course Outcomes:

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

CO1	Understand Significance of Operations Management.
CO2	Optimize Plant Layout and factors affecting it
CO3	Analyze Stages in Product development and Product life cycle
CO4	To apply methods of forecasting such as Delphi technique, Nominal Group Technique,
CO5	To do production planning and economic analysis.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	1	0	0	1	0	1	0
CO2	0	2	1	0	1	1	0	1	0	1	0	0
CO3	0	1	1	1	2	0	1	0	0	0	0	1
CO4	0	1	0	0	1	0	0	0	0	0	0	0
CO5	0	0	1	1	0	0	0	0	0	0	0	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						
IP62A	Applied Thermodynamics	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work	100	L	T	P	4
		70	20	10	-	-		3	1	-	

Course Objective:

- To understand the fundamentals of heat transfer mechanisms in fluids and solids and their applications in various heat transfer equipment.
- To understand the principles of refrigeration and air conditioning.
- To calculate the cooling load for different applications.
- To design and implement refrigeration and air conditioning systems using standards

Course content:

APPLIED THERMODYNAMICS
(IP62A)

MODULE I: Conduction: Basic concepts, Conduction, Convection and Radiation, Electrical Analogy, Fourier's law of conduction, Conduction of heat transfer through slabs, hollow cylinder, Sphere, Composite systems, Critical radius of insulation for Pipes/cables.
Convection: Natural & forced convection. Simple problems on correlations based on horizontal Pipe and Plate.

MODULE II: Heat exchangers: Logarithmic Mean Temperature difference for Parallel and Counter flow Heat **Exchanger**. LMTD correction factor & Fouling factor, Effectiveness of Heat Exchanger. Simple problems based on LMTD method.

MODULE III: Radiation: Basic introduction to radiation heat transfer. Black body laws, Emissivity, solid angle, Intensity of Radiation, Shape factor, Heat transfer by radiation for simple configurations.
Refrigeration: Methods of refrigeration, Module of refrigeration and COP, Carnot refrigeration cycle, Air refrigeration cycle, Bell Coleman air refrigeration cycle, Introduction to air craft refrigeration system. Simple and Boot strap air craft refrigeration system, Simple problems on air refrigeration cycle.

MODULE IV: Refrigerants: Classification, Nomenclature, Desirable properties of Refrigerants, Comparative study of Refrigerant, Leak detection, Future Refrigerants.
Simple vapour compression refrigeration cycle: P-H, T-S and H-S diagrams for vapour compression refrigeration system, Analysis of simple saturated cycle, Effect of Condenser and Evaporator pressure, Sub-cooling and Super heating. Simple problems.

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MODULE V: Air Conditioning: Psychometric properties & relations. Psychometric chart, Psychometric processes, Sensible heat factor, Bypass factor, Infiltrated air, and Ventilation. Requirement of comfort air conditioning, Simple problems based on Psychrometry, Psychrometric processes and cooling load calculations.

References:

1. Heat transfer - J.P. Holmon
2. Engineering Heat transfer - Gupta & Prakash
3. Fundamental of Engineering Heat and Mass transfer- P.K.Nag
4. Refrigeration & air conditioning - Stoecker & Jones
5. Refrigeration & air conditioning - C.P. Arora

Course Outcomes:

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

CO1	Ability to understand and solve conduction convection and radiation problems.
CO2	Ability to analyze the performance of heat exchangers.
CO3	Illustrate the basic concepts of refrigeration system.
CO4	Analyze the vapour compression cycle and interpret the usage of refrigerants.
CO5	Explain the components of vapour compression system.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	2	1	2	0	1	0	1	0
CO2	2	2	1	2	2	1	1	1	0	1	0	0
CO3	3	1	1	1	2	0	1	0	0	0	0	1
CO4	2	1	1	2	2	0	2	0	0	0	0	0
CO5	3	0	1	1	2	0	0	0	0	0	0	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	
IP63	Operations Research	70	20	10	30	20	150	3	-	2	4

Course Objective:

- Identification and developing operational research models from the verbal description of the real system.
- Explain the mathematical tools that are needed to solve optimization problems.
- Provide knowledge of mathematical software to solve the proposed models.
- Analyze the results to learn about Linear Programming.
- Explain network analysis, Game theory

Course content:

OPERATIONS RESEARCH
(IP63)

MODULE 1: Linear Programming: Introduction, History and development of Operations Research, Model building, Linear programming-formulation, Graphical method, Conical and standard forms of linear programming problems, Theory of simplex method, Big-M method, Two-phase method, Degeneracy in linear programming problems, Revised simplex, Sensitivity analysis.

MODULE II: Allocations in Linear Programming Problem: Assignment model-Hungarian method, Travelling salesman and miscellaneous problem, Assumptions in Transportation model, Optimality test, Degeneracy in Transportation Problem, Unbalanced Transportation Problem and Transshipment Problem.

MODULE III: Decision and Game theory: Decision tree, Decision making models under certainty, Risk and uncertainty, Hurwicz criteria, Game theory, two persons zero sum games, maximin and minimax principles, Saddle point, Dominance rule, Graphical and algebraic methods of solution.

MODULE IV: Dynamic Programming: Characteristics of dynamic Programming, Bellman principal, Typical problems, Salesmen problem, Forward and backward recursion, Use of software to solve linear programming and Dynamic programming.

MODULE V: Queuing Theory Network Analysis: Characteristics of queuing system, Poisson formula, birth-death system, equilibrium of queuing system, Analysis of M/M/1 queues, Project Planning, Project scheduling, Project controlling, Basic tools and technique of project management, AOA and AON diagrams, Critical path method, Program evaluation and review technique.

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References:

1. Taha. H.A. Operations Research, PHI, Publications.
2. Hiller and Liberman Introduction to Operations Research, TMH Publications.
3. Sharma. J.K. Operations Research Theory and Applications, Macmillan Publications.
4. Ramamurthy. P. Operations Research, New Age Publications.
5. Banerjee. B. Operations Research, Business Publicity, Bombay.
6. Hira and Gupta. Operations Research, S. Chand Publication.

OPERATIONS RESEARCH LAB

List Of Experiments (Expendable):

1. To Solve L.P.P. (Maximization Problem) by graphical method Using Operations Research software.
2. To Solve L.P.P. (Minimization Problem) by graphical method Using Operations Research software.
3. To Solve L.P.P. (Maximization Problem) by simplex method Using Operations Research software.
4. To Solve L.P.P. (Minimization Problem) by simplex method Using Operations Research software.
5. To find Initial basic feasible Solution of the given Transportation Problem.
6. To find Initial Optimal Solution of the given Transportation Problem.
7. To find optimal Solution of the given Assignment Problem.
8. To find optimal solution of two-person zero sum game.

Course Outcomes:

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

CO1	Understand methodology of Operations Research.
CO2	Analyze the results to learn about Linear Programming.
CO3	Solve optimization problems
CO4	Develop a report that describes the model and the solving technique.
CO5	To carry out network analysis.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	1	1	0	0	1	1	1	1
CO2	1	3	1	0	3	1	0	1	0	1	1	0
CO3	1	3	3	1	3	0	1	0	0	1	1	1
CO4	1	1	1	0	1	0	0	0	0	1	1	1
CO5	1	2	1	1	2	0	0	0	0	1	1	1

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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
IP64	Manufacturing Technology	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 learn about working procedure of arc welding, gas welding, special welding process, soldering, brazing, surface finishing process, press working, their process parameters and working principle.

Course content:

MANUFACTURING TECHNOLOGY
(IP64)

MODULE I: Arc welding: Arcing phenomenon, Metal transfer in arc welding, Arc blow, Types of electrodes, Carbon Arc Welding, Flux Shielded Metal Arc Welding, Submerged Arc Welding, TIG Welding, MIG Welding, Plasma Arc Welding, Arc Welding equipments.
Gas welding: Oxy Acetylene Welding, Welding flames, Leftward and Rightward welding, filler metals and rods, Gas Welding equipments, Oxy Hydrogen and other Fuel gas welding, Air acetylene welding. Pressure welding; Spot, Seam and Butt welding, Thermo Chemical welding.

MODULE II: Resistance welding: Electric resistance welding, Variables in resistance welding, Spot welding: procedure, spot welding methods, Heat balance in spot-welding, Spot-welding equipment, Seam welding: Seam welding equipments, Principle of operation, Applications, Projection welding, Resistance butt welding, Flash butt welding, Percussion welding.
Special welding process: Cold pressure welding; Diffusion welding, ultra sonic welding, Explosive welding, Friction welding and Inertia welding, Forge welding, Electron beam welding, laser beam welding, atomic hydrogen welding, Thermit welding, Under water welding process, Thermal spraying & Metal-addition.

MODULE III: Soldering & Brazing: Soldering: Definition. Principles of soldering process, Soldering alloys, Soldering fluxes, Soldering methods.
Brazing: Principle of operation, Brazing procedure, Brazing fluxes, Constituents of fluxes, Brazing processes, limitations in brazing.
Surface finishing process: Super finishing, Lapping, Honing, Tumbling, Electroplating, Metal spraying.

