DIPLOMA CURRICULUM OF MECHANICAL ENGINEERING (SECOND YEAR) (3rd Semester)

(To be implemented from 2025-26)

Prepared by;

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Vetted by:
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PROGRAMME TITLE: MECHANICAL ENGINEERING

SEMESTER - III

SL. No	Category of Course	Code No	Course Title	Study Scheme				Evaluation Scheme				Total Marks	Credits
				Pre-requisite	Contact Hours/ week			Theory		Practical			
					L	T	P	End Exam	Progressive Assessment	End Exam	Progressive Assessment		
1	Programme core	MEPC201 TH:1	Manufacturing Processes		3	0	0	70	30	-	-	100	3
2		MEPC203 TH:2	Strength of Materials		3	0	0	70	30	-	-	100	3
3		MEPC205 TH:3	Material Science and Engineering		3	0	0	70	30	-	-	100	3
4		MEPC207 TH:4	Fluid Mechanics & Fluid Power		3	0	0	70	30	-	-	100	3
5		MEPC209 TH:5	Thermal Engineering-I		3	0	0	70	30	-	-	100	3
6		MEPC211 PR:1	Manufacturing Engineering Lab-I		0	0	4	-	-	15	35	50	2
7		MEPC213 PR:2	Material Testing and Metallography Lab		0	0	4	-	-	15	35	50	2
8		MEPC215 PR:3	Fluid mechanics & Fluid Power Lab		0	0	4	-	-	15	35	50	2
9		MEPC217 PR:4	Thermal Engineering-I Lab		0	0	4	-	-	15	35	50	2
10	**Summer Internship**	SI201	Summer internship – I*		0	0	0	-	-	15	35	50	2
TOTAL					**15**	**0**	**16**	**350**	**150**	**75**	**175**	**750**	**25**

*4-weeks after 2nd Semester

SEMESTER – III COURSES

TH:1- MANUFACTURING PROCESSES

L	T	P		
3	0	0		**Course Code: MEPC201**
Total Contact Hours				**Theory Assessment**
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam 70
				Progressive Assessment 30
Pre Requisite		**: Nil**		
Credit		**3**		Category of Course: PC

RATIONALE: Engineering basically means production of goods and services for human consumption The knowledge of various manufacturing processes leads to production of components, which are made from different metallic and non-metallic materials. These parts are produced using a variety of manufacturing processes with requisite strength, surface finish, size and shape. As a mechanical technician/ engineer, one should have the knowledge of these manufacturing processes, which will be very helpful for discharging his duties in manufacturing or maintenance.

LEARNING OUTCOMES:

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

- Illustrate the importance of cutting fluids & lubricants in machining.
- Study various types of basic production processes. To select, operate and control the appropriate processes for specific applications.
- Define the concept of gear making and list various gear materials.
- Describe the importance of press tools and various die operations.
- Explain grinding and finishing processes.

DETAILED COURSE CONTENTS

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	**Cutting Fluids & Lubricants:** Introduction; Types of cutting fluids, Fluids and coolants required in turning, drilling, shaping, sawing & broaching; Selection of cutting fluids, methods of application of cutting fluid; Classification of lubricants (solid, liquid, gaseous), Properties and applications of lubricants. **Lathe Operations:** Types of lathes – light duty, medium duty and heavy duty geared lathe, CNC lathe; Specifications; Basic parts and their functions; Operations and tools – Turning, parting off, Knurling, facing, Boring, drilling, threading, step turning, taper turning, Nomenclature of single point cutting tool of lathe.	10
II	**Broaching Machines:** Introduction to broaching; Types of broaching machines – Horizontal type (Single ram & duplex ram), Vertical type, pull up, pull down, and push down; Elements of broach tool; broach teeth details; Nomenclature; Tool materials. **Drilling:** Classification; Basic parts and their functions; Radial drilling machine; Types of operations; Specifications of drilling machine; Types of drills and reamers.	9

III	**Welding:** Classification; Gas welding techniques; Types of welding flames; Arc Welding – Principle, Equipment, Applications; Shielded metal arc welding; Submerged arc welding; TIG / MIG welding; Resistance welding - Spot welding, Seam welding, Projection welding; Welding defects; Brazing and soldering: Types, Principles, Applications. **Milling:** Introduction; Types of milling machines: plain, Universal, vertical; constructional details – specifications; Milling operations: simple, compound and differential indexing; Milling cutters – types; Nomenclature of teeth; Teeth materials; Tool signature of milling cutter; Tool & work holding devices.	9
IV	**Gear Making:** Manufacture of gears – by Casting, Moulding, Stamping, Coining Extruding, Rolling, Machining; Gear generating methods: Gear Shaping with pinion cutter & rack cutter; Gear hobbing; Description of gear hob; Operation of gear hobbing machine; Gear finishing processes; Gear materials and specification; Heat treatment processes applied to gears. **Press working:** Types of presses and Specifications, Press working operations - Cutting, bending, Drawing, punching, blanking, notching, lancing; Die set components- punch and die shoe, guide pin, bolster plate, stripper, stock guide, feed stock, pilot; Punch and die clearances for blanking and piercing, effect of clearance.	9
V	**Grinding and finishing processes:** Principles of metal removal by Grinding; Abrasives – Natural & Artificial; Bonds and binding processes: Vitrified, silicate, shellac, rubber, Bakelite; Factors affecting the selection of grind wheels: size and shape of wheel, kind of abrasive, grain size, grade and strength of bond, structure of grain, spacing, kinds of bind material; Standard marking systems: Meaning of letters & numbers sequence of marking, Grades of letters; Grinding machines classification-: Cylindrical, Surface, Tool & Cutter grinding machines; Construction details; Principle of centerless grinding; Advantages & limitations of centerless grinding; Finishing by grinding: Honing, Lapping, Super finishing; Electroplating: Basic principles, Plating metals, applications; Hot dipping: Galvanizing, Tin coating, Parkerizing, Anodizing; Metal spraying: wire process, powder process and applications; Organic coatings: Oil base Paint, Lacquer base, Enamels, Bituminous paints, rubber base coating; Finishing specifications.	8

REFERENCES:

1. Manufacturing technology – P N Rao, Tata McGraw-Hill Publications
2. Elements of workshop Technology (Volume I & II) – S. K. Hajra Chaudary, Bose & Roy, Media Promoters and Publishers Limited.
3. Production Technology (Volume I & II) – O. P. Khanna & Lal, Dhanpat Rai Publications.
4. Fundamental of metal cutting and machine tools– B. L. Juneja, New age international limited.
5. Manufacturing Technology, Metal Cutting & Machine tools– P. N. Rao, Tata McGraw-Hill Publications

TH:2- STRENGTH OF MATERIALS

L	T	P		
3	0	0		**Course Code: MEPC203**
Total Contact Hours				**Theory Assessment**
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam 70
				Progressive Assessment 30
Pre Requisite		**: Nil**		
Credit		**3**		Category of Course: PC

RATIONALE:

Strength of materials deals with the internal behavior of solid bodies loaded in different manner. The common solid bodies e.g. shafts, bars, beams, plates and columns are the basic components of structures and machines. This subject primarily focuses on mechanical properties of materials, analysis of stress, strain and evaluation of deformation. Hence all students should have acquainted with strength of materials to become successful technician

LEARNING OUTCOMES:

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

- Apply the concept of Simple Stresses and Strains.
- Describe the concept of Strain Energy.
- Define the concept of Shear Force and Bending Moment Diagrams.
- Apply the concept of Theory of Simple Bending and Deflection of Beams.
- Outline the concept of Torsion in Shafts and Springs.
- Illustrate the concept of Thin Cylindrical Shells.

DETAILED COURSE CONTENTS

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	**Simple Stresses and Strains:** Types of forces; Stress, Strain and their nature; Mechanical properties of common engineering materials; Significance of various points on stress – strain diagram for M.S. and C.I. specimens; Significance of factor of safety; Relation between elastic constants; Stress and strain values in bodies of uniform section and of composite section under the influence of normal forces; Thermal stresses in bodies of uniform section and composite sections; Related numerical problems on the above topics. **Strain Energy:** Strain energy or resilience, proof resilience and modulus of resilience; Derivation of strain energy for the following cases: i) Gradually applied load, ii) Suddenly applied load, iii) Impact/ shock load; Related numerical problems.	10
II	**Shear Force & Bending Moment Diagrams:** Types of beams with examples: a) Cantilever beam, b) Simply supported beam, c) Over hanging beam, d) Continuous beam, e) Fixed beam; Types of Loads – Point load, UDL and UVL; Definition and explanation of shear force and bending moment; Calculation of shear force and bending moment and drawing the S.F and B.M. diagrams by the analytical method only for the following cases: a) Cantilever with point loads, b) Cantilever with uniformly distributed load, c) Simply supported beam with point loads, d) Simply supported beam with UDL, e) Over hanging beam with point loads, at the center and at free ends, f) Over hanging beam with UDL throughout, g) Combination of point and UDL for the above; Related numerical problems.	9

III	**Theory of Simple Bending and Deflection of Beams:** Explanation of terms: Neutral layer, Neutral Axis, Modulus of Section, Moment of Resistance, Bending stress, Radius of curvature; Assumptions in theory of simple bending; Bending Equation $M/I = \sigma/Y = E/R$ with derivation; Problems involving calculations of bending stress, modulus of section and moment of resistance; Calculation of safe loads and safe span and dimensions of cross-section; Definition and explanation of deflection as applied to beams; Deflection formulae without proof for cantilever and simply supported beams with point load and UDL only (Standard cases only); Related numerical problems.	9
IV	**Torsion in Shafts and Springs:** Definition and function of shaft; Calculation of polar M.I. for solid and hollow shafts; Assumptions in simple torsion; Derivation of the equation $T/J=f_S/R=G\theta/L$; Problems on design of shaft based on strength and rigidity; Numerical Problems related to comparison of strength and weight of solid and hollow shafts; Classification of springs; Nomenclature of closed coil helical spring; Deflection formula for closed coil helical spring (without derivation); stiffness of spring; Numerical problems on closed coil helical spring to find safe load, deflection, size of coil and number of coils.	9
V	**Unit-V: Thin Cylindrical Shells:** Explanation of longitudinal and hoop stresses in the light of circumferential and longitudinal failure of shell; Derivation of expressions for the longitudinal and hoop stress for seamless and seam shells; Related numerical Problems for safe thickness and safe working pressure.	8

REFERENCES:

1. Strength of Materials – D.S. Bedi, Khanna Book Publishing Co. (P) Ltd., Delhi, 2017
2. Strength of Materials – B.C.Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publica- tions, New Delhi, 2013
3. Strength of Materials – R.S. Khurmi, S.Chand Company Ltd. Delhi

TH:3- MATERIAL SCIENCE & ENGINEERING

L	T	P		**Course Code: MEPC205**	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam	70
				Progressive Assessment	30
Pre Requisite		**: Nil**			
Credit		**3**		Category of Course: PC	

RATIONALE:

Engineering Materials play an important role as the vital tool for solving the problems of material selection and application in the production and manufacturing of equipment/machines, devices, tools, etc. Therefore, an engineering diploma student must be conversant with the properties, composition and behavior of materials from the point of view of reliability and performance of the product. Subject is concerned with the changes in structure and properties of matter. Many of the processes which are involved to bring out these changes, forms the basis of engineering activities. The study of basic concepts of material science and metallurgy will help the students understanding engineering subjects where the emphasis is laid on the application of these materials.

