DIPLOMA CURRICULUM OF

MECHANICAL ENGINEERING

(SECOND YEAR)

(3rd 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 – 700 106

Vetted by:

Domain experts from Polytechnics of Odisha

State Council for Technical Education & Vocational Training

Near Raj Bhawan, Unit-VIII, Bhubaneswar, Odisha

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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	TH-01	Manufacturing Processes		3	0	0	70	30	-	-	100	3
2		TH-02	Strength of Materials		3	0	0	70	30	-	-	100	3
3		TH-03	Material Science and Engineering		3	0	0	70	30	-	-	100	3
4		TH-04	Fluid Mechanics & Fluid Power		3	0	0	70	30	-	-	100	3
5		Th-05	Thermal Engineering-I		3	0	0	70	30	-	-	100	3
6		PR-01	Manufacturing Engineering Lab-I		0	0	4	-	-	15	35	50	2
7		PR-02	Material Testing and Metallography Lab		0	0	4	-	-	15	35	50	2
8		PR-03	Fluid mechanics & Fluid Power Lab		0	0	4	-	-	15	35	50	2
9		PR-04	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

MANUFACTURING PROCESSES

L	T	P	Total Marks: 100	Course Code: (TH-01)	
3	0	0		**Theory Assessment**	
Total Contact Hours				End Term Exam	70
Theory		: 45Hrs		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 centreless grinding; Advantages & limitations of centreless 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

STRENGTH OF MATERIALS

L	T	P	Total Marks: 100	Course Code: (TH-02)	
3	0	0		**Theory Assessment**	
Total Contact Hours				End Term Exam	70
Theory		: 45Hrs		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 centre 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

MATERIAL SCIENCE & ENGINEERING

L	T	P		
3	0	0		**Course Code: (TH-03)**
Total Contact Hours				**Theory Assessment**
Theory		: 45Hrs		End Term Exam 70
			Total Marks: 100	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; Types of 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 aluminium, copper, tin, lead, zinc, magnesium and nickel; Copper alloys: Brasses, bronzes – composition, properties and uses; Aluminium 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

Fluid Mechanics & Fluid Power

L	T	P	Total Marks: 100	Course Code: (TH-04)	
3	0	0		**Theory Assessment**	
Total Contact Hours				End Term Exam	70
Theory		: 45Hrs		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.

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.

THERMAL ENGINEERING I

L	T	P	Total Marks: 100	Course Code: (TH-05)	
3	0	0		**Theory Assessment**	
Total Contact Hours				End Term Exam	70
Theory		: 45Hrs		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	**Sources of Energy:** Brief description of energy Sources: Classification of energy sources: Renewable, Non-Renewable; Fossil fuels, including CNG, LPG; Solar Energy: Flat plate and concentrating collectors & its applications (Solar Water Heater, Photovoltaic Cell, Solar Distillation); 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 carburetors; 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.

MANUFACTURING ENGINEERING LAB-I

L	T	P	Total Marks: 50	Course Code: (PR-01)	
0	0	4			
Total Contact Hours				**Practical Assessment**	
Practical		:60Hrs		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

MATERIAL TESTING AND METALLOGRAPHY LAB

L	T	P		
0	0	4		**Course Code: (PR-02)**
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 of shear modulus and shear stress.
VI	Finding Young's Modulus of Elasticity, yield points, percentage elongation and percentage reduction 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

FLUID MECHANICS & FLUID POWER LAB

L	T	P	Total Marks: 50	Course Code:(PR-03)	
0	0	4			
Total Contact Hours				**Practical Assessment**	
Practical		:60Hrs		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.

THERMAL ENGINEERING-I LAB

L	T	P	Total Marks: 50	Course Code: (PR-04)	
0	0	4			
Total Contact Hours				**Practical Assessment**	
Practical		:60Hrs		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	Total Marks: 50	Course Code: SI201	
0	0	0		Assessment	
Total Contact Hours				End Term Exam	15
Practical		0		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 deliverables.

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.

Suggested Online Link:

Web Links:

1.https://www.youtube.com/watch?v=LZP1StpYEPM

2.http://nptel.ac.in/courses/12110600/