MODULE IV: Press working: Press operations, Classification of Presses, Press working terminology, Types of dies, drawing dies, bending dies, Punch design, Pilots, Types of pilots, shearing operations: Piercing, Blanking, Notching, Drawing, Spinning, Bending, Stretch Forming, Embossing and Coining.
Powder Metallurgy: Process, Method of production of powder, Metal powder characteristics, Application of powder metallurgy.

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MODULE V: Distortion & discontinuities in weld-jobs: Weld-jobs distortion and its control, various discontinuities in welds, Residual stresses in weld-jobs residual stresses-distortion-relieving of stresses. **Automation in welding**: Structure analysis; Basic operations, Robotic welding, Types of welding robots.

Non-Destructive Testing and inspection of weld-jobs: Non destructive methods of testing weld-jobs; stages of weld inspection and testing, visual inspection, leak test; stethoscopes test; X-ray and γ-ray radiography, magnetic particle inspection; liquid(dye) penetrate test; fluorescent penetrate inspection; ultrasonic inspection and Eddy current testing.

References

1. Malhotra; Handbook on Non-destructive Testing of Concrete; CRC Press,
2. Henrique L M; Non-Destructive Testing and Evaluation for Mfg, Hemisphere Pub NY,
3. Rao PN; Manufacturing Technology Vol 1; TMH
4. Groover MP; Fundamentals of Modern mfg; Wiley India
5. Kaushish JP; Manufacturing Processes; PHI Learning
6. Oswald PF; Mfg Processes and Systems; Wiley India
7. Parmar, R.S; Welding Processes and Technology
8. Srinivasan. N.K.; Welding Technology; Khanna Pub.

Manufacturing technology Lab

List of experiments (Expendable):

1. Study of tools used for various manufacturing process (it includes application, use and live demonstration.
2. Perform on welding of simple workpiece (arc or resistance welding)
3. Demonstration of process like shearing, punching, piercing, blanking, trimming, drawing.
4. Study of soldering and brazing operations.
5. To perform metal arc welding and prepare lap and butt joint.
6. To study powder metallurgy.

Course Outcomes:

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

CO1	Understand Principles and working procedure of arc welding and gas welding.
CO2	Understand soldering, brazing, surface finishing process.
CO3	Find out Distortion & discontinuities in weld-jobs.
CO4	Perform non destructive testing and inspection of weld jobs.
CO5	Understand Application of powder metallurgy.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	0	1	1	0	0	1	0	1	0
CO2	2	2	1	0	2	1	0	1	0	1	0	0
CO3	1	3	1	2	2	0	1	0	0	0	0	1
CO4	1	2	1	1	2	0	0	0	0	0	0	0
CO5	1	0	1	0	1	0	0	0	0	0	0	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						
IP65	Turbo 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:
The course aims at giving an overview of different types of turbo machinery used for energy transformation, such as pumps, compressors, as well as hydraulic, steam and gas-turbines.

Course content:

TURBO MACHINES
(IP65)

Module 1: Basics of turbo machines, Principles of impulse and reaction machines. **Steam turbines:** Impulse staging, Velocity and Pressure Compounding, Utilization factor, Analysis for optimum U.F Curtis stage, and Rateau stage, includes qualitative analysis, Effect of Blade and Nozzle losses on Vane Efficiency, Stage efficiency, Analysis for Optimum Efficiency, Mass Flow and Blade Height.

Module 2: Reactions staging: Parson's stages, Degree of reaction, Nozzle Efficiency, Velocity Coefficient, Stage Efficiency, carry over efficiency, Vane Efficiency, Conditions for Optimum Efficiency, Speed Ratio, Axial thrust, Reheat Factor in Turbines, Governing and Performance Characteristics of Steam Turbines.

Module 3: Water turbines: Classification, Pelton, Francis and Kaplan turbines, Vector diagrams and Work-done, Draft tubes, Governing of Water Turbines.
Centrifugal Pumps: Classification, Advantage over Reciprocating Type, Definition of Mano-metric head, Gross head, Static head, Vector diagram and work done.

Module 4 Rotary Compressors: **(a) Centrifugal Compressors** – Vector diagrams, Work done, Temp. and Pressure ratio, Slip factor, Work input factor, Pressure Coefficient, Dimensions of Inlet eye, Impeller and Diffuser.
(b) Axial flow Compressors- Vector Diagrams, Work done factor, Temperature Dimensional Analysis, Characteristics, Surging, Polytrophic and Isentropic Efficiencies.

Module 5: Gas Turbines: Introduction, Classification, Application. Gas turbine & its components. Closed and open cycle Gas turbines, Optimum Pressure ratio for maximum specific & thermal efficiency in actual Gas Turbine Cycle. Effect of operating variables on thermal efficiency.

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References:

1. Venkanna B. K.; Turbomachinery; PHI
2. Hill G Philip and Peterson RC; Mechanics and thermodynamics of propulsion; Pearson.
3. Kadambi V Manohar Prasad; An introduction to EC Vol. III-Turbo machinery; New age Delhi
4. Ganeshan V; Gas Turbines; TMH
5. Yahya SM; Turbines, Compressors and Fans; TMH
6. Shepherd DG; Principles of Turbo machinery; McMillan
7. Bansal R. K; Fluid Mechanics & Fluid Machines; Laxmi Pub
8. Sarvanmulto HIH, Rogers GFC &; Cohen Henry Gas Turbine Theory; Pearson

TURBO MACHINE LAB

List of Experiments (Expandable)

1. To study various parameters of steam turbine.
2. To study various Performance parameters of Pelton wheel.
3. To study various Performance parameters of Francis Turbines.
4. To study various Performance parameters of Kaplan turbines.
5. To study various Performance parameters of Centrifugal Pumps.
6. To study various Performance parameters of Rotary Compressors.
7. To study various Performance parameters of Gas Turbines.

Course Outcomes:

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

CO1	Explain the working principles of turbo machines and apply it to various types of machines.
CO2	Explain the working principle of various types of hydro turbines and know their application
CO3	Explain the working and governing of gas turbines.
CO4	Recognize and discuss todays and tomorrow's use of turbo machines for enabling a sustainable society.
CO5	Explain the working principles of Centrifugal compressors, Axial flow compressors

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	1	0	0	1	0	1	0
CO2	1	2	1	0	1	1	0	1	0	1	0	0
CO3	1	1	1	1	2	0	1	0	0	0	0	1
CO4	1	1	0	0	1	0	0	0	0	0	0	0
CO5	1	0	1	1	0	0	0	0	0	0	0	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	
IP73	Industrial Robotics & Mechatronics	70	20	10	30	20	150	3	-	2	4

Course Objective:

- To be familiar with Automation and Robotics.
- To provide the knowledge of Structure of Robotic System, Robot Sensors and Vision, Robot Programming, and mechatronics basics.

INDUSTRIAL ROBOTICS AND MECHATRONICS
(IP73)

MODULE I: **Introduction to Robotics:** Introduction, Definition, Automation and Robotics, Need and importance, basic concepts, Anatomy of Robots, Structure and classification of Robots, Robot configurations, Comparative advantages of different configurations, Resolution, Accuracy, Repeatability.

MODULE II: **Structure of Robotic System:** Robot links, Joints in Robots, Robot Specification, Performance Parameters, Robot Drive Systems, Hydraulic Actuators, Pneumatic Actuators, Electric Drives, Steeper Motors, Comparison of Characteristics of robot Drive Systems, Wrist and Motions, Designs of Gripper Fingers, Gripper Mechanisms, Force Analysis of Gripper Mechanism, Selection Consideration of Gripper.

MODULE III: **Robot Sensors and Vision:** Introduction, Classification of Sensors and their functions, Touch Sensors, Binary Sensors, Analog Sensors, Tactile Sensors, Desirable Features for Sensors and Transducers, Proximity Sensors, Range Sensors, Force and Torque Sensors, Robot Vision, Block Diagram of Vision System, Constructional Features of Vidicon Camera, Analog to Digital Conversion, Image Storage, Image Processing and Analysis, Feature Extraction, Object Recognition.

MODULE IV: **Robot Programming:** Introduction, Lead through Programming, Manual, walk through, off line Programming Concepts, Requirement of Good Programming Language, VAL Commands with description, Definition and Statements of AL AND AML, Programming Languages features and applications, Program for Pick and Place Activity.

MODULE V: **Mechatronics:** Transducers, Applications and Selection, Application of Proximity Switch, Application of Photoelectric Sensor, Sensor Array, Wrist Sensors, Compliance Sensing, Range Sensing, Guidelines for Selection, Active and Passive Sensors, Basic Requirements of a Sensor/Transducer.

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Text Books

1. Groover M.P. Weiss M. Industrial Robotics, Tata McGraw Hill Publication.
2. Groover M.P. Cam and Automation, PHI Learning Publishing Ltd.
3. Ganesh S. Hegde. A Text Book on Industrial Robotics. Laxmi Publication.