LEARNING OUTCOMES:

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

- Explain about crystal structures and atomic bonds.
- Describe about classification of ferrous metals and their properties.
- Explain about non-ferrous metals, cutting tool materials and composites along with their properties.
- Describe about the various metallic failures and knowledge in testing of materials.
- Explain the principle of corrosion, their types, its prevention methods along with the various surface engineering processes.

DETAILED COURSE CONTENTS

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	**Crystal structures and Bonds:** Unit cell and space lattice: Crystal system: The seven basic crystal systems; Crystal structure for metallic elements: BCC, FCC and HCP; Coordination number for Simple Cubic, BCC and FCC; Atomic radius: definition, atomic radius for Simple Cubic, BCC and FCC; Atomic Packing Factor for Simple Cubic, BCC, FCC and HCP; Simple problems on finding number of atoms for a unit cell. **Bonds in solids:** Classification - primary or chemical bond, secondary or molecular bond; Typesof primary bonds: Ionic, Covalent and Metallic Bonds; Types of secondary bonds: Dispersion bond, Dipole bond and Hydrogen bond	10
II	**Unit-II: Phase diagrams, Ferrous metals and its Alloys:** Isomorphs, eutectic and eutectoid systems; Iron-Carbon binary diagram; Iron and Carbon Steels; flow sheet for production of iron and steel; Iron ores – Pig iron: classification, composition and effects of impurities on iron; Cast Iron: classification, composition, properties and uses; Wrought Iron: properties, uses/applications of wrought Iron; comparison of cast iron, wrought iron and mild steel and high carbon steel; standard commercial grades of steel as per BIS and AISI; Alloy Steels – purpose of alloying; effects of alloying elements – Important alloy steels: Silicon steel, High Speed Steel (HSS), heat resisting steel, spring steel,Stainless Steel (SS): types of SS, applications of SS – magnet steel – composition, properties and uses	9

III	**Non-ferrous metals and its Alloys:** Properties and uses of aluminum, copper, tin, lead, zinc, magnesium and nickel; Copper alloys: Brasses, bronzes – composition, properties and uses; Aluminum alloys: Duralumin, hindalium, magnelium – composition, properties and uses; Nickel alloys: Inconel, monel, nicPerome – composition, properties and uses. Anti-friction/Bearing alloys: Various types of bearing bronzes - Standard commercial grades as per BIS/ASME.	9
IV	**Failure analysis & Testing of Materials:** Introduction to failure analysis; Fracture: ductile fracture, brittle fracture; cleavage; notch sensitivity; fatigue; endurance limit; characteristics of fatigue fracture; variables affecting fatigue life; creep; creep curve; creep fracture; Destructive testing:Tensile testing; compression testing; Hardness testing: Brinell, Rockwell; bend test; torsion test; fatigue test; creep test. Non-destructive testing: Visual Inspection; magnetic particle inspection; liquid penetrant test; ultrasonic inspection; radiography.	9
V	**Corrosion & Surface Engineering:** Nature of corrosion and its causes; Electro chemical re-actions; Electrolytes; Factors affecting corrosion: Environment, Material properties and physical conditions; Types of corrosion; Corrosion control: Material selection, environment control and design; Surface engineering processes: Coatings and surface treatments; Cleaning and mechanical finishing of surfaces; Organic coatings; Electroplating and Special metallic plating; Electro polishing and photo-etching ;– Conversion coatings: Oxide, phosphate and chromate coatings; Thin film coatings: PVD and CVD; Surface analysis; Hard-facing, thermal spraying and high-energy processes; Process/mate-rial selection. Pollution norms for treating effluents as per standards.	8

REFERENCES:

1. Material Science –GBS Narang-Khanna Publishers, New Delhi
2. Material Science –R.K.Rajput –Lakshmi Publication , New Delhi
3. Material Science-R.S.Khurmi,R,S.Sedha-S.Chand,Publication
4. Material Science and Metallurgy –D.S.Nutt-S.K,Katariya and Sons,New Delhi
5. Material Science and Engineering -V.Raghavan-EEE Edition,Prentice Hall ,New Delhi

TH:4- FLUID MECHANICS & FLUID POWER

L	T	P		Course Code: EEPC207	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam	70
				Progressive Assessment	30
Pre Requisite		**: Nil**			
Credit		**3**		Category of Course : PC	

RATIONALE: Use of fluids in engineering field is of great importance. It is therefore necessary to study the physical properties and characteristic of fluids which have very important use and application in automobile engineering. Fluid power plays dominant role in industrial world knowledge of which is essential for mechanical engineering students. Actual use of or action by various liquids like water and oil can be realized by a group of machines called fluid machines. Mechanical students should be conversant with design, operation and use of these fluid machines.

LEARNING OUTCOMES:

After completion of the course, the students will be able

- Identify the properties of a fluid and hydrostatics.
- Explain the basic kinematics and dynamics of fluid mechanics
- Describe the flow through orifices, notches and pipes.
- Classify different types of turbines and pumps.
- Apply the knowledge of fluid power.

DETAILED CONTENT

Unit No.	Content	Time Allotted (Hrs.)
I	**PROPERTIES OF A FLUID AND HYDROSTATICS:** Definition of a fluid, classification of fluids, various fluid properties such as density, specific weight, specific gravity, viscosity and surface tension and state the units, fluid pressure, total pressure (hydrostatic force) and location of centre of pressure on vertical, horizontal , inclined and curved surfaces by fluid, working of various measuring devices for pressure, the principle of manometers of simple, differential and inverted types, principle of buoyancy and floatation. Simple numericals on Manometer.	**9**
II	**KINEMATICS AND DYNAMICS OF FLUID MECHANICS** Various types of flow, circulation and vorticity, stream-line, path line and streak-line, various energies of fluid, law of conservation of mass, energy equation -Bernoulli's theorem, the limitations of same-application of Bernoulli's equation, the working of venturimeter, pitot tube, equation of flow rate and velocity with respect to venturimeter and pitot tube respectively, the working of flowmeter: current meter, Simple numericals.	**6**
III	**FLOW THROUGH ORIFICES AND NOTCHES, PIPES:** Definition –orifice, orifice coefficient such as Cc, Cv, Cd, Relationship between orifice coefficients, weir and notch, Discharge over rectangular notch and weir, triangular notch. Simple numericals. Definition of a pipe. laws of fluid friction, Equation of loss of head through pipe due to friction, Darcy's formula and Chezy's formula, hydraulic gradient and total energy line, Nozzle and its application, Power transmission through nozzle The condition of maximum power transmission through nozzle, Expression for diameter of nozzle for maximum power transmission.	**9**

IV	**Turbines and Pumps:** Classification of hydraulic turbines, Selection of turbine on the basis of head and discharge available, Construction and working principle of Pelton wheel, Francis and Kaplan turbines. Draft tubes – types and construction, Concept of cavitation in turbines, Calculation of Work done, Power, efficiency of turbines. Simple numericals **Centrifugal Pumps:** Principle of working and applications, Types of casings and impellers, Concept of multistage, Priming and its methods, Manometric head, Work done, Manometric efficiency, Overall efficiency. Simple numericals **Reciprocating Pumps:** Construction, working principle and applications of single and double acting reciprocating pumps, Concept of Slip, Negative slip, Cavitation and separation. Simple numericals	**12**
V	**FLUID POWER:** Definition of fluid power, classification – hydraulic power and pneumatic power, Hydraulic Systems -Basic principle of enclosed hydraulic system – Pascal's law, Oil hydraulic system – reservoir, filter pressure limiting valves, direction control valves, flow control valves, actuators (linear and rotary), accumulator, pipes and fittings, various positive displacement pumps-gear, vane, piston, drawing of hydraulic circuits - extension and retraction of linear actuator, motion of rotary actuator, holding a job, hydraulic press etc.	**9**

REFERENCES:

1. Fluid Mechanics and Hydraulic Machines – R. K. Bansal, Laxmi Publications, New Delhi.
2. Fluid Mechanics and Hydraulic Machines, S.S. Rattan, Khanna Publishing House, New Delhi.
3. Hydraulics and fluid mechanics including Hydraulic machines – Modi P.N. and Seth S.M., Standard Book House. New Delhi.
4. Hydraulics and Fluid Mechanics - Jagadish Lal- Metropolitan Book
5. Fluid Power with Applications - Anthony Esposito -Pearson Education Limited.
6. Hydraulic, fluid mechanics and fluid machines – S. Ramamrutham, Dhanpat Rai and Sons, New Delhi.

TH:5- THERMAL ENGINEERING I

L	T	P		
3	0	0		**Course Code: ME PC209**
Total Contact Hours				**Theory Assessment**
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam 70
				Progressive Assessment 30
Pre Requisite		**: Nil**		
Credit		**3**		Category of Course : PC

RATIONALE: Thermal-engineering is a crucial field that helps learners to understand and harness the power of heat transfer and energy conversion. From power generation to automotive engineering, the principles of thermal engineering have a wide range of applications in various industries.

LEARNING OUTCOMES:

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

- Describe various sources of Energy and their applications.
- Classify I.C. engines and their working and constructional features.
- Draw the energy flow diagram of an I.C. engine and evaluate its performance.
- Describe the constructional features of air compressor and working of different air compressors.
- Describe the applications of refrigeration and Classify air-conditioning systems.

