

Second Year, First Semester Diploma Mechanical Engineering

 सत्यं शिवं सुन्दरम् Estd. 1949 Accredited Grade "A+" by NAAC	The Maharaja Sayajirao University of Baroda Polytechnic, Department of Mechanical Engineering Near Shastri Bridge, Fatehgunj, Vadodara 390002 Ph: 02652783914-15 email: principal-poly@msubaroda.ac.in			Last Revision 2018-19 Implemented Progressively	
First Semester Second Year Diploma Mechanical					
Year: II		PRODUCTION TECHNOLOGY – I (MEC3308)		MARKS	100(T)+50(T.W/ PRA)
Semester: I				HOURS	60(L)+60(P)
Course Outcomes		CO1 Understand various metal extraction processes. CO2 Apply principles of pattern, moulding and casting design. CO3 Apply various metal joining process in fabrication work. CO4 Apply metal forming process in production work. CO5 Understand various defects in foundry, metal joining and forming process.			

Unit No.	Content	Contact hours	Theory Marks
UNIT-I	Introduction:	03	05
	Classifications of manufacturing processes, their applications, Advantages, Limitations, giving examples of component produced		
UNIT-II	METALS:-	07	10
	Production of irons and steels, Pig iron, Steel, Wrought iron, Different types of important irons and steels, their composition properties and applications, Extraction of Aluminium and Copper, Composition properties and applications of important alloys of Steels - Aluminium and Copper.		
UNIT-III	FOUNDARY –I : PATTERN AND MOULDING: -	10	20
	A. PATTERN: Pattern, Types of Patterns, Pattern materials, Allowances colour code, Pattern making, Instruments and equipment used for pattern making. B. MOULDING: Principle procedure of simple green sand moulding, Green sand moulding, Types of sand properties, Reclamation, Moulding equipment and Instruments, Runners, Risers getting systems, Moulding machines, Types of moulding, Pit moulding, Loam moulding, CO₂ moulding, Shell moulding, Core and core prints.		
UNIT-IV	FOUNDARY –II : CASTINGS:-	10	15
	Melting of metals, Furnaces, Cupola, Sand casting, Gravity casting, Die casting, Centrifugal castings, Investment casting, Casting defects, Remedies, Inspection of castings		
UNIT-V	FABRICATION TECHNOLOGY –I:-	12	
	Theory of welding, Classifications of welding, Plastics and fusion welding, Smith (forge) welding, Detail Study of electrical arc		

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	welding, Classifications, Theory-Welding parameters and its effects, Welding power characteristic, Different arc welding methods, Metal arc welding, Carbon