References

1. Ghosal Ashitava Robotics Fundamental Concepts and Analysis, Oxford Publication.
2. Shimon K. Handbook of Industrial Robots, John Willey& Sons.
3. Fu, Gonzalez, Lee, Robots Control, Sensing, Tata McGraw Hill Publication

List Of Experiments (Expendable):

1. To Study Robot Anatomy.
2. To study Robot joints.
3. to study various types of Robots classified on degree of freedom.
4. To study gripper mechanism.
5. To study various types of sensors used in Robot arm

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
CO5	Understand Application of Proximity Switch, Photoelectric Sensor, Sensor Array, Wrist Sensors

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	2	1	0	0	1	0	1	0
CO2	1	2	1	0	2	1	0	1	0	1	0	0
CO3	1	1	1	1	2	0	1	0	0	0	0	1
CO4	1	1	1	0	2	0	0	0	0	0	0	0
CO5	1	0	1	1	2	0	0	0	0	0	0	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	
IP75	Industrial Engineering	70	20	10	30	20	150	3	-	2	4

Course Objective:

- To acknowledge industrial engineering with the aspect of Reliability Engineering.
- To provide the knowledge of Industrial Engineering and domain knowledge.
- Evaluate the sequencing model study with industrial engineering.
- Learn Human Recourse Management & marketing fundamentals and capacity calculations for industrial engineering.

Course Content:

INDUSTRIAL ENGINEERING
(IP-75)

MODULE – I: Reliability Engineering: Introduction and objectives of Reliability Engineering, System Reliability, Achieving Reliability, Failure Rate, Hazard Rate, Failure Modes and the 'Bath-tub' curve, Series Structure, Parallel Structure, Combination Structure, Design, Important Aspect of Reliability, Maintainability, Availability, Improving Reliability.

MODULE - II: Capacity Planning: Measurement of Capacity, Estimating Future capacity, Factors influencing effective capacity, Factors Favoring over capacity and under capacity, Business Process Reengineering, Definition, Characteristics of BPR, Need for Re-engineering, Steps in Re-engineering, Process of Re-engineering, Industrial Engineering and Re-engineering, Success factors in reengineering, Advantages of Re-engineering.

MODULE - III: Sequencing Models: Introduction, Assumptions, Gantt chart for Solving Sequencing Problems, Processing n jobs through 2 machines, Johnsons Algorithm, Loading, Sequencing and Scheduling, Visual load Profile, Priority Sequencing, Assignment Problems, Principles of scheduling, Inputs to scheduling, Scheduling strategies, Forward scheduling and backward scheduling, Finite Loading, Critical ratio loading, Index method.

MODULE – IV: Marketing Management: Marketing Function, Marketing Management Process and Marketing Planning, Market Research, Consumer Behavior, Product Life Cycle, Product, Product Lines and Brands, Physical Distribution Channels, Sales Promotion & advertising programs.

MODULE – V: Human Resource Management: Definition, Objective of Human Resource Management, Characteristics, Functions/Scope, Principles of Human Resource Management, and Manpower Planning –factors Affecting Manpower Planning, Steps in Manpower Planning, recruitment, and Selection procedure of Manpower. Training and Development of Manpower: Need of Training, Benefits of Training, Method of Training Workers, Foreman, or Supervisory Training, Executive/Managers Training and Development, learning curves and classifications.

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Text Books

1. Khanna O. P., "Industrial Engineering and Management", DhanpatRai and sons, 2007.
2. Banga T. R. and Sharma S. C., "Industrial Organization & Engineering economics", 23ed., Khanna Publishers, 2001, ISBN 81-7409-078-9.
3. Mahajan M., "Industrial Engineering and Production Management" Dhanpatrai and Sons Publishers, 2005, ISBN-81-7700-047-0
4. Chabra T. N., "Principles & Practices of Management", Dhanpatlal & company.
5. Srinath N., "Reliability Engineering", East West Publication Ltd.

Reference Books

1. Koontz Harold and Weinrich Heinz, "Essentials of management", 7ed, Tata McGraw - Hill publishing, 2008, ISBN 0-07-0623030-x.
2. Luthans f., "Organizational Behavior", McGraw-Hill Company, 2008, ISBN 81-317- 05021.
3. Kotler Philip & Keller K.L., "Marketing Management. Dorling Kindersley pvt.Ltd.,2008, ISBN-978-81-317-1683-0
4. Cynthia L.Greene , "Entrepreneurship: Ideas In Action", Thomson, ISBN-981-243-257-1.
5. Mamoria C.B. and Gankar S.V., "Personnel Management", Himalaya Publishing House, 20

INDUSTRIAL ENGINEERING LAB

List Of Experiments (Expandable):

1. To Study Failure rate and Hazard rate of Component (Industry supported case study).
2. To Construct Gantt Chart for the given Scheduling Problems.
3. Estimate Future capacity of the given plant (Industry supported case study).
4. To find the Training needs of the given plant (Industry supported case study).
5. To study Physical Distribution Channels, Sales Promotion & advertising programs of the given product (Industry supported case study

Course Outcomes:

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

CO1	Illustrate the concept of reliability engineering.
CO2	To gain the knowledge of capacity planning.
CO3	Acquire the knowledge of sequencing models.
CO4	Learn capacity building of fundamentals of industrial marketing.
CO5	Create the learning aspects of human resource management & key functions of training modules.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	2	1	0	0	1	0	1	0
CO2	1	2	1	0	2	1	0	1	0	1	0	0
CO3	1	1	1	1	2	0	1	0	0	0	0	1
CO4	1	1	1	0	2	0	0	0	0	0	0	0
CO5	1	0	1	1	2	0	0	0	0	0	0	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						
IP71A	Vibration & Maintenance Engineering	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 the concept of vibration analysis.
- . Acquire the knowledge of maintenance management.
- To learn the concept of whirling motion & critical speed.
- To gain fundamental of condition-based maintenance

VIBRATIONS AND MAINTENANCE ENGINEERING
(IP-71A)

MODULE – I: Fundamental Aspects of Vibrations : Vibration, main causes, advantages and disadvantages; engineering applications of vibration; vector method of representing harmonic motion; characteristics of vibration, harmonic analysis and beats phenomenon, work done by harmonic forces on harmonic motion;; elements of vibratory system; lumped and distributed parameter systems, degreed of freedom.

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. Equivalent spring stiffness, Systems involving angular oscillations: the compound pendulum.

MODULE -II: Damped Free Vibrations: Viscous damping: coefficient of damping; damping ratio; under damped, overdamped and critically damped systems; logarithmic decrement; frequency of damped free vibration; frequency, decay rate, systems with two degrees of freedom.

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, Free Transverse Vibration due to a Point Load on a Simply Supported Shaft, Free Torsional Vibration of a Single Rotor System

MODULE – III: Maintenance Concepts and Strategies: Introduction, maintenance functions and objectives, maintenance planning and scheduling, maintenance organization.

General Introduction to Maintenance Types: Breakdown, emergency, corrective, predictive, and preventive; maintenance prevention; design-out maintenance, productive maintenance, shutdown maintenance and scheduled maintenance.

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MODULE - IV: Condition Based Maintenance: Principles of CBM, pillars of condition monitoring, CBM implementation and benefits; condition monitoring techniques- visual monitoring, vibration monitoring, wear debris monitoring, corrosion monitoring, performance monitoring

MODULE - V: Reliability Centered Maintenance (RCM): –Concept, methodology, benefits;
Total Productive Maintenance: Evolution of TPM, TPM objectives, concept, pillars of TPM.
Failure Modes and Effects Analysis **(FMEA)/ Failure Modes, Effects and Criticality Analysis, (FMECA)**: Overview, elements of FMECA, applications and benefits, risk evaluation, risk priority numbers, criticality analysis, process FMEA, qualitative and quantitative approach to FMECA; design FMEA and steps for carrying out design FMEA

References:

1- Ambekar A.G., Mechanical Vibrations and Noise Engineering; PHI
2- Meirovitch Leonard; Element of Vibration Analysis; TMH
3- Dukikipati RV 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
8- V. P. Singh, Mechanical vibrations, Dhanpat rai and Co.
9- Sadhu Singh, Mechanical Vibrations, Khanna Publishers.
10- Ebeling CE; An Introduction to Reliability & Maintainability Engg; John Wiley and Sons
11- Mishra R.C; Reliability and Maintenance Engineering; New age international publisher.
12- Kelly Anthony; Maintenance Planning and Control
13- R.C. Mishra and Pathak; Maintenance Engineering and Management; PHI

Course Outcomes:

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

CO1	Analyze Undammed free vibration systems.
CO2	Analyze Damped free vibration systems.
CO3	Whirling motion and critical speed in Harmonically excited Vibration.
CO4	Analyze condition-based maintenance.
CO5	Analyze Reliability Centered Maintenance

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	1	1	0	0	1	1	1	1
CO2	1	3	1	0	3	1	0	1	0	1	1	0
CO3	1	3	3	1	3	0	1	0	0	1	1	1
CO4	1	1	1	0	1	0	0	0	0	1	1	1
CO5	1	2	1	1	2	0	0	0	0	1	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						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work		L	T	P	
IP705 MA	Material Management & Product Design	70	20	10	-	-	100	3	1	-	4

Course Objective:

- To acquaint students with the basic concepts of Reliability engineering
- To impart a fundamental knowledge of capacity planning and Re-engineering
- Selection and application of different Sequencing Models.
- To Know Fundamentals of Marketing Management
- To impart a fundamental knowledge of Human resource management.