DETAILED COURSE CONTENTS

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	**Introduction to Thermodynamics:** Thermodynamic Systems (closed, open, isolated) ; Thermodynamic properties of a system (pressure, volume, temperature, entropy, enthalpy, Internal energy and units of measurement) ; Intensive and extensive properties ; Define thermodynamic processes, path, cycle , state, path function, point function; Thermodynamic Equilibrium ; Quasi-static Process ; Laws of thermodynamics (statements only) **Sources of Energy:** Brief description of energy Sources: Classification of energy sources: Renewable, Non-Renewable; Fossil fuels (CNG & LPG) ; Solar Energy: Flat plate and concentrating collectors & its applications (working principles of Solar Water Heater, Photovoltaic Cell, Solar Distillation);Definitions of Wind Energy; Tidal Energy; Ocean Thermal Energy; Geothermal Energy; Biogas, Biomass, Bio-diesel; Hydraulic Energy, Nuclear Energy; Fuel cell.	10

II	**Internal Combustion Engines:** Assumptions made in air standard cycle analysis; Brief description of Carnot, Otto and Diesel cycles with P-V and T-S diagrams; Internal and external combustion engines; advantages of I.C. engines over external combustion engines; classification of I.C. engines; neat sketch of I.C. engine indicating component parts; Function of each part and materials used for the component parts - Cylinder, crank case, crank pin, crank, crank shaft, connecting rod, wrist pin, piston, cooling pins cylinder heads, exhaust valve, inlet valve; Working of four-stroke and two stroke petrol and diesel engines; Comparison of two stroke and four stroke engines; Comparison of C.I. and S.I. engines; Valve timing and port timing diagrams for four stroke and two stroke engines.	9
III	**I.C. Engine Systems:** Fuel system of Petrol engines; Principle of operation of simple and Zenith carburettors; Fuel system of Diesel engines; Types of injectors and fuel pumps; Cooling system: air cooling, water cooling system with thermo siphon method of circulation and water cooling system with radiator and forced circulation (description with line diagram). Comparison of air cooling and water cooling system; Ignition systems – Battery coil ignition and magneto ignition (description and working). Comparison of two systems; Types of lubricating systems used in I.C. engines with line diagram; Types of governing of I.C. engines – hit and miss method, quantitative method, qualitative method and combination methods of governing; their applications; Objective of super charging.	9
IV	**Performance of I.C. Engines:** Brake power; Indicated power; Frictional power; Brake and Indicated mean effective pressures; Brake and Indicated thermal efficiencies; Mechanical efficiency;Relative efficiency; Performance test; Morse test; Heat balance sheet; Methods of determination of B,P., I.P. and F.P.; Simple numerical problems on performance of I.C. engines.	9
V	**Unit-V: Air Compressors:** Functions of air compressor; Uses of compressed air; Types of air compressors; Single stage reciprocating air compressor - its construction and working (with line diagram) using P-V diagram; Multi stage compressors – Advantages over single stage compressors; Rotary compressors: Centrifugal compressor, axial flow type compressor and vane type compressors. **Refrigeration & Air-conditioning:** Refrigeration; Refrigerant; COP; Air Refrigeration system: components, working & applications; Vapour Compression system: components, working & applications; Air conditioning; Classification of Air-conditioning systems; Comfort and Industrial Air-Conditioning; Window Air-Conditioner; Summer Air-Conditioning system, Winter Air-Conditioning system, Year-round Air-Conditioning system.	**8**

REFERENCES:

1 Introduction to Renewable Energy – Vaughn Nelson, CRC Press

2. Thermal Engineering – P. L. Ballaney, Khanna Publishers, 2002

3. A Course in Thermal Engineering – S. Domkundwar & C.P. Kothandaraman, Dhanpat Rai.

4. Thermal Engineering – R. S. Khurmi and J.K. Gupta, 18th Edition, S. Chand & Co, New Delhi.

5. Thermal Engineering – R. K. Rajput, 8th Edition, Laxmi publications Pvt Ltd, New Delhi.

PR:1- MANUFACTURING ENGINEERING LAB-I

L	T	P			
0	0	4		**Course Code: MEPC211**	
Total Contact Hours				**Practical Assessment**	
Practical		:60Hrs	**Total Marks: 50**	End Term Exam	35
				Progressive Assessment	15
Pre Requisite		:			
Credit		**2**		Category of Course : PC	

RATIONALE: Manufacturing Engineering Lab-I provides hands-on experience with machining, welding, and fabrication processes, enhancing technical skills for industrial applications. It helps students understand manufacturing techniques, safety standards, and quality control essential for mechanical engineering careers.

LEARNING OUTCOMES:

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

- Prepare a mould sand mix and molten metal and calculate the amount of metal to be poured in the mould
- Centre the job and select the proper tool to perform the job on lathe machine.
- Calculate the taper angle and practice different taper turning methods on lathe.
- Prepare the edges for welding and select the suitable electrode, voltage and current.
- Operate the welding transformer and generator to perform various weld joint operations.

List of Experiments

S.No.	Topics for practice
1.	Moulding & casting of (i) Connecting rod (ii) Solid bearing (iii) V-Pulley/Gear Pulley
2.	Arc welding (i) Lap Joint (ii) Butt Joint (iii) T- Joint
3.	Gas welding (i) Lap Joint (ii) Butt Joint
4.	Spot welding (i) Lap Joint
5.	Turning Exercise (i) Facing, Step Turning & Chamfering (ii) Step Turning & Taper Turning (iii) Step Turning & Groove Cutting (iv) Step Turning & & Knurling (v) Step Turning & Thread Cutting (vi) Turning and Drilling
6.	Grinding the Lathe Cutting tools to the required angles
7.	Study of Lathe, Drilling machine, shaping machine and slotting machine
8.	The dismantling some of the components of lathe and then assemble the same
9.	List the faults associated with lathe and its remedies
10.	The routine and preventive maintenance procedure for lathe

REFERENCES:

1. Elements of Workshop Technology (Volume I & II) – Hajra Chowdry & Bhattacharaya, MediaPromoters, 11th Edition, 2007
2. Introduction of Basic Manufacturing Processes and Workshop Technology – Rajendersingh,New age International (P) Ltd. NewDelhi, 2006
3. Workshop Technology – Raghuwanshi, Khanna Publishers. Jain &Gupta, New Delhi, 2002
4. Production Technology – Jain & Gupta, Khanna Publishers, New Delhi, 2006.
5. Production Technology – HMT, 18th edition, Tata McGraw Hill, New Delhi
6. Manufacturing process – Myro N Begman, 5th edition, Tata McGraw Hill, New Delhi

PR:2- MATERIAL TESTING AND METALLOGRAPHY LAB

L	T	P		Course Code: MEPC213	
0	0	4			
Total Contact Hours				**Practical Assessment**	
Practical		:60Hrs	**Total Marks: 50**	End Term Exam	35
				Progressive Assessment	15
Pre Requisite		:			
Credit		**2**		Category of Course : PC	

RATIONALE: Material Testing and Metallography Lab helps students understand the mechanical properties of materials through tests like hardness, tensile, and impact testing. It also provides hands-on experience in metallographic techniques for analyzing microstructures, ensuring quality control in engineering applications.

LEARNING OUTCOMES:

After completion of the course, the students will be able to
to identify the type of material based on its grain structure
to learn the procedure for identifying the cracks in the material
to Illustrate various material testing methods to determine mechanical properties such asyield stress, Ultimate stress, percentage elongation, Young's Modulus etc.

Sl. No.	**Topics for practice**
I	Prepare a specimen and examine the microstructure of the Ferrous and Non- ferrous metals using the Metallurgical Microscope.
II	Detect the cracks in the specimen using (i) Visual inspection and ring test (ii) Die penetration test (iii) Magnetic particle test.
III	Determination of Rockwell's Hardness Number for various materials like mild steel, high carbon steel, brass, copper and aluminium.
IV	Finding the resistance of materials to impact loads by Izod test and Charpy test.
V	Torsion test on mild steel – relation between torque and angle of twist determination ofshear modulus and shear stress.
VI	Finding Young's Modulus of Elasticity, yield points, percentage elongation and percentagereduction in area, stress strain diagram plotting, tests on mild steel.
VII	Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Open & Closed coil spring)
VIII	Single or double Shear test on M.S. bar to finding the resistance of material to shear load.

REFERENCES:

1. Measurement system (Application and Design) – Ernest O Doebelin.
2. Strength of Materials – R. S. Khurmi, S. Chand Company Ltd. Delhi
3. A Text Book strength of Material– R.K. Bansal, Laxmi Publication New Delhi

PR:3- FLUID MECHANICS & FLUID POWER LAB

L	T	P		Course Code: MEPC215	
0	0	4			
Total Contact Hours				**Practical Assessment**	
Practical		:60Hrs	**Total Marks: 50**	End Term Exam	35
				Progressive Assessment	15
Pre Requisite		:			
Credit		**2**		Category of Course : PC	

RATIONALE: Fluid Mechanics & Fluid Power Lab helps students understand fluid properties, flow behavior, and hydraulic and pneumatic systems. It provides hands-on experience with flow measurement, pump testing, and fluid power applications essential for mechanical engineering.

LEARNING OUTCOMES

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

- Measure various properties such as pressure, velocity, flow rate using various instruments.
- Calculate different parameters such as co-efficient of friction, power, efficiency etc. of various systems.
- Illustrate the need and importance of calibration of pressure gauges.
- Describe the construction and working of turbines and pumps.
- Test the performance of turbines and pumps and Plot characteristics curves.
- Study the hydraulic and pneumatic circuits,

List of Experiments

Sl. No.	Topics for practice
1	Verification of Bernoulli's theorem.
2	Determination of Coefficient of Discharge of Venturi meter.
3	Determination of Coefficient of Discharge, coefficient of contraction and coefficient of velocity of Orifice meter.
4	Determination of coefficient of friction of flow through pipes.
5	Determination of force exerted by the jet of water on the given vane.
6	Determination of minor losses of flow through pipes.
7	Calibration of pressure gauge using dead weight pressure gauge tester.
VIII	Trial on centrifugal pump to determine overall efficiency.
IX	Trial on reciprocating pump to determine overall efficiency.
X	Trial on Pelton wheel /Francis/Kaplan turbine to determine overall efficiency.
XI	Analysis of Hydraulic circuits in a hydraulic trainer
XII	Analysis of pneumatic circuits in a pneumatic trainer

REFERENCES:

1. Fluid Mechanics and Machinery Laboratory Manual- N. Kumara Swamy, Charotar Publishing House Pvt. Ltd., ANAND 388 001, Ed. 2008

2. Fluid Power with Applications - Anthony Esposito -Pearson Education Limited.

PR:4- THERMAL ENGINEERING-I LAB

L	T	P		Course Code: MEPC217	
0	0	4			
Total Contact Hours				**Practical Assessment**	
Practical		:60Hrs	**Total Marks: 50**	End Term Exam	35
				Progressive Assessment	15
Pre Requisite		:			
Credit		**2**		Category of Course : PC	

RATIONALE: Thermal Engineering-I Lab helps students understand the IC engine performance through practical experiments. It provides hands-on experience with engines, compressors, and calorimeters essential for thermal system analysis.