Course Content:

MATERIAL MANAGEMENT & PRODUCT DESIGN
(IP705 MA)

Module-I: Material Management: Introduction to Material Management Functions, objectives, Integration concept Material classification and coding system importance of writing specifications and variety reduction techniques, Material Planning-importance & techniques, Master & material budget, Quality control in material management, Theory of sampling inspection.

Module-Il: Purchasing: Make or buy decision, Factors, purchasing objectives, organization of purchase department, responsibilities, Principles of purchasing, purchasing process, Tender system, Negotiation, Vendor rating, Legal aspects of purchasing, international purchasing.

Module-III: Stores management & Material Handling: introduction, objective of store keeping, stores functions, stores organization, stores systems and procedures, stores accounting and verification systems, store's location and layout, factor affecting location, centralized and decentralized storing, automated/retrieval storage. Planning and operating principles material handling equipment's and classification; belt conveyer, chain conveyers, fork lifts, overhead cranes, automated material handling in modern industries.

Module-IV: Product Design: Design by evolution & innovation, factors of product design, morphology of design, Primary design phases & flow charting, design for safety and reliability, value engineering, role of computer in design process.

Module-V: Product design Practice: Product considerations, procedure adopted by industrial practice, creativity- process, techniques, group engineering. strategies, analysis of the product, basic design designers, role of aesthetics, functional design technology, concurrent engineering & reverse engineering.

References:

1. Product design & Manufacturing-A.K. Chitale, R. C. Gupta-third edition
2. Purchasing and materials management-Gopalkrishnan P, TMH
3. Materials Management-Chitale AK and Gupta RC, PHI

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Course Outcomes:

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

C01	understand objectives and integration concept of material management
C02	Understand purchasing process, purchasing objectives, and purchasing p1tlgtp&s
C03	Understand store management, store function, store organization, store system and Procedure.
C04	Understand product design and morphology of design.
C05	Understand the creativity and strategies & reverse engineering.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	2	1	0	0	1	0	1	0
CO2	1	2	1	0	2	1	0	1	0	1	0	0
CO3	1	1	1	1	2	0	1	0	0	0	0	1
CO4	1	1	1	0	2	0	0	0	0	0	0	0
CO5	1	0	1	1	2	0	0	0	0	0	0	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	
IP72 D	Manufacturing System Design	70	20	10	-	-	100	3	1	-	4

Course Objective:

- To acquire the basic knowledge Manufacturing System.
- To establish knowledge regarding production, planning, design, cost optimization, computer simulation & modern approaches in manufacturing system.

Course content:

Manufacturing Systems Design
(IP72D)

Module I

Fundamentals: System concept, Hierarchical structure, System design, Decision making procedure, System types in manufacturing environments; Manufacturing Systems: Structural aspects, transformational aspects, procedural aspects, integrated manufacturing systems; Modes of Production- Jobbing / Intermittent /Continuous; Mass Production- Economies of Scale, Optimum production scale, Mass .Customization; Multi-Product Small Batch Production- Economies of Scope with Diversification; Logistic Systems- Material flow: conversion / transportation / storage.

Module II

Product / Process Planning and Design: Product Life Cycle, Planning of a new product, Product Design Aspects, Design cost considerations, Concurrent Engineering; Process and Operation Design- Computer Aided Process Planning, Optimum routing analysis using Dynamic Programming.

Module III

Manufacturing Optimization: Criteria for Evaluation, Optimization of single Stage manufacturing- Unit production time and cost; Optimization of multistage manufacturing system- Scope, basic mathematical models; Cost Estimating- Classical metal cutting cost analysis, Industrial cost estimation practices, Estimating material, setup and cycle times.

Module IV

Computer Simulation in Manufacturing System Analysis: Characteristics, Simulation Models, applications of probability and statistics; Design and evaluation methodology of manufacturing systems, General design framework, Analysis of situation, Setting objectives, Conceptual modeling, Detailed design, Evaluation and Decision.

Module V

Modern approaches in Manufacturing: Cellular Manufacturing- Group Technology, Composite part, Rank Order Clustering Technique, Hollier method for GT cell layouts; Flexible Manufacturing- Concept, components, architecture; Lean Production- concept, principles, Agile Manufacturing- concept, principles and considerations for achieving agility.

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Reference Books:

1. Katsudo Hitomi, (1998), "Manufacturing Systems Engineering", Viva Low Priced Student Edition, ISBN 81-85617-88-0
2. B. Wu, "Manufacturing Systems Design & Analysis: Context and Techniques" (2/e), Chapman & Hall, UK, ISBN 041258140X
3. Mikell P. Groover, (2002), "Automation, Production Systems and Computer Integrated Manufacturing", (2/e), Pearson Education, ISBN 81-7808-511-9
4. Radhakrishan P., Subramaniyan S. and Raju V., "CAD / CAM / CIM", (3/E), New Age International Publication
5. Luca G. Sartori, (1998), "Manufacturing Information Systems", Addison Wesley Publishing Co.
6. N. Viswanadhan& Y, Narhari, (1998), "Performance Modeling of Automated Manufacturing Systems", Prentice Hall of India
7. Phillip F. Ostwald, JairoMunez, (2002), "Manufacturing Processes and Systems", John Wiley & Sons (Students' Edition), ISBN 9971-512-34-

Course Outcomes:

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

CO1	To acquire the basic knowledge manufacturing system.
CO2	To establish knowledge regarding product/process planning & design.
CO3	To build-up knowledge of manufacturing optimization.
CO4	To know about computer simulation in manufacturing system.
CO5	To know about modern approaches in manufacturing system.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	1	0	0	1	0	1	0
CO2	0	2	1	0	1	1	0	1	0	1	0	0
CO3	0	1	1	1	2	0	1	0	0	0	0	1
CO4	0	1	0	0	1	0	0	0	0	0	0	0
CO5	0	0	1	1	0	0	0	0	0	0	0	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	
IP72A	Advance Manufacturing Process	70	20	10	-	-	100	3	1	-	4

Course Objective:
To learn about advance manufacturing processes their process parameters and working principle.

Course content:

ADVANCED MANUFACTURING PROCESSES
(IP72A)

MODULE I

Abrasive Jet Machining (AJM): Principles of Abrasive jet machining, Process parameters, Metal removal rate, Effect of parameters on Abrasive jet machining, Application & limitation.
Water Met Machining: Procedure of Water jet machining, Jet cutting equipments, process detail, Practical applications.

MODULE II

Ultrasonic Machining: Principle, Process parameters, Cutting tool design, tool feed mechanism, transducer, design of velocity transformers, Mechanics of cutting , Effect of parameters, Economic consideration, Applications & limitations.
Plasma Arc Machining: Non-thermal generation of plasma, Mechanics of metal removal, Parameters, Accuracy & surface finish, Applications.

MODULE III

Electrochemical Machining: Principle, Elements of process, Metal removal rate, Electro-chemistry of process, tool design, Applications, choice of electrolyte. Electrochemical grinding, Electrochemical deburring and Electrochemical honing.
Chemical Machining: Elements of process, Applications and advantages.

MODULE IV

Electro Discharge Machining: Process, Mechanism of metal removal, Electrode feed control , Metal removal rate, Machining accuracy, tool material, dielectric fluid, flushing, application & limitation. Wire cut EDM, Electro discharge grinding.

MODULE V

Laser Beam Machining: Features, Metal removal rate, Thermal analysis, Cutting speed and accuracy.
Electron Beam Machining Procedure, Forces in machining, Process capability.
High Energy Rate Forming: High energy rate forming process, High Velocity Forming process, Explosive Forming, Electro Hydraulic Forming. Electromagnetic forming, High-speed forming machines.

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References:

1. Modern Machining Process, P.C. Pandey &H.S. Shan, Tata McGraw hill.
2. New Technology, Dr. Amitabh Bhattacharya, The Institution of Engineers.
3. Unconventional Manufacturing Process, Dr. V.K. Jain, Allied Publishers
4. Principles of Engineering Production, A.S. Lissaman & S.J. Martin
5. Production Engineering, P.C. Sharma, S Chand company Ltd

Course Outcomes:

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

CO1	Understand Principles of Abrasive jet machining.
CO2	Understand non-thermal generation of plasma, Mechanics of metal removal in plasma arc machining.
CO3	Understand Electrochemical deburring and Electrochemical honing.
CO4	Understand Process of electro discharge machining.
CO5	Understand Process of Laser Beam Machining, electron beam machining

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	2	1	0	0	1	0	1	0
CO2	1	2	1	0	2	1	0	1	0	1	0	0
CO3	1	1	1	1	2	0	1	0	0	0	0	1
CO4	1	1	1	0	2	0	0	0	0	0	0	0
CO5	1	0	1	1	2	0	0	0	0	0	0	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	
IP72 B	Rapid Prototyping	70	20	10	-	-	100	3	1	-	4

Course Objective:

- To acquire the basic knowledge of Rapid Prototyping.
- To establish knowledge regarding 3d printers, prototype properties, applications & fundamental processes.