LEARNING OUTCOMES

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

- Determine the flash and fire point of a given sample of fuel using given apparatus (Abels, Cleveland & Penesky martin)
- Find out the viscosity of a given sample of oil using given apparatus.
- Calculate the calorific value of a given sample of fuel using given apparatus.
- Determine the amount of carbon residue of a given sample of petroleum product.
- Draw VTD /PTD of given I.C. Engine and understand how the processes are controlled during its operation.
- Describe the functions of various parts of IC engines and the working of IC engines.

Course Content

Sl. No.	Topics for practice
1	Flash & Fire point tests using Able's/Cleveland/Pensky Martin Apparatus
2	Viscosity measurement usi/Saybolt viscometer
3	Calorific value tests using Bomb Calorimeter (Solid and Liquid fuels) and Junkers Gas Calorimeter (Gaseous fuels)
4	Carbon residue test using Conradson's apparatus.
5	Assembling and disassembling of I.C. Engines
6	Port timing diagram of Petrol engine
7	Port timing diagram of Diesel engine
8	Valve timing diagram of Petrol engine
9	Valve timing diagram of Diesel engine
10	Study of petrol and diesel engine components and Models

REFERENCES:

1. Thermal Engineering – P.L. Ballaney, Khanna Publishers, 2002
2. A Course in Thermal Engineering – S. Domkundwar & C.P. Kothandaraman, Dhanpat Rai & Publication New Delhi
3. Thermal Engineering – R.S. Khurmi and J.K. Gupta, 18th Edition, S. Chand & Co, New Delhi

SUMMER INTERNSHIP – I

L	T	P		Course Code: SI201	
0	0	0			
Total Contact Hours				Assessment	
Practical		0	Total Marks: 50	End Term Exam	15
				Progressive Assessment	35
Pre Requisite		: Nil			
Credits		2		Category of Course : SI	

Duration: 3-4 weeks during summer vacation after 2nd Semester.

RATIONALE

Summer Internship - I is to offer a structured and practical learning experience that prepares individuals for their future careers, helps them make informed career choices, and equips them with the skills and knowledge necessary to succeed in their chosen field. This course provides opportunities to students for hands-on industry experience.

LEARNING OUTCOMES

After completion of the course, the students will be able to:

- Apply theoretical knowledge gained in their academic coursework to real-world situations.
- Enhance specific skills relevant to their field.
- Gain hands-on experience in a professional network by interacting with mentors and industry professionals.
- Manage time effectively.
- Clarify career goals.

DETAILED COURSE CONTENTS

SUGGESTED ACTIVITIES:

I Orientation:

- Introduction to the organization's mission, values, and culture.
- Familiarization with workplace policies, procedures, and safety guidelines.
- Orientation to the team and organizational structure.

II Project-Based Learning:

- Description of the main project or tasks the intern will be working on during the internship.
- Detailed project goals and objectives.
- Training and guidance on project-specific tools, technologies, or methodologies.

III Technical and Skill Development:

- Training sessions or workshops to enhance technical skills relevant to the internship role (e.g., programming languages, software tools, laboratory techniques).
- Soft skills development, including communication, teamwork, problem solving, and time management

IV Mentorship and Supervision:

- Regular meetings with a designated mentor or supervisor for guidance, feedback, and support.
- Mentorship objectives and expectations.

V Professional Development:

- Sessions on professional etiquette, networking, and building a personal brand
- Resume writing and interview preparation workshops.

VI Industry and Field-Specific Knowledge:

- Lectures, seminars, or presentations on industry trends, best practices, and emerging technologies.
- Guest speakers from the field to share insights and experiences.

VII Reporting and Documentation:

- Training on how to document project progress, results, and findings.
- Practice in creating reports, presentations, or other deliverable.

VIII Ethics and Professionalism:

- Discussions on ethical considerations within the field.
- Scenarios and case studies related to ethical decision-making

IX Feedback and Evaluation:

- Regular performance evaluations and feedback sessions.
- Self-assessment and goal-setting exercises.

X Networking and Industry Exposure:

- Opportunities to attend industry conferences, webinars, or networking events.
- Encouragement to connect with professionals in the field.

NOTE

As per AICTE guidelines, in Summer Internship-I, students are required to be involved in Inter/ Intra Institutional Activities viz;

- Training with higher Institutions;
- Soft skill training organized by Training and Placement Cell of the respective institutions;
- contribution at incubation/ innovation /entrepreneurship cell of the institute;
- participation in conferences/ workshops/ competitions etc.;
- Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop;
- Working for consultancy/ research project within the institutes and
- Participation in all the activities of Institute's Innovation Council for eg: IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

DIPLOMA CURRICULUM OF MECHANICAL ENGINEERING (SECOND YEAR) (4th Semester)

(To be implemented from 2025-26)

Prepared by;

National Institute of Technical Teachers' Training & Research Kolkata
Block – FC, Sector – III, Salt Lake City, Kolkata – 700106

Vetted by:
Domain experts from Polytechnics of Odisha

State Council for Technical Education & Vocational Training
Near Raj Bhawan, Unit-VIII, Bhubaneswar, Odisha

Table of Contents

PROGRAMME TITLE: MECHANICAL ENGINEERING

SEMESTER - IV

SL. No	Category of Course	Code No	Course Title	Study Scheme				Evaluation Scheme				Total Marks	Credits
				Pre-requisite	Contact Hours/ week			Theory		Practical			
					L	T	P	End Exam	Progressive Assessment	End Exam	Progressive Assessment		
1	Programme core	MEPC202 TH:1	Theory of machines & mechanism		3	0	0	70	30	-	-	100	3
2		MEPC204 TH:2	Thermal Engineering-II		3	0	0	70	30	-	-	100	3
3		MEPC206 TH:3	Computer-integrated Manufacturing (CIM)		3	0	0	70	30	-	-	100	3
4		MEPC208 PR:1	Theory of machines & mechanism lab		0	0	4	-	-	15	35	50	2
5		MEPC210 PR:2	Thermal Engineering-II lab		0	0	4	-	-	15	35	50	2
6		MEPC212 PR:3	CAD/CAM Lab		0	0	4	-	-	15	35	50	2
7	Programme elective	MEPE202 (Any one) TH:4	(a). Refrigeration and Air Conditioning (b). Renewable Energy Technologies c) Hydraulics & Pneumatics		3	0	0	70	30	-	-	100	3
8		MEPE204 (Any one) TH:5	(a). Computer-Aided Design and Manufacturing (b). Tool Engineering (c). Mechatronics		3	0	0	70	30	-	-	100	3
9	Minor Project	PR202 PR:4	MINOR PROJECT		0	0	4	-	-	30	70	100	2
10	**Mandatory**	AU202	Essence of Indian knowledge and tradition		**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL					**17**		**16**	**350**	**150**	**75**	**175**	**750**	**23**

SEMESTER - IV COURSES

TH:1- THEORY OF MACHINES & MECHANISM

L	T	P		Course Code: MEPC202	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam	70
				Progressive Assessment	30
Pre Requisite		**: Nil**			
Credit		**3**		Category of Course : PC	

RATIONALE: This course provides foundational knowledge in machine elements and mechanical systems, focusing on the motion, design, and analysis of mechanisms. It equips students with the skills to apply kinematics, dynamics, and innovation in real-world mechanical applications.

LEARNING OUTCOMES:

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

- Explain different machine elements and mechanisms.
- Analyze kinematics and dynamics of various machines and mechanisms.
- Select suitable drives and mechanisms for specific applications.
- Apply the concepts of balancing and vibration in mechanical systems.
- Develop the ability to generate innovative mechanical design ideas.
- Identify different types of cams and their motions.

DETAILED COURSE CONTENTS

Unit	Topic/Subtopic	Hours
I	**Simple mechanism:** Link ,kinematic pair and types (Lower pair and higher pair) , kinematic chain, mechanism, Inversion, four bar link mechanism and its inversion **Cams and Followers:** Concept; Definition and application of Cams and Followers; Classification of Cams and Followers; Different follower motions and their displacement diagrams like uniform velocity, SHM, uniform acceleration and Retardation;	7
II	**Power Transmission:** Types of Drives – Belt, Chain, Rope, Gear drives & their comparison; Belt Drives - flat belt, V– belt & its applications; Material for flat and V-belt; Angle of lap, Belt length. Slip and Creep; Determination of Velocity Ratio, Ratio of tight side and slack side tension; Centrifugal tension and Initial tension; Condition for maximum power transmission (Simple numericals); Chain Drives – Advantages & Disadvantages; Selection of Chain & Sprocket wheels; Methods of lubrication; Gear Drives – Spur gear terminology; Types of gears and gear trains, their selection for different applications; Train value & Velocity ratio for compound, reverted and simple epicyclic gear train; Methods of lubrication; Law of gearing; Rope Drives – Types, applications, advantages & limitations of Steel ropes.	11

III	**Flywheel and Governors:** Flywheel - Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-Stroke I.C. Engine (no Numericals); Coefficient of fluctuation of energy, Coefficient of fluctuation of speed and its significance; Governors - Types and explanation with neat sketches (Centrifugal, Watt and Porter);Concept, function and applications & Terminology of Governors (sensitivity, stability and isochronisms); Simple numericals on Watt and Porter Governor. Comparison between Flywheel and Governor	10
IV	**Brakes, Dynamometers, Clutches & Bearings**: Function of brakes and dynamometers; Types of brakes and Dynamometers; Comparison between brakes and dynamometers; Construction and working of i) shoe brake, ii) Band Brake, Numerical problems to find braking force and braking torque for shoe & band brakes;Concept of Self Locking & Self energizing brakes Construction and working of i) Rope Brake Dynamometer, ii) Hydraulic Dynamometer Clutches- Uniform pressure and Uniform Wear theories; Function of Clutch and its application; Construction and working of i) Single plate clutch, ii) Multiplate clutch, iii) Centrifugal Clutch iv) Cone clutch and v) Diaphragm clutch. (Simple numericals on single and Multiplate clutch) Bearings – i) Simple Pivot, ii) Collar Bearing, iii) Conical pivot. Torque & power lost in friction (no derivation). Simple numericals.	10
V	**Balancing & Vibrations:** Concept of balancing; Balancing of single rotating mass; Graphical method for balancing of several masses revolving in same plane; Concept and terminology used in vibrations, Causes of vibrations in machines; their harmful effects and remedies.	7

REFERENCES:

1. Theory of machines – S.S .Rattan ,Tata McGraw-Hill publications.
2. Theory of machines – R.K.Bansal ,Laxmi publications
3. Theory of machines – R.S. Khurmi & J.K.Gupta , S.Chand publications.
4. Dynamics of Machines – J B K Das, Sapna Publications.
5. Theory of machines – Jagdishlal, Bombay Metro – Politan book Ltd.