Course content:

Rapid Prototyping
(IP72 B)

Module I
Introduction to RP, Technology Description and Definition to RP, Overview of RP, Benefits and Application. RP Processes: Process overviews, STL file Generation, File Verification and Repair, Build File Creation, Part Construction, Part Cleaning and finishing, Process Strength, and its limitations.

Module II
Classes of RP systems: 3D Printers, Enterprise Prototyping centers, Direct digital tooling, Direct digital manufacturing, system classification, Stereo lithography, SL with photo polymerization, SL with liquid thermal polymerization, Selective Laser Sintering, Fused deposition modeling, Laminated object manufacturing, Laser powder forming.

Module III
Prototype properties: Material properties, color, dimensional accuracy, stability, surface finish, machinability, environmental resistance, operational properties.

Module IV
RP Applications: Design, Concept Models, Form & fit checking, Ergonomic Studies, Functional testing, Requesting Price quotes, CAD data verification, Rapid Tooling, Rapid manufacturing, Science & Medicine, Archeology, Paleontology & forensic Science, miniaturization.

Module V
Fundamental Process: Background, The line spread function of scanned Gaussian Laser Beam. The Parabolic Cylinder, The working curved equation, The curved line width function, Mechanical properties, Bilateral exposure of a Thin Sample, The Photo modulus Model, Experimental Method, Experimental Results.

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REFERENCES

1. T. A. Grimm & Associates, Users Guide to Rapid Prototyping, Society of Manufacturing Engineers (SME) ISBN 0872636976
2. Frank W. Liou, Rapid Prototyping & engineering applications, CRC Press, ISBN 978-0-8493-3409-2
3. Rapid Prototyping theory & practice, Manufacturing System Engineering Series, Ali K. Kamarani, Springer Verlag
4. Rapid Prototyping- case book, J. A. McDonalds, C. J. Ryall, Wiley Eastern
5. Rapid & Virtual Prototyping & applications, C. E. Bocking, AEW Rennie, Wiley Eastern
6. Paul F. Jacobs, Rapid Prototyping and Manufacturing, First Edition Published by Society of Manufacturing Engineers. ISBN: 0-87263-425-6

Course Outcomes:

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

CO1	To acquire the basic knowledge rapid prototyping.
CO2	To establish knowledge regarding classes of rapid prototype system.
CO3	To build-up knowledge of prototype properties.
CO4	To know about rapid prototyping applications.
CO5	To know about fundamental processes of rapid prototyping.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	1	0	0	1	0	1	0
CO2	0	2	1	0	1	1	0	1	0	1	0	0
CO3	0	1	1	1	2	0	1	0	0	0	0	1
CO4	0	1	0	0	1	0	0	0	0	0	0	0
CO5	0	0	1	1	0	0	0	0	0	0	0	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	
IP72 C	Research Methodology & Optimization Techniques	70	20	10	-	-	100	3	1	-	4

Course Objective:

- To acquire the basic knowledge of Research Methodology.
- To establish knowledge regarding Integer linear programming methods, multi-objective optimization methods and Algorithm.

Course content:

RESEARCH METHODOLOGY AND OPTIMIZATION TECHNIQUES
(IP72C)

Module I

Introduction to Research Methodology, Various Types of Techniques, Alternative approaches to the study of the research problem and problem formulation. Formulation of hypotheses, Feasibility, Preparation, and presentation of research proposal.

Introduction to Experimental Design, Taguchi Method, Concept of Orthogonal Array, Primary and Secondary data collection, S/N ratio, Validation, Regression, and correlation analysis. Tests of significance based on normal. t and chi square distributions, Analysis of variance.

Module II

Edition, tabulation & testing of hypotheses, interpolation of results, presentation, styles for figures, tables, text, quoting of reference and bibliography. Use of software for statistical analysis like SPSS, Mini Tab or MAT Lab, Report writing, preparation of thesis, use of software like MS Office. The course will include extensive use of software, reporting writing and seminars in tutorial class.

Module III

Integer linear programming methods and applications, Introduction to integer non-linear Programming, Basics of geometric programming.

Module IV

Multi-objective optimization methods and applications, Formulation of problems – Separable programming and stochastic programming.

Module V

Introduction to Genetic algorithms, neural network-based optimization, and optimization of fuzzy systems, Evolutionary Algorithm and Ant Colony Optimization techniques.

Note: - Some of the algorithm is used to be exercised using MAT LAB

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RECQMMENDED BOOKS:

1. C.R Kothari, Research Methodology, Wishwa Prakashan
2. P.G Tripathi, Research Methodology, Sultan Chand & Sons, N. Delhi
3. Fisher, Design of Experiments, Hafner
4. Sadhu Singh, Research Methodology in Social Sciences, Himalya Publishers
5. Kalyanmoy Deb, Optimization for Engineering design – algorithms and examples. PHI, New Delhi 1995
6. Singiresu S.Rao, "Engineering optimization – Theory and practices", John Wiley and Sons, 1998.
7. Garfinkel, R.S. and Nemhauser, G.L., Integer programming, John Wiley & Sons, 1972.

Course Outcomes:

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

CO1	To acquire the basic knowledge research methodology.
CO2	To establish knowledge regarding edition, tabulation, testing of hypothesis etc.
CO3	To build-up knowledge of Integer linear programming methods.
CO4	To know about multi objective optimization methods.
CO5	To know about Genetic & evolutionary algorithm.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	1	0	0	1	0	1	0
CO2	0	2	1	0	1	1	0	1	0	1	0	0
CO3	0	1	1	1	2	0	1	0	0	0	0	1
CO4	0	1	0	0	1	0	0	0	0	0	0	0
CO5	0	0	1	1	0	0	0	0	0	0	0	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						
IP81 A	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 explain the scope of Computer Integrated Manufacturing Business forecasting and aggregate production plan
- To explain the Computer Aided Process Planning (CAPP)
- To be provide the knowledge about automated material handling, automated storage and Retrieval System.
- To familiar about CAM, Computer Numerical Control, Manual and Computer Aided Part Program.

COMPUTER INTEGRATED MANUFACTURING
(IP81 A)

Module 1 Introduction to CIM: Objectives of CIM, Enterprise wide Integration of CIM Information requirements of manufacturing organizations, Scope of Computer Integrated Manufacturing Business forecasting and aggregate production plan, Production Activity Control (PAC), Manufacturing as a system, Production processes on volume-variety axes, Importance of batch and job shop production, CIM definition and CIM wheel, Evolution and benefits of CIM, Automation, Types of Automation, Advantages of Automation.

Module II Computer Aided Process Planning (CAPP): Introduction to CAPP, Objectives to CAPP, Introduction to Process Planning, Approaches to Process Planning, Manual Experience-based Process Planning, Computer Aided Process Planning, Approaches to Computer Aided Process Planning, Variant Process Planning, Advantages and Disadvantages, Generative Process Planning, Advantages and Disadvantages, Knowledge-based Process Planning, Feature Recognition in Computer Aided Process Planning, Approaches to Part Feature Recognition, Recent Trends in Computer Aided Process Planning.

Module III Computer Aided Manufacturing: Introduction to CAM, Numerical Control system, Suitability of NC technology, Need of NC system, Features and classification of NC system, Computer Numerical Control, Features of CNC , Direct Numerical Control, NC words used in part program, Manual and Computer Aided Part Program, APT Programming.

Module IV Automated Material Handling and Storage: Introduction and Objectives of Automated Material Handling, Principles of Automated Material Handling, Factors considered in selection of automated material handling equipment's, Material handling Equipment, Conveyor systems, Cranes and Hoists, Industrial Trucks, Monorail, Automated Guided Vehicle, Automated storage and Retrieval System.

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Module V Group Technology: Importance of batch and job shop production, Merits of converting zigzag process layout flow to smooth flow in cellular layout, Production flow Analysis and clustering methods, Concept of part families and coding, Optiz, MIClass and Dclass coding, FMS.

Text Books

1. Roa. P.N. CAD/CAM, Tata McGraw Hill Publishing Co.
2. S.Kant Vajpay, Principles of CIM, PHI Publishing Co.
3. Radhakrishan P.CAD/CAM/CIM, New age Publishing Co.

References

1. Zeid A. CAD/CAM, Tata McGraw Hill Publishing Co.
2. Roa. CAD/CAM, Tata McGraw Hill Publishing Co.

Course Outcomes:

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

CO1	Understand the scope of Computer Integrated Manufacturing
CO2	Do Business forecasting and aggregate production plan
CO3	Understand automated material handling, automated storage and Retrival System.
CO4	familiar about CAM, Computer Numerical Control, Manual and Computer Aided Part Program
CO5	To understand group technology.

Mapping of 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	0	0	2	1	1	0	1	1	1
CO2	2	2	1	1	1	0	0	1	0	1	0	1
CO3	2	1	1	1	1	0	0	1	0	1	1	1
CO4	3	3	2	2	2	2	1	0	1	1	1	1
CO5	2	1	2	2	1	2	1	0	1	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						
IP74	Computer Aided Design	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 be familiar with CAD, Automation and CAD, computer software and their application.
- To creating Drawing, Various drawing commands, Editing Drawing.
- To draw Geometric modeling, wire frame model, parametric representation of synthetic curves.
- To perform 2D and 3D geometric transformations.
- To study **methods** to solve engineering problems, Computer Aided Engineering (CAE) and design.

COMPUTER AIDED DESIGN
(IP74)

MODULE- I Fundamental of CAD, Automation and CAD, Product Cycle & CAD, Introduction to computer Hardware, Design of workstation, Graphics terminal. Operator input & output devices, CPU and Secondary storage. Introduction to computer software and their application.

MODULE- II- Computer Aided Drafting - Creating Drawing: Various drawing commands: Line, Pline, Ellipse, Circle, Arc, Hatch, Text, Dimension, Limits, Scale, Grid, Layers, Fill, Snap, Trace, Modules, Ortho. Editing Drawing: c: Move, Erase, Copy, Zoom, Pan, View, Chamfer, Break, Explode, Extend, Trim, Help, Rotate, Mirror etc.
Other Utilities: Block, Array, Save, Quit, Plot Advanced Features of Auto- CAD: UCS, 3D-line, 3D-Objects, DXF & DXB files.

MODULE–III Geometric modeling- introduction, wire frame model, data structures for computer graphics, Review of vector algebra, lines, circle, ellipses, parabolas, hyperbolas, conics, parametric representation of synthetic curves: Hermite cubic splines, Bezier curve, b spline curves, rational curves. Curves: Algebraic and geometric forms, tangents and normal, blending functions

MODULE–IV 2D and 3D geometric transformations, homogenous coordinates, translation, rotation, scaling, reflection, shear, and transformations between coordinate systems, affine transformations.3-D geometric transformations, 3-D viewing operations and graphics projections, visual realism, hidden line removal, shading and color models.

MODULE –V Methods to solve engineering problems- analytical, numerical, experimental, their merits and comparison, discretization into smaller elements and effect of size/ shape on accuracy, importance of meshing, boundary conditions, Computer Aided Engineering (CAE) and design, chain-bumping-stages vs concurrent-collaborative design cycles, computer as enabler for concurrent design and Finite Element Method (FEM), degree of freedom (DOF), mechanical systems with mass, damper and spring, stiffness constant K for tensile, bending and torsion; Practical applications of FEA in new design, optimization/ cost-cutting and failure analysis.

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Reference Books:

1. Inside AutoCAD by Ranker
2. CAD/CAM – principle and application By P N Rao, TMH
3. CAD/CAM – Zeid Ibrahim, TMH
4. Practical Finite Element Analysis by Gokhle Nitin
5. Finite Element Analysis, Theory and programming By Krishnamoorthy, TMH

COMPUTER AIDED DESIGN LAB

List of Experiment (Expandable):

1. Preparation of 2-D drawings using various 2-D commands.
2. Preparation of 3-D drawings for machine components.
3. 3-D modeling - solid, surface, wireframe using standard CAD packages - Assembly of standard parts created using 3-D model.
4. Parametric modeling, creating standard machine parts, connecting rod, flange coupling, bearings
5. Analysis of simple machine parts by meshing into finite elements

Course Outcomes:

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

CO1	Calculate stresses and strain in different members of the materials.
CO2	Draw Shear force and Bending moment diagram for different types of beams with different loadings.
CO3	Find out deflection deformation and stress for different types of beams
CO4	Calculate torsion and stresses of shafts.
CO5	Calculate critical load by apply Euler's theory and Rankine's formula for column and strut.

Mapping of 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	0	0	2	1	1	0	1	1	1
CO2	2	2	1	1	1	0	0	1	0	1	0	1
CO3	2	1	1	1	1	0	0	1	0	1	1	1
CO4	3	3	2	2	2	2	1	0	1	1	1	1
CO5	2	1	2	2	1	2	1	0	1	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						
IP82 A	Entrepreneurship & Management Concept	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work	100	L	T	P	4
		70	20	10	-	-		3	1	-	

Course Objective:

- Explain the meaning of management its characteristics and clarify management as science or profession.
- To be familiar intellectual property system, copyrights, trademark and intellectual property rights.
- To explain the marketing concept and advertising CRM and marketing research.
- To provide the knowledge of entrepreneur, classification, function and sociological and economic theories of entrepreneurship.

MANAGEMENT & ENTREPRENEURSHIP CONCEPTS
(IP82 A)

Module I: Management: Importance, definition and functions; schools of theories, BCG matrix, SWOT analysis, steps in decision making, structured and unstructured decision; dimensions of organizations, departmentalization, spam and line of control, technology and Mintzberg organization typology, line and staff organization, business process reengineering and process of change management, leader & manager, leadership grid, Maslow's need hierarchy and Herzberg two factor theory, team work and stress management, , HR planning placement and training

Module II: 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 societal marketing concepts; four P's, product, price, placement, promotion; consumer, business and industrial market, market targeting, advertising, publicity, CRM and market research.

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

Module IV: Intellectual Property System: Introduction, Definition of Intellectual property, Concept of Intellectual Property, Different Types of IP, Intellectual Property Rights (IPR), Benefits of securing IPRs;, Rationale behind Intellectual Property, Enforcement of IPRs, Patent Law in India, Interpretations and Implementations, Copyrights and related rights, Trademarks, Geographical indications, Industrial designs, Trade secrets and layout of Integrated circuits , Indian Legislations for the protection of various types of Intellectual Properties; TRIPs and various provisions in TRIPs Agreement.

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Module V: Entrepreneurship: Definition and concepts, characteristics, comparison with manager, Becoming an Entrepreneur, Need for Entrepreneurship, Benefits of Self-Employment, who is an entrepreneur? Sensing opportunities- Sources of Idea, Creating Efforts, SWOT Analysis, Entrepreneur and Economy, classification and function of entrepreneurs, sociological and economic theories of entrepreneurship, entrepreneur traits and behavior, roles in economic growth.

References:

1- Daft R; The new era of management; Cengage.

2- Bhat Anil, Arya Kumar; Management: Principles, Processes and Practices; Oxford higher Edu.

3- Davis & Olson; Management Information System; TMH.

4- Steven Alter; Information systems, Pearson, www.stevenalter.com

5- Kotler P; Marketing management;

6- Khan, Jain; Financial Management;

7- ILO; Work study; ILO.

8- Mohanty SK; Fundamental of Entrepreneurship; PHI.

Course Outcomes:

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

CO1	Understand management its characteristics and clarify management as science or profession.
CO2	Understand intellectual property system, copyrights, trademark, and intellectual property rights.
CO3	Understand marketing concept and advertising CRM and marketing research.
CO4	Make balance sheet and calculate breakeven point.
CO5	Understand need for Entrepreneurship and Benefits of Self-Employment

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	0	2	1	0	0	2	1	1	0	1	1	1
CO2	0	2	1	1	1	0	0	1	0	1	0	1
CO3	0	1	1	1	1	0	0	1	0	1	1	1
CO4	0	3	2	2	2	2	1	0	1	1	1	1
CO5	0	1	2	2	1	2	1	0	1	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						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work		L	T	P	
IP81 C	Industrial Psychology & Human Behavior	70	20	10	-	-	100	3	1	-	4

Course Objective:

- To acquire the basic knowledge of Industrial Psychology & human behavior.
- To establish knowledge regarding maintenance of human resource, industrial relations & group behavior.

Course content:

INDUSTRIAL PSYCHOLOGY AND HUMAN BEHAVIOR
(IP81 C)

Module -I Industrial Psychology: Basic concepts, Role and Application, Discipline, Fatigue, Accidents, Labour welfare, Supervision.

Module –II Maintenance of Human Resource: Health, Safety, Labor welfare, Welfare measures, Human Relations, Personnel audit, Industrial Safety, Safety efforts by government, Safety programs.

Module – III Industrial Relations: Objective, Industrial unrest, Industrial peace, Parties in industrial relations, Organizational conflicts, Industrial disputes and their settlement, Impact of Conflicts, Sources of conflicts, Labor policy, Worker's grievances, Suggestion system

Module - IV Human Behavior: Attitudes and Job satisfaction, Emotions and Moods, Personality and values, Perception and Decision making.

Module –V Group Behavior: Foundation of group behavior, Understanding work teams, Communication, power and Politics, Conflicts and Negotiations

Reference Books:

1. Industrial Organization and Engineering Economics – T.R. Banga and S.C. Sharma
2. Organization Behavior – Stephen P. Robbins, Timathy A. Judge and Neharika Vohra
3. organizational Behavior part-1 and Part-2 –John B. Miner

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Course Outcomes:

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

CO1	To acquire the basic knowledge of industrial psychology.
CO2	To establish knowledge regarding maintenance of human resource.
CO3	To build-up knowledge of industrial relations.
CO4	To know about human behavior.
CO5	To know about group behavior.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	1	0	0	1	0	1	0
CO2	0	2	1	0	1	1	0	1	0	1	0	0
CO3	0	1	1	1	2	0	1	0	0	0	0	1
CO4	0	1	0	0	1	0	0	0	0	0	0	0
CO5	0	0	1	1	0	0	0	0	0	0	0	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	
IP81 D	Finite Element Methods	70	20	10	-	-	100	3	1	-	4

Course Objective:

- To get the knowledge of finite element methods.
- To enhance the knowledge about coordinates and matrices and various approaches of FEM.
- To provide the knowledge of high order & iso parametric formulation.
- To gain the knowledge about solid and structural mechanisms.