TH:2- THERMAL ENGINEERING-II

L	T	P	Total Marks: 100	Course Code: MEPC204	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45Hrs		End Term Exam	: 70
				Progressive Assessment	: 30
Pre Requisite		**:** Thermal Engineering- I(MEPC209)			
Credit		**: 3**		Category of Course : PC	

RATIONALE:

Subject knowledge of thermal engineering is required in many industries. The objective of this course is to establish basic fundamental and practical knowledge in the field of gas turbines, jet propulsion, properties of steam, steam generator etc. These are major fields of mechanical engineering. Student will be able to understand different systems and apply its competencies in major fields in related industries. Knowledge of alternate fuels is required as emerging field and today's need of society which will be provided by the course content.

LEARNING OUTCOMES:

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

- Explain the working cycle of gas turbines, and the working of Jet and Rocket Engines apart from identifying the fuels used for Jet and Rocket propulsion.
- Compute the work done, enthalpy, internal energy and entropy of steam at given conditions using steam tables and Mollier chart.
- Distinguish between water tube and fire-tube boilers and explain the function all the mountings and accessories.
- Calculate Velocity of steam at the exit of nozzle in terms of heat drop analytically and by using Mollier chart.
- State the necessity of governing and compounding of a turbine.
- Explain the principle of working of a steam turbine and distinguish between the impulse turbines and reaction turbines.

DETAILED COURSE CONTENTS

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	**Gas Turbines:** Air-standard Brayton cycle; Description with p-v and T-S diagrams; Gas turbines Classification: open cycle gas turbines and closed cycle gas turbines; comparison of gas turbine with reciprocating I.C. engines and steam turbines. Applications and limitations of gas turbines; General lay-out of Open cycle constant pressure gas turbine; P-V and T-S diagrams and working; General lay-out of Closed cycle gas turbine; P-V and T-S diagrams and working. **Jet Propulsion:** Principle of jet propulsion; Fuels used for jet propulsion; Applications of jet propulsion; Working of a turbojet engine; Principle of Ram effect; Working of a Ram jet engine; Principle of Rocket propulsion; Working principle of a rocket engine; Applications of rocket propulsion; Comparison of jet and rocket propulsions.	10

II	**Properties of Steam:** Formation of steam under constant pressure; Industrial uses of steam; Basic definitions: saturated liquid line, saturated vapor line, liquid region, vapor region, wet region, superheat region, critical point, saturated liquid, saturated vapor, saturation temperature, sensible heat, latent heat, wet steam, dryness fraction, wetness fraction, saturated steam, superheated steam, degree of superheat; Determination of enthalpy, internal energy, internal latent heat, entropy of wet, dry and superheated steam at a given pressure using steam tables and Mollier chart for the following processes: Isochoric process, Isobaric process, Hyperbolic process, Isothermal process, Isentropic process, Throttling process, Polytropic process; Simple direct problems on the above using tables and charts; Steam calorimeters: Separating, throttling, Combined Separating and throttling calorimeters – problems.	10
III	**Steam Generators:** Function and use of steam boilers; Classification of steam boilers with examples; Brief explanation with line sketches of Cochran, Babcock and Wilcox Boilers; Comparison of water tube and fire tube boilers; Description with line sketches and working of modern high pressure boilers Lamont and Benson boilers; Boiler mountings: Pressure gauge, water level indicator, fusible plug, blow down cock, stop valve, safety valve, (dead weight type, spring loaded type, high pressure and low water safety alarm); Boiler accessories: feed pump, economizer, super heater and air preheater; Study of steam traps & separators; Explanation of the terms: Actual evaporation, equivalent evaporation, factor of evaporation, boiler horse power and boiler efficiency; Formula for the above terms without proof; Simple direct problems on the above; Draught systems (Natural, forced & induced).	8
IV	**Steam Nozzles:** Flow of steam through nozzle; Velocity of steam at the exit of nozzle in terms of heat drop using analytical method and Mollier chart; Discharge of steam through nozzles; Critical pressure ratio; Methods of calculation of cross-sectional areas at throat and exit for maxi- mum discharge; Effect of friction in nozzles and Super saturated flow in nozzles; Working steam jet injector; Simple numerical problems.	10
V	**Steam Turbines:** Classification of steam turbines with examples; Difference between impulse & reaction turbines; Principle of working of a simple De-lavel turbine with line diagrams- Velocity diagrams; Expression for work done, axial thrust, tangential thrust, blade and diagram efficiency, stage efficiency, nozzle efficiency; Methods of reducing rotor speed; compounding for velocity, for pressure or both pressure and velocity; Working principle with line diagram of a Parson's Reaction turbine–velocity diagrams; Simple problems on single stage impulse turbines (without blade friction) and reaction turbine including data on blade height. Bleeding, re-heating and re-heating factors(Problems omitted); Governing of steam turbines: Throttle, By-pass & Nozzle control governing.	7

REFERENCES:

1. A Course in Thermal Engineering – S. Domkundwar & C. P. Kothandaraman, Dhanpat Rai & Publication, New Delhi
2. Thermal Engineering – R. K. Rajput, Laxmi Publication New Delhi
3. Thermal Engineering – P. L. Ballaney, Khanna Publishers, 2002
4. Treatise on Heat Engineering in MKS and SI Units – V. P. Vasandani & D.S. Kumar, Metropolitan Book Co. Pvt. Ltd, New Delhi.

TH:3- COMPUTER-INTEGRATED MANUFACTURING (CIM)

L	T	P		
3	0	0		**Course Code: MEPC206**
Total Contact Hours				**Theory Assessment**
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam 70
				Progressive Assessment 30
Pre Requisite		**: Nil**		
Credit		**3**		Category of Course : PC

RATIONALE: Computer Integrated Manufacturing (CIM) encompasses the entire range of product development and manufacturing activities with all the functions being carried out with the help of dedicated software packages. CIM is considered a natural evolution of the technology of CAD/CAM. The product data is created during design and this data is transferred from the modeling software to manufacturing software without any loss of data.

LEARNING OUTCOMES:

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

- Describe basic components and networks involved in CIM.
- Illustrate hardware, software and product modeling at industry level
- Apply process planning and program coding of task.
- Design a manufacturing cell and cellular manufacturing system.
- Design automated material handling and storage systems for a typical production system.

DETAILED COURSE CONTENTS

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	Concept of Computer Integrated Manufacturing (CIM); Basic components of CIM; Distributed database system; distributed communication system, computer networks for manufacturing; future automated factory; social and economic factors.	10
II	Computer Aided Design (CAD): CAD hardware and software; product modelling, automatic drafting; engineering analysis; FEM design review and evaluation; Group Technology Centre.	10
III	Computer Aided Manufacturing (CAM), Computer assisted NC part programming for plain turning and step turning; Computer assisted robot programming; computer aided process planning (CAPP); computer aided material requirements planning (MRP)	8
IV	Computer aided production scheduling; computer aided inspection planning; computer aided inventory planning, Flexible manufacturing system (FMS); concept of flexible manufacturing.	10
V	Integrating NC machines, robots, AGVs, and other NC equipment; Computer aided quality control; business functions, computer aided forecasting; office automation	7

REFERENCES:

1. CAD, CAM, CIM by P. Radhakrishnan and S. Subramanyan, New Age International Publishers.
2. Computer Integrated Manufacturing by Paul G. Rankey, Prentice Hall.
3. Robotics Technology and Flexible Automation – S.R. Deb, TMH

PR:1- THEORY OF MACHINES & MECHANISM LAB

L	T	P		
0	0	4		**Course Code: MEPC208**
Total Contact Hours				**Practical Assessment**
Practical		: 60Hrs	**Total Marks: 50**	End Term Exam 15
				Progressive Assessment 35
Pre Requisite		**: Nil**		
Credit		**2**		Category of Course : PC

RATIONALE: This lab provides hands-on experience in analyzing and understanding the motion of various machine mechanisms. It enhances the students' ability to apply theoretical concepts in kinematics and dynamics to real-world mechanical systems.

LEARNING OUTCOMES:

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

- Identify various links in popular mechanisms.
- Select suitable mechanismfor various applications.
- Analyze the motion of cams and followers.
- Select relevant belts, chains and drives for different applications.
- Select relevant brakes and clutches for various applications
- Select suitable flywheel and governor for various applications.

DETAILED COURSE CONTENTS

Sl. No.	List of Experiments
1.	Measure the ratio of time of cutting stroke to the return stroke in shaping machine available in institute's workshop by varying the stroke length.
2.	Estimate important kinematic data related to following mechanisms and sketch them (any one) a. Bicycle free wheel sprocket mechanism b. Geneva mechanism c. Ackerman's steering gear mechanismc d. Foot operated air pump mechanism
3.	Study of construction and working principle of Eddy current Dynamometers
4.	Determine velocity and acceleration of various links of the given mechanism (any two) by relative velocity method for analysis of motion of links size drawing sheet).
5.	Determine velocity and acceleration in an I. C. engine's slider crank mechanism by Kleins's construction
6.	Drawing of profile of radial cam with knife-edge and roller follower with offset reciprocating motion (graphical method).
7.	Drawing of profile of radial cam with knife-edge and roller follower without offset reciprocating motion (graphical method).
8.	Estimate slip, length of belt, angle of contact in an open and cross belt drive.
9.	Calculate braking torque at different speeds and load situations of i) Internal expanding shoe brake ii) Disc Brake
10.	Assemble and dissemble different clutches.