Course content:

FINITE ELEMENT METHODS
(IP81 D)

Module -I: General procedure of finite element method: Basic concept of FEM, Engineering applications, Comparison of FEM with other methods of analysis, Discretization of the domain-Basic element shapes, discretization process, Interpolation polynomials, Selection of the order of the interpolation polynomial, Convergence requirements, Linear interpolation

Module -II: polynomials in terms of global and local coordinates, Formulation of element characteristic matrices and vectors-Direct approach, variational approach, weighted residual approach, Assembly of element
matrices and vectors and derivation of system equations together with their solution.

Module -III: High-- order and iso-parametric element formulations: Introduction, Higher order one-dimensional element, Higher order elements in terms of natural coordinates and in terms of classical interpolation polynomials, Continuity conditions, Iso-parametric elements, Numerical integration in one, two and three-dimensions.

Module -IV: Solid and structural mechanics: Introduction, Basic equations of solid mechanics, Static analysis-Formulation of equilibrium equations, analysis of trusses and frames, analysis of plates, analysis of three-dimensional problems, analysis of solids of revolution, Dynamic analysis-Dynamic equations of motion, consistent and lumped mass matrices, consistent mass matrices in global coordinate system, Dynamic response calculation using FEM

Module -V: Applications and generalization of the finite element METHOD: Energy balance and rate equations of heat transfer, Governing differential equation for the heat conduction in three-dimensional bodies, Derivation of finite element equations for one-dimensional, two-dimensional, unsteady state and radiation heat transfer problems and their solutions, Solution of Helmholtz equation and Reynolds equation, Least squares finite element approach.

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RECOMMENDED BOOKS:

1. The Finite Element Method in Engineering – S.S. Rao, Pub.- Pergamon Press.
2. Numerical Methods in Finite Element Analysis—Klaus-Jurgen Bathe and Edwar L. Wilson, Pub.- PHI.
3. The Finite Element Method – O.C. Zienkiewicz – McGraw-Hill
4. The Finite Element Methods for Engineers – K.H. Huebner – Wiley, New York

Course Outcomes:

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

CO1	To acquire the knowledge about general procedures of FEM.
CO2	To enhance the knowledge about coordinates and matrices and various approaches of FEM.
CO3	To provide the knowledge of high order & iso parametric formulation.
CO4	To gain the knowledge about solid and structural mechanisms.
CO5	To acquire the knowledge about applications and generalization of FEM.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	1	0	0	1	0	1	0
CO2	0	2	1	0	1	1	0	1	0	1	0	0
CO3	0	1	1	1	2	0	1	0	0	0	0	1
CO4	0	1	0	0	1	0	0	0	0	0	0	0
CO5	0	0	1	1	0	0	0	0	0	0	0	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	
IP81 B	Management Information System	70	20	10	-	-	100	3	1	-	4

Course Objective:

- To acquire the basic knowledge Management Information System.
- To establish knowledge regarding system engineering, information & e business technology, planning & controlling and enterprise management system.

Course content:

MANAGEMENT INFORMATION SYSTEM
(IP 81 B)

Module-I: Management Information System (MIS): Concept of MIS, Definition, role of Management Information System, Objectives and benefits, MIS as strategic tool, obstacles and challenges for MIS, functional and cross functional systems, hierarchical view of CBIS, structured and unstructured decision, Decision process and MIS, information system components and activities, Value chain and MIS support. Database and data structures.

Module -II: System Engineering : System concepts, System control , Types of System, handling System, complexity system, efficiency and effectiveness, classes of system ,data processing system, business function processing system transaction processing system, Integrated information processing system, application processing system ,system analysis, need for system analysis, procedure for analyzing the existing system, work system model and comparison with input-process-output model, five views of work system, knowledge based systems.

Module -III: Information and e business technology: Information concepts, classification of information method of data and information collection, Value of information, information storage and retrieval system, general model of a human as an information processor, MIS and the Information and knowledge, introduction to e business, models of e business, MIS in web environment, MIS and e business, Information technology and computer NW support to MIS

Module -IV: Planning and control Concepts: concept of corporate planning, dimensions of planning, Essentiality of strategic planning, Development of business strategic, types of strategies, tools of planning, MIS strategic business planning ,(SDLC) system development life cycle ,system investigation, analysis of needs, design and implementation phases, Control and Maintenance of Information Systems.

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Module -V: Enterprise management System: EMS system concept, Enterprise resource planning (ERP)system ERP models and modules, benefits of ERP, ERP product Evolution, ERP implementation (ERP) from MRP, information management in SCM, Customer relationship management (CRM), Integrated data model in ER Business Process Re-Engineering (BPR), significance and functions,

References

1. Davis and Olson, Management Information Systems, TMH
2. James O' Brian, Management Information Systems, TMH
3. Oz, Management Information Systems, Cengage
4. Alter Stevenson, Information Systems: Foundation of E-Business; (Prentice-Hall, USA)
5. Jayaraman, Business Process Re-Engineering, TMH.
6. Garg. V.K.; ERP, PHI
7. Kelkar SA; Management Information Systems A Concise Study; PHI Learning.
8. Radhakrishnan R and Balasubramanian S; Business Process Reengineering; PHI Learning.
9. Alex Leon; ERP, TMH
10. Jawadekar WS; MIS- text and cases; TM

Course Outcomes:

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

CO1	To acquire the basic knowledge Management Information System.
CO2	To establish knowledge regarding system engineering.
CO3	To build-up knowledge of information & e-business technology.
CO4	To know about planning & controlling concepts.
CO5	To know about enterprise management system.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	1	0	0	1	0	1	0
CO2	0	2	1	0	1	1	0	1	0	1	0	0
CO3	0	1	1	1	2	0	1	0	0	0	0	1
CO4	0	1	0	0	1	0	0	0	0	0	0	0
CO5	0	0	1	1	0	0	0	0	0	0	0	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	
IP82 B	Work Design & Ergonomics	70	20	10	-	-	100	3	1	-	4

Course Objective:

- To acquire the basic knowledge of work study, work processes & motion study.
- To establish knowledge regarding work sampling, measuring and motion economy.

Course content:

WORK DESIGN AND ERGONOMICS
(IP 82 B)

Module I: Introduction to work study - Productivity – scope of motion and time study - Work methods design.

Module II: Motion study-process analysis – process chart – flow diagram – assembly process chart – man and machine chart – two handed process chart - Micro motion and memo motion study. Work measurement and its methods.

Module III: Work sampling – Determining time standards from standard data and formulas – Predetermined motion time standards – work factor system – methods time measurement, Analytical Estimation.

Module IV: Measuring work by physiological methods – heart rate measurement – measuring oxygen consumption– establishing time standards by physiology methods.

Module V: Motion economy- Ergonomics practices – human body measurement – layout of equipment – seat design - design of controls and compatibility – environmental control – vision and design of displays. Design of work space, chair table.

RECOMMENDED BOOKS:

1. Barnes, Raeph. M., "Motion and Time Study – Design and Measurement of Work ", John Wiley & sons, New York, 1990.
2. McCormick, E.J., "Human Factors in Engineering and Design", McGraw Hill.
3. ILO, "Introduction to Work study ", Geneva, 1974.

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Course Outcomes:

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

CO1	To acquire the basic knowledge of work study.
CO2	To establish knowledge regarding motion study.
CO3	To build-up knowledge of work sampling.
CO4	To know about work measuring.
CO5	To know about motion economy.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	1	0	0	1	0	1	0
CO2	0	2	1	0	1	1	0	1	0	1	0	0
CO3	0	1	1	1	2	0	1	0	0	0	0	1
CO4	0	1	0	0	1	0	0	0	0	0	0	0
CO5	0	0	1	1	0	0	0	0	0	0	0	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	
IP82 D	Concurrent Product Design	70	20	10	-	-	100	3	1	-	4

Course Objective:

- To acquire the basic knowledge of concurrent product design.
- To establish knowledge regarding design process, design cost estimations, material & manufacturing process selection and product development approaches.

Concurrent Product Design
(IP 82 D)

Module I: Introduction: Types of design, importance of design, design considerations, product life cycle, technology life cycle, benchmarking, and mass customization. Concurrent design team its elements.

Module II: Product Design Process: Steps in design, Functional requirement analysis, Axiomatic design, Product design specifications, concurrent design model.

Module III: Material And Manufacturing Process Selection In Design: Factors influencing material and process selection, approaches, tools and software used in selection. Design For 'X': An introduction: Design for manufacturing, assembly and dissemble, an overview of DF'X'. Deign for maintainability and serviceability, design for environment, design for aesthetic, design for packaging, design for handling, design for safety, etc.