11.	Measureradius and height of anytwo types of governors for different rotational speeds, mass of balls and spring stiffness (in spring loaded governors)
12.	Perform balancing of rotating unbalanced system

REFERENCES:

6. Theory of machines – S.S .Rattan ,Tata McGraw-Hill publications.
7. Theory of machines – R.K.Bansal ,Laxmi publications
8. Theory of machines – R.S. Khurmi & J.K.Gupta , S.Chand publications.
9. Dynamics of Machines – J B K Das, Sapna Publications.
10. Theory of machines – Jagdishlal, Bombay Metro – Politan book Ltd.

PR:2- THERMAL ENGINEERING-II LAB

L	T	P		**Course Code: MEPC210**	
0	0	4			
Total Contact Hours				**Practical Assessment**	
Practical		: 60Hrs	**Total Marks: 50**	End Term Exam	35
				Progressive Assessment	15
Pre Requisite		**: Nil**			
Credit		**2**		Category of Course : PC	

RATIONALE: Thermal Engineering-II Lab provides hands-on experience with heat exchangers, boilers, steam turbines, and refrigeration systems. It helps students understand energy conversion, efficiency analysis, and thermal system performance in practical applications.

LEARNING OUTCOMES:

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

- Evaluate the performance characteristics of single cylinder diesel/petrol engine at different loads and draw the heat balance sheet.
- Find the indicated power of individual cylinders of an engine by using morse test.
- Evaluate the performance characteristics Multi stage air compressor
- Evaluate the co efficient of performance of refrigerator
- Find the thermal conductivity of material

LIST OF EXPERIMENTS

1. Study of high-pressure boiler with model
2. Study of boiler mountings and accessories
3. Conduct performance test on VCR test rig to determine COP of the refrigerator
4. Conduct performance test on multi stage reciprocating compressor
5. Conduct Morse test to determine the indicated power of individual cylinders
6. Conduct Performance test on 2-S CI/SI engine.
7. Conduct Performance test on 4-S CI/SI engine.
8. Conduct Heat balance test on CI/SI engine.
9. Conduct Economical speed test on 4-S CI/SI engine.
10. Thermal conductivity test on 1) Thick slab 2) Composite wall 3) Thick cylinder
11. Leak detection of refrigeration equipment
12. Conduct performance test on A/C test rig to determine COP of the refrigerator

REFERENCES

1. Thermal Engineering – P.L. Ballaney, Khanna Publishers, 2002
2. A Course in Thermal Engineering – S. Domkundwar & C.P. Kothandaraman, Dhanpat Rai & Publication New Delhi
3. Thermal Engineering – R.S. Khurmi and J.K. Gupta, 18th Edition, S. Chand & Co, NewDelhi

PR:3- CAD/CAM LAB

L	T	P		**Course Code: MEPC212**	
0	0	4			
Total Contact Hours				**Theory Assessment**	
Practical		: 60Hrs	**Total Marks: 50**	End Term Exam	35
				Progressive Assessment	15
Pre Requisite		**: Nil**			
Credit		**2**		Category of Course : PC	

RATIONALE: CAD/CAM Lab provides hands-on experience in computer-aided design (CAD) and computer-aided manufacturing (CAM) for product modeling and machining. It helps students develop skills in 3D modeling, CNC programming, and simulation for modern manufacturing applications.

LEARNING OUTCOMES:

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

- Explain the 3D commands and features of a CAD software
- Create 3D solid model and find the mass properties of simples solids
- Demonstrate the working of CNC turning and milling machine
- Develop the part program using simulation software for Lathe and Milling
- Assess the part program, edit and execute in CNC turning and machining centre

LIST OF EXPERIMENTS

S. No.	Topics for practice
PART-A	Introduction: Part modelling; Datum Plane; constraint; sketch; dimensioning; extrude; revolve; sweep; blend; protrusion; extrusion; rib; shell; hole; round; chamfer; copy; mirror; assembly; align; orient. Exercises: 3D Drawings of 1). Geneva Wheel; 2). Bearing Block; 3). Bushed bearing: 4). Gib and Cotter joint; 5). Screw Jack; 6). Connecting Rod: Note: Print the orthographic view and sectional view from the above assembled 3D drawing.
PART-B	CNC Programming and Machining: Introduction; 1). Study of CNC lathe, milling; 2). Study of international standard codes: G-Codes and M-Codes; 3). Format – Dimensioning methods; 4). Program writing – Turning simulator – Milling simulator, IS practice – commands menus; 5). Editing the program in the CNC machines; 6). Execute the program in the CNC machines; Exercises: Note: Print the Program from the Simulation Software and make the Component in the CNC Machine. CNC Turning Machine: (Material: Aluminium/Acrylic/Plastic rod) 1. Using Linear and Circular interpolation - Create a part program and produce component in the Machine. 2. Using Stock removal cycle – Create a part program for multiple turning operations

	and produce component in the Machine. 3. Using canned cycle - Create a part program for thread cutting, grooving and pro duce component in the Machine. CNC Milling Machine (Material: Aluminium/ Acrylic/ Plastic) 1. Using Linear interpolation and Circular interpolation – Create a part program for grooving and produce component in the Machine. 2. Using canned cycle - Create a part program for drilling, tapping, counter sinking and produce component in the Machine. 3. Using subprogram - Create a part program for mirroring and produce component in the Machine.

REFERENCES

1. Machine Drawing – P.S. Gill S. K. Kataria & Sons, Delhi., 17th Revised edition, 2001
2. Mechanical Draughtsmanship - G.L. Tamta Dhanpat Rai & Sons, Delhi, 1992
3. Inside AutoCAD – D. Raker and H. Rice, BPB Publications, New Delhi, 1985
4. CAD/CAM/CIM – P. Radhakrishnan, S. Subramaniyan & V. Raju, New Age International Pvt. Ltd., New Delhi, 3rd Edition,
5. Engineering AutoCAD, A.P. Gautam & Pradeep Jain, Khanna Book Publishing Co., Delhi

TH:4(a)- REFRIGERATION AND AIR CONDITIONING

L	T	P		**Course Code: MEPE202(a)**	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam	70
				Progressive Assessment	30
Pre Requisite		**: Nil**			
Credit		**3**		Category of Course : PE	

RATIONALE: Main objective of the course in refrigeration and air conditioning is to make the students understand the basics of Refrigeration cycles. The basics of vapor compression and vapor absorption systems, components and refrigerants and lubricants of a refrigeration system, control strategies for refrigeration system and air conditioning systems are elaborated in this course.

LEARNING OUTCOMES:

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

- Define refrigeration and types of Refrigeration cycles
- Explain Vapor Compression and Vapor Absorption System working principles
- Identify the components required for refrigeration system.
- Identify the controlling components for a refrigeration system.
- Explain the working principles of Air-conditioning.

DETAILED COURSE CONTENTS

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	Introduction to Refrigeration: Definition of Refrigeration; Refrigerating effect- unit of refrigeration- Coefficient of performance; Types of Refrigeration-Ice, dry ice, Steam jet, Throttling, Liquid nitrogen refrigeration; Carnot refrigeration Cycle; Air refrigeration- Bell - Coleman cycle, PV& TS diagram; Advantage and disadvantages in air refrigeration; Simple problems	10
II	Refrigeration systems: Basic Components, Flow diagram of working of Vapour compression cycle; Representation of the vapour compression cycle on P-H, T-S & P-V Diagram; Expression for Refrigerating effect, work done and power required; Types of Vapour Compression cycle; Effects of super heating and under cooling, its advantages and disadvantages; Simple Vapour absorptions cycle and its flow diagram; Simple Electrolux system for domestic units; Comparison of Vapour absorption and vapour compression system; Simple problems on vapour compression cycle.	10
III	Refrigeration equipment: Compressor - types of compressors; Hermetically sealed and Semi hermetically sealed compressor; Condensers - Air Cooled, water cooled, natural and forced draught cooling system; Advantages and disadvantages of air cooled and water cooled condensers; Evaporators -natural, convection, forced convection types.	8
IV	Refrigerant flow controls: Capillary tube; Automatic Expansion valve; Thermo-static expansion valve; High side and low side float valve; Solenoid valve; Evaporator pressure regulator. Application of refrigeration: Slow and quick freezing; Cold storage and Frozen storage; Dairy refrigeration; Ice making industry; Water coolers.	8

V	**Air conditioning:** Introduction to Air conditioning; Factors affecting Air conditioning; Psychometric chart and its use; Psychometric process-sensible heating and cooling, Humidifying and dehumidifying; Adiabatic saturation process; Equipment used in air conditioning cycle; Air conditioning units and plants. **Refrigeration and Air-conditioning tools:** Tools used in refrigeration and Air conditioner installation; Installation procedure; Faults in refrigeration and air conditioning system; Servicing procedure.	9

REFERENCES:

1. Refrigeration and Air Conditioning – Sadhu Singh, Khanna Book Publishing Co., New Delhi
2. Refrigeration and Air Conditioning – S. Domakundawar, Dhanpat Rai publications.
3. Refrigeration and Air Conditioning – A.S.Sarao & G.S. Gabi, 6th edition, Satya Prakashan publications, New Delhi, 2004.
4. Principles of Refrigeration – Roy J.Dossat, 5th edition, Pearson Publications, 2001.
5. Refrigeration and Air Conditioning – M.Zakria Baig, Premier/ Radiant Publishing House.
6. Refrigeration and Air Conditioning – C.P Arora, Tata McGraw Hill Education, 2000.

TH:4(b)- RENEWABLE ENERGY TECHNOLOGIES

L	T	P		
3	0	0		**Course Code: MEPE202(b)**
Total Contact Hours				**Theory Assessment**
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam 70
				Progressive Assessment : 30
Pre Requisite		**: Nil**		
Credit		**3**		Category of Course : PE

RATIONALE: The knowledge of renewable energy technologies is very much needed for diploma holders of mechanical engineering. The course is designed to give knowledge of various renewable energy sources, systems and applications in the present context and need.

LEARNING OUTCOMES:

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

- Illustrate importance of renewable energy sources
- Describe various types of renewable energy technologies
- State applications of different renewable energy sources

DETAILED COURSE CONTENTS

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	Scenario of Renewable Energy (RE) Sources: Needs of renewable energy, advantages and limitations of RE, present energy scenario of conventional and RE sources. Solar Energy: Energy available from the sun, spectral distribution, solar radiation outside the earth's atmosphere and at the earth's surface, solar radiation geometry, Instruments for solar radiation measurements, empirical equations for prediction of availability of solar radiation, radiation on tilted surface solar energy conversion into heat, types of solar collectors, evacuated and non-evacuated solar air heater, concentrated collectors, thermal analysis of liquid flat plate collector, air heater and cylindrical parabolic collector, solar energy thermal storage, heating and cooling of buildings, solar pumping, solar cooker, solar still, solar drier, solar refrigeration and air conditioning, solar pond, heliostat, solar furnace photovoltaic system for power generation, solar cell modules and arrays, solar cell types, material, applications, advantages and disadvantages	10
II	Wind Energy: Energy available from wind, basics of lift and drag, basics of wind energy conversion system, effect of density, angle of attack and wind speed, windmill rotors, horizontal and vertical axes rotors, drag, lift, torque and power coefficients, tip speed ratio, solidity of turbine, wind turbine performance curves, wind energy potential and site selection, basics of wind farm	10

III	Bio Energy : Types of biogas plants, biogas generation, factors affecting biogas generation, advantages and disadvantages, biomass energy, energy plantation, gasification, types and applications of gasifiers, concept of green energy.	8
IV	Ocean Energy: OTEC principle, open, closed and hybrid cycle OTEC system, Energy from tides, estimation of tidal power, tidal power plants, single and double basin plants, site requirements, advantages and limitations, wave energy, wave energy conversion devices, advantages and disadvantages, ocean thermal energy	10
V	Geothermal energy: Introduction, vapor and liquid dominated systems, binary cycle, hot dry rock resources, magma resources, advantages and disadvantages, applications	7

REFERENCES:

1. Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, McGraw Hill Education
2. Solar Engineering of Thermal Processes, John A. Duffie, William A. Beckman, John Wiley, New York
3. Non-conventional energy resources, Shobh Nath Singh, Pearson India
4. Solar Energy Engineering, Soteris Kalogirou, Elsevier/Academic Press
5. Principles of Solar Energy, Frank Krieth & John F Kreider, John Wiley, New York

TH:4(c)- HYDRAULICS & PNEUMATICS

L	T	P		
3	0	0		**Course Code: MEPE202(c)**
Total Contact Hours				**Theory Assessment**
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam 70
				Progressive Assessment 30
Pre Requisite		**: Nil**		
Credit		**3**		Category of Course : PE

RATIONALE: The course aims to provide students with knowledge of fluid power applications in industry and an understanding of hydraulic and pneumatic components and systems. It covers topics like fluid properties, pumps, actuators, control valves, hydraulic circuits, pneumatic systems, troubleshooting, and applications. The course objectives are to teach fluid power principles, hydraulic and pneumatic components, circuit design, and applications in industrial processes.

LEARNING OUTCOMES:

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

- Describe the working principles of fluid power systems.
- Illustrate the fluids and components used in modern industrial fluid power system.
- Develop the design, construction, and operation of fluid power circuits.
- Explain working principles of a pneumatic power system and its components
- Apply the troubleshooting methods in fluid power systems.

DETAILED COURSE CONTENTS

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	**Fluid Power Principles and Hydraulic Pumps** Introduction to Fluid Power – Advantages and Applications – Fluid power systems – Types of fluids Properties of fluids and selection – Basics of Hydraulics – Pascal's Law – Principles of flow – Friction loss – Work, Power, and Torque- Problems, Sources of Hydraulic power: Pumping Theory – Pump Classification – Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criteria of pumps – Fixed and Variable displacement pumps – Problems.	10
II	**Hydraulic Actuators and Control Components-**Hydraulic Actuators: Cylinders – Types and construction, Application, Hydraulic cushioning – Rotary Actuators-Hydraulic motors – Control Components: Direction Control, Flow control and pressure control valves – Types, Construction, and Operation – Accessories: Reservoirs, Pressure Switches – Filters –types and selection-Applications – Fluid Power ANSI Symbols – Problems.	10
III	**Hydraulic Circuits and Systems-**Accumulators, Intensifiers, Industrial hydraulic circuits – Regenerative, Pump Unloading, Double-Pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control, Deceleration circuits, Sizing of hydraulic systems, Hydrostatic transmission, Electro-hydraulic circuits, –Servo and Proportional valves – Applications- Mechanical, hydraulic servo systems.	8

IV	**Pneumatic and Electro Pneumatic Systems**-Properties of air –Air preparation and distribution – Filters, Regulator, Lubricator, Muffler, Air Control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit – classification- single cylinder and multi-cylinder circuits-Cascade method – Integration of fringe circuits, Electro Pneumatic System – Elements – Ladder diagram – timer circuits-Problems, Introduction to fluidics and pneumatic logic circuits.	10
V	**Trouble Shooting and Applications**-Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems, Conditioning of hydraulic fluids Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications- mobile hydraulics; Design of Pneumatic circuits for metalworking, handling, clamping counter and timer circuits. – Low-cost Automation – Hydraulic and Pneumatic power packs, IOT in Hydraulics and pneumatics.	7

REFERENCES:

1. Fluid Power with Applications- Anthony Esposito, Prentice Hall, 2009.
2. Fluid Power Theory and Applications-James A. Sullivan, Fourth Edition, Prentice Hall, 1997.
3. Pneumatics Concepts, Design and Applications -Jagadeesha. T., Universities Press, 2015.
4. Oil Hydraulics Systems – Principles and Maintenance S.R. Mujumdar-Tata McGraw Hill, 2001
5. Hydraulic and Pneumatic Controls- R., Srinivasan. Vijay Nicole Imprints, 3rd edition,2019.

TH:5(a)- COMPUTER-AIDED DESIGN AND MANUFACTURING

L	T	P		**Course Code:** MEPE204(a)	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam	70
				Progressive Assessment	30
Pre Requisite		**: Nil**			
Credit		**3**		Category of Course : PE	

RATIONALE: This subject focuses on the use of computer technology for designing and manufacturing products. It covers CAD for creating detailed 2D and 3D models, and CAM for automated machining and production processes. These subject helps students understand modern design techniques, CNC programming, simulation, and integration of digital tools in manufacturing industries.

LEARNING OUTCOMES:

After completion of the course, the students will be able

- Provide an outline of how computers are being used in mechanical component design.
- Illustrate the application of computers in various aspects of Manufacturing
- Program the CNC machines
- Describe the concept of flexible manufacturing

DETAILED COURSE CONTENTS

Unit No.	**Topic/Sub-Topic**	**Allotted Time (Hours)**
I	INTRODUCTION Product cycle- Design process- sequential and concurrent engineering- Computer aided design — CAD system architecture- Computer graphics — co-ordinate systems- 2D and 3D transformations- homogeneous coordinates — Line drawing -clipping- viewing transformation-brief introduction to CAD and CAM — Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM – CAD/CAM concepts —-Types of production — Manufacturing models and Metrics — Mathematical models of Production Performance	10
II	GEOMETRIC MODELING Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves-Techniques for surface modeling — surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG and B-rep.	10

III	CAD STANDARDS Standards for computer graphics- Graphical Kernel System (GKS) — standards for exchange images- Open Graphics Library (OpenGL) — Data exchange standards — IGES, STEP, CALS etc. — communication standards.	8
IV	FUNDAMENTAL OF CNC AND PART PROGRAMING Introduction to NC systems and CNC — Machine axis and Co-ordinate system- CNC machine tools- Principle of operation CNC- Construction features including structure- Drives and CNC controllers- 2D and 3D machining on CNC- Introduction of Part Programming, types — Detailed Manual part programming on Lathe & Milling machines using G codes and M codes- Cutting Cycles, Loops, Sub program and Macros- Introduction of CAM package.	10
V	CELLULAR MANUFACTURING AND FLEXIBLE MANUFACTURING SYSTEM (FMS) Group Technology(GT), Part Families–Parts Classification and coding–Simple Problems in Opitz Part Coding system–Production flow Analysis–Cellular Manufacturing–Composite part concept–Types of Flexibility — FMS — FMS Components — FMS Application & Benefits — FMS Planning and Control — Quantitative analysis in FMS ME8691 Computer Aided Design and Manufacturing	7

REFERENCES:

1. Mastering CAD CAM -Ibrahim Zeid -Tata McGraw-Hill Publishing Co. 2007.
2. Automation, Production Systems and Computer Integrated Manufacturing -Mikell. P. Groover - Prentice Hall of India, 2008.
3. CAD/CAM/CIM- P, Radhakrishnan, S..Subramanian and V Raju.- 2nd Edition, New Age International (P) Ltd, New Delhi, 2000.
4. CAD/CAM Principles -Chris McMahon and Jimmie Browne -Practice and Manufacturing management" Second Edition, Pearson Education, 1999.
5. Principles of Computer Graphics-William M Neumann and Robert F.Sproul, McGraw Hill Book Co. Singapore, 1989.
6. Computer Graphics-Donald Hearn and M. Pauline Baker. Prentice Hall, Inc, 1992.
7. Computer graphics principles & practice- Foley, Wan Dam, Feiner and Hughes –Pearson Education – 2003.

TH:5(b)- TOOL ENGINEERING

L	T	P		**Course Code: MEPE204(b)**	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam	70
				Progressive Assessment	30
Pre Requisite		**: Nil**			
Credit		**3**		Category of Course : PE	

RATIONALE: Tool Engineering is a subject that focuses on the design, development, and application of cutting tools, jigs, fixtures, and dies used in manufacturing. It covers tool materials, tool design, machining processes, and optimization techniques to enhance production efficiency, precision, and quality in industrial applications.