Module IV: Design Cost Estimation: Need, cost indexes, categories; cost-capacity factors; design to cost and life cycle costing.

Module V: Product Development Approaches: Concurrent engineering, partnership with supplier, collaborative and Internet based design, Design Project Management: PDM tools.

Reference Books

1. Dieter George E., Engineering Design, McGraw Hill Publication, 2000.
2. Ulrich Karl T and Eppinger Steven D., Product design and development, McGraw Hill Publication, 1995.
3. Chitale A.K. and Gupta R.C. Product Design and Manufacture, Prentice-Hall of India, New Delhi
4. Bralla, James G., Handbook of Product Design for Manufacturing, McGraw Hill Publication

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Course Outcomes:

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

CO1	To acquire the basic knowledge of concurrent product design.
CO2	To establish knowledge regarding product design process.
CO3	To build-up knowledge of material & manufacturing process selection.
CO4	To know about design cost estimation.
CO5	To know about product development approaches.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	1	0	0	1	0	1	0
CO2	0	2	1	0	1	1	0	1	0	1	0	0
CO3	0	1	1	1	2	0	1	0	0	0	0	1
CO4	0	1	0	0	1	0	0	0	0	0	0	0
CO5	0	0	1	1	0	0	0	0	0	0	0	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	
IP71 B	Project Management	70	20	10	-	-	100	3	1	-	4

Course Objective:

- To acquire the basic concept of project management.
- To establish knowledge regarding planning, costing and financing.
- To build-up knowledge regarding project organization, culture and leadership.
- To know about project management performance and human resourses.

Course content:

PROJECT MANAGEMENT
(IP71 B)

Module- I: Concepts of Project Management: Meaning, Introduction Project Management Role & Scope of Project Management, Need for Project Management, definition and characteristics of a project, Project objectives and functions, Project classification, Project life cycle phases, elements of project management, Tools & Techniques in Project Management, roles, and attributes for project manager. Methods and techniques for developing project managers.

Module- II: Project selection and initiation: Project identification, Projection screening and selection criteria. Establishing the project scope, detailed project report, Market and demand study, Primary and secondary information, Nature of Project Decision, The Project Development Cycle, Opportunity Studies, Pre-feasibility and Feasibility Studies, Project feasibility report, Technical Analysis.

Module- -III: Project planning, Costing and Financing: Project planning, Project Scheduling Project management system, Work breakdown structure, Schedule development Costing of Projects, Costing and Pricing of Project, Types of Cost Estimates in Projects, Project Scoping Project Financing, Sources of Long-Term Rupee Funds, Sources of Long-Term Rupee Loans, Sources of Long-Term Free Exchange, Sources of Short-Term Rupee Funds, Feed forward Project Control.

Module- -IV: Project organization, culture, and leadership: Organization structure, Characteristics of organization, Elements of organization, Process of organization, Principles of organization Types of Organization Structures, Hierarchical Organization Structures, Functional organization Matrix organization Line and Staff organization, Integrating Projects in Functional Organizations, comparison of functional, matrix and project organization. Evolution of Organization Structures in Projects, Types of Matrix Organization Structures.

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Module- -V: project management performance and close out: Factors influencing project success, factor responsible for project failure, Performance indicator, time overrun, cost overrun, project sickness, Approaches to performance analysis, Project close out, computer project management system (CPMS). Schematic of Planning and Control.

Human Resources: Human Beings as a Resource, Balancing Human Resources, Types of Problems in Balancing Human Resources, Delegation, documenting project authority, Principles of delegations of authority.

References:

1. Prasana Chandra: Projects: planning Implementation control; TMH.
2. Gray Clifford F And Larson EW; Project The managerial Process; TMH
3. Panneerselven and Serthil kumar; Project management, PHI
4. Burke ; Project Management-Planning and control technics; Wiley India
5. Kamaraju R; Essentials of Project Management; PHI Learning

Course Outcomes:

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

CO1	To get the knowledge about concept of project management.
CO2	To know about project selection & initiation.
CO3	To know about project planning, costing, and financing.
CO4	To get the knowledge about project organization, culture & leadership.
CO5	To acquire the knowledge about project management performance & human resources.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	1	0	0	1	0	1	0
CO2	0	2	1	0	1	1	0	1	0	1	0	0
CO3	0	1	1	1	2	0	1	0	0	0	0	1
CO4	0	1	0	0	1	0	0	0	0	0	0	0
CO5	0	0	1	1	0	0	0	0	0	0	0	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						
IP71 C	Automobile Engineering	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work	100	L	T	P	4
		70	20	10	-	-		3	1	-	

Course Objective:

- To acquire the basic knowledge of chassis & body.
- To establish knowledge regarding Steering system, transmission system, suspension system, electrical system, and control system.

Course content:

AUTOMOBILE ENGINEERING
(IP 71 C)

MODULE I: Chassis & Body Engg: Types, Technical details of commercial vehicles, types of chassis, lay out, 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, 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.

MODULE -IV: Suspension system : Basic suspension movements, 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, disc theory, mechanical, hydraulic & pneumatic power brake systems, performance, self-energization, air bleeding of hydraulic brakes, types of wheels and tires, tyre specifications, construction and material properties of tyres & tubes.

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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 and II, Euro-I and Euro-II 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 HN; Internal Combustion Engines; PHI;
4. Joseph Heitner, Automotive Mechanics, Principles and Practices, CBS Pub.
5. Kripal Singh, Automotive Engineering Khanna Pub.
6. Newton & Steeds, Automotive Engineering
7. Emission standards from BIS and Euro –I and Euro-II

Course Outcomes:

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

CO1	To acquire the basic knowledge of chassis & body.
CO2	To establish knowledge regarding Steering system.
CO3	To build-up knowledge regarding transmission system.
CO4	To know about suspension system.
CO5	To know about electrical & control system.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	1	0	0	1	0	1	0
CO2	0	2	1	0	1	1	0	1	0	1	0	0
CO3	0	1	1	1	2	0	1	0	0	0	0	1
CO4	0	1	0	0	1	0	0	0	0	0	0	0
CO5	0	0	1	1	0	0	0	0	0	0	0	1

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Jabalpur Engineering College, Jabalpur
(Declared Autonomous by MP Govt., Affiliated to RGPV, Bhopal)
(AICTE Model Curriculum Based Scheme)
Bachelor of Technology (B.Tech.) VII Semester (Industrial & Production 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	
IP71 D	Computer Aided Production Planning	70	20	10	-	-	100	3	1	-	4

Course Objective:

- To acquire the basic knowledge of Computer aided forecasting.
- To establish knowledge regarding Group Technology, computer aided planning, operation management, testing, MRP & ERP with simulation.

Course content:

Computer Aided Production Planning
(IP71D)

Module I

Computer Aided Forecasting: Nature and use of forecast, sources of data, demand patterns, forecasting models, selection of forecasting technique, measurement of forecast Accuracy, Adoptive methods. Computerized relative allocation of facility technique, automated layout design program and computerized relationship layout planning for facility location and layout.

Module II

Group Technology: - Introduction, objectives part families, algorithms and models for G.T. - Rank order clustering, Bond energy, mathematical model for machine – component cell formation. Design and manufacturing attributes. Parts classification and coding, concept of composite job machine group, cell group tooling, design rationalization, CAD/CAM and GT benefits.

Module III

Computer Aided Process Planning, Operation Management, Computer Aided Inspection- Computer Aided Testing, contact type, non-contact type.

Module IV

MRP: Introduction, Objective, Input, Computational procedure, information provided by the system. Detailed capacity planning, manufacturing resources planning
ERP: Introduction, main features, generic model of ERP system, selection of ERP, proof of concept approach, analytic hierarchy approach, ERP implementation.

Module V

Simulation – Major activities, purpose, simulation process, types methodology, simulation packages, process quality simulator, computer requirements trends, applications simulation of manufacturing systems.

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Reference Books

1. An introduction to Automated Process Planning – Tien – Chien Chang and Richard Awysk/Prentice Hall
2. M.P. Groover, Automation production systems and computer aided mfg.-
3. P.N. Rao, N.K. Tewari, T.K. Kundra, Computer aided manufacturing
4. G.T. in the engineering industry Bur bridge
5. MRP – by Orlikey
6. Buffa & Sarin, Modern Production Management
7. P.B. Mahapatra, Computer Aided production management
8. Averill M Law & David Kelton, Simulation modeling and analysis, Tata McGraw Hill

Course Outcomes:

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

CO1	To acquire the basic knowledge computer aided forecasting.
CO2	To establish knowledge regarding group technology.
CO3	To build-up knowledge of computer aided process planning & operation management.
CO4	To know about computer aided MRP & ERP.
CO5	To know about computer aided simulation.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	1	0	0	1	0	1	0
CO2	0	2	1	0	1	1	0	1	0	1	0	0
CO3	0	1	1	1	2	0	1	0	0	0	0	1
CO4	0	1	0	0	1	0	0	0	0	0	0	0
CO5	0	0	1	1	0	0	0	0	0	0	0	1

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