LEARNING OUTCOMES:

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

- Illustrate concepts, principles and procedures of tool engineering
- Classify and explain various tools and tool operations
- Select proper tool and a die for a given manufacturing operation to achieve highest produc- tivity
- Estimate tool wear and tool life

DETAILED COURSE CONTENTS

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	Metal Cutting: Mechanics of Metal cutting; requirements of tools; cutting forces; types of chips; chip thickness ratio; shear angle ; simple numerical only; types of metal cutting process; or- thogonal; oblique and form cutting; Cutting fluids: types; characteristics and applications. Tool wear: Types of wear; Tool life; Tool life equations.	10
II	Machinability: definition; factors affecting machinability; machinability index. Tool materials: Types; characteristics; applications; Heat treatment of tool steels; Specification of carbide tips; Types of ceramic coatings. Cutting Tool Geometry: Single point cutting tool; drills; reamers; milling; cutters.	10
III	Types of dies and construction: Simple Die; Compound Die; Progressive Die; Combination Die. Punch & Die mountings: pilots; strippers; misfeed detectors; Pressure Pads; Knock outs; stock guide; Feed-Stop; guide bush; guide pins.	8
IV	Die Design Fundamentals: Die Operations; blanking; piercing; shearing; cropping; notchng; lancing; coining; embossing; stamping; curling; drawing; bending; forming; Die set; Die shoe; Die area; Calculation of clearances on die and punch for blanking and piercing dies; Strip layout; Calculation of material utilization factor.	10

V	Forming Dies: Bending methods; Bending Dies; bend allowance; spring back; spanking; bending pressure; pressure pads; development of blank length. Drawing: operations; Metal flow during drawing; Calculation of Drawing blank size; variables affecting metal flow during drawing; single action and double action dies; combination dies. Fundamentals of other Tools: Constructional features of - Pressure Die casting dies; metal extrusion dies; injection molding dies; forging dies; plastic extrusion dies.	7

REFERENCES:

1. Tool Design - Donaldson Anglin, Tata McGraw Hill.
2. Production Technology- H.M.T.Jain, Tata McGraw Hill.
3. A Text Book of Production engineering – P.C. Sharma, S.Chand & Co.
4. Production Technology, R.K.Jain, Khanna Publishers.

TH:5(c)- MECHATRONICS

L	T	P		Course Code: MEPE204(c)	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam	70
				Progressive Assessment	30
Pre Requisite		**: Nil**			
Credit		**3**		Category of Course : PE	

RATIONALE: It is an interdisciplinary subject that integrates mechanical engineering, electronics, computer control, and automation. It covers sensors, actuators, microcontrollers, PLCs, and robotics, helping students understand modern automated systems used in industrial and manufacturing applications.

LEARNING OUTCOMES:

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

- Describe about various types of sensors and transducers.
- Explain the concept of various mechanical, electrical and pneumatic actuation systems.
- Explain the basic mathematical building blocks for mechanical, electrical, thermal and fluid actuation system and its interfacing of input/output requirements.
- Illustrate the basic PLC architecture and PLC programming concepts.
- Describe the design examples of mechatronics system. Explain the condition monitoring of production systems using sensors.

DETAILED COURSE CONTENTS

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	Introduction to Mechatronics: Mechatronics; Importance of Mechatronics; Systems: Mea- surement systems; Control systems and their types; Closed-loop control System; Automatic water level controller; Sequential controllers-washing machine Measurement System terminology: Displacement, Position & Proximity Sensors; Velocity and Mo- tion Sensors; Force Sensors; Fluid Pressure Sensors; Flow Sensors; Liquid Level Sensors; Tempera- ture Sensors; Light Sensors; Selection of Sensors.	10
II	Mechanical Actuation Systems: Types of motion; Freedom and constraints; Loading; Gear Trains; Pawl & Ratchet; Belt & Chain drives; Bearings: Selection, Ball & Roller bearings; Mechanical aspects of motor selection. Electrical Actuation Systems: Switches & Relays; Solenoids; D.C Motors; A.C.Motors; Stepper Mo- tors: Specifications and Control of stepper motors; Servomotors: D.C Servomotor and A.C Servomotor. Pneumatic & Hydraulic Systems: Power supplies; DCV; PCV; Cylinders; Rotary actuators.	10
III	Mathematical Model: Introduction to Mathematical model; Mechanical System building blocks; Electrical System building blocks; Fluid System building blocks; Thermal System building blocks. System Model: Engineering.Systems: Rotational, Translational Systems; Electro-Mechanical System; Hydro-Mechanical System.	8

	Input/Output Systems: Interfacing; Input/output ports; Interface requirements: Buffers, Hand- shaking, Polling and interrupts, Serial interfacing; Introduction to PIA; Serial communications inter- face; Example of interfacing of a seven-segment display with a decoder.	
IV	Programmable Logic Controller (PLC): Definition; Basic block diagram and structure of PLC; Input/Output processing; PLC Programming: Ladder diagram, its logic functions, Latching and Sequencing; PLC mnemonics; Timers; Internal relays and Counters; Shift registers; Master and Jump Controls; Data handling; Analog input/output; Selection of PLC.	10
V	Design Examples & Advanced Applications in Mechatronics: Design process stages;Traditional Vs Mechatronics designs; Possible design solutions: Timed switch, Wind-screen wiper motion, Bath room scale; Case studies of Mechatronics systems: A pick-and-place robot, Car park barrier, Car engine management system, Automatic Camera and Automatic Washing Machine only.Sensors for Condition Monitoring Systems of Production Systems: Examples of Monitoring methods: Vibration monitoring, Temperature monitoring, Wear behavior monitoring; Mechatronics control in automated manufacturing: Monitoring of Manufacturing processes, On-line quality moni- toring, Model based systems, Hardware in-the-loop simulation, Supervisory control in manufacturing inspection, Integration of heterogeneous systems	7

REFERENCES:

1. Mechatronics – W. Bolton, Pearson Education India.
2. A Text Book on Mechatronics – R.K.Rajput, S.Chand& Co, New Delhi.
3. Mechatronics – M.D.Singh & Joshi, Prentice Hall of India.
4. Mechatronics – HMT, Tata McGraw Hill, New Delhi.
5. Mechatronics System – Devadas Shetty, PWS Publishing
6. Exploring Programmable Logic Controllers with applications – Pradeep Kumar Srivastava, BPB Publications.

PR:4- MINOR PROJECT

<table>
<tr><td>L</td><td>T</td><td>P</td><td rowspan="8">Total Marks: 100</td><td colspan="2">Course Code: PR202</td></tr>
<tr><td>0</td><td>0</td><td>4</td><td colspan="2">Laboratory Assessment</td></tr>
<tr><td colspan="3">Total Contact Hours</td><td colspan="2">End Term Exam 30</td></tr>
<tr><td colspan="3">Practical : 60Hrs</td><td colspan="2">Progressive Assessment 70</td></tr>
<tr><td colspan="3"></td><td colspan="2"></td></tr>
<tr><td colspan="3">Pre Requisite : Nil</td><td colspan="2"></td></tr>
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<tr><td colspan="3">Credit 2</td><td colspan="2">Category of Course : Project</td></tr>
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RATIONALE:

A Minor project is generally requires a larger amount of effort and more independent work than that involved in a normal assignment. It requires students to undertake their own fact-finding and analysis. The students will select the topic, perform and design work. Minor project is as preparation for the students to take on more responsibilities and bigger project in the future. It is a learning experience, which aims to provide students with the opportunity to synthesize knowledge from different areas of learning, and critically and creatively apply it to real life situations. The leadership quality, co-ordination of job and maintaining good communal harmony is an important factor of this type of activity.

LEARNING OUTCOMES:

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

- Plan a Minor Project
- Execute a Minor Project with team.
- Implement hardware/software/analytical/numerical techniques, etc. based on project requirements.
- Optimize time related works through sharing of work responsibility
- Develop cost awareness and utilisation of fund.
- Prepare a technical report on the project.

GUIDELINES FOR MINOR PROJECT

- Minimum three and maximum five students can form a group for the minor project.
- Project type can include
    - Development of a simple prototype system/product.
    - Investigation of performance of some systems using experimental method
    - Analysis of components/systems/devices using suitable software
    - Investigation of optimum process/material for product development using market survey.
    - Solution for society/industry problems
- Project domain may not be limited to the specific area / discipline.
- Project report to be prepared and submitted by the students with following components:
    1. Title
    2. Objectives
    3. Relevance and significance
    4. Methodology
    5. Analysis-Simulation/experimentation/survey/testing etc.
    6. Result and Discussion
    7. Conclusion

ESSENCE OF INDIAN KNOWLEDGE AND TRADITION

L	T	P		Course Code: AU202	
2	0	0			
Total Contact Hours				Theory Assessment	
Theory		: 30Hrs	Total Marks: NA	End Term Exam	0
				Progressive Assessment*	100
Pre Requisite		: Nil			
Credit		0		Category of Course : Mandatory	

***Mandatory Audit Courses will be assessed only for confirmation of student learning without reflecting in the total scores or Credit.**

RATIONALE:

Considering the need of protecting Indian knowledge and tradition, the diploma level students of Automobile Engineering should be facilitated the concepts Indian traditional knowledge and to make themunderstand the importance of roots of knowledge system and methods of application in today's life and how to protect traditional knowledge system. Interpretation of the concepts of Intellectual property to protect the traditional knowledge as well as importance of Traditional knowledge in Agriculture and Medicine must be known.

COURSE OUTCOME:

On successful completion of the course, students will be able to

- Discuss the concepts of traditional Indian knowledge and roots of knowledge system and indigenous knowledge system
- Explain the technique of protection of traditional Indian knowledge
- Discuss legal frameworks of traditional knowledge
- State intellectual property rights
- State traditional knowledge in Different Sectors

DETAILED COURSE CONTENTS

UNIT	TOPIC/SUB-TOPIC	Allotted HRS.
1	Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge (Unani / Siddha/ Ayurveda), Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge of Odisha	07
2	Protection of traditional knowledge (TK): The need for protecting traditional knowledge, Significance of TK Protection, value of TK in global economy, Role of Governmentto harness TK.	07
3	Legal framework and TK: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 andRules 2004, the protection of traditional knowledge bill, 2016.	06
4	Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, Geographical Indications (GI).	04

5	Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK	06

REFERENCES:

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. "Knowledge Traditions and Practices of India" Kapil Kapoor.
3. Madhya Himalayi Sanskriti mein Gyan, Vigyan evam Paravigyan by Prof PC Pandey.

Suggested Online Link:

Web Links:

1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/12110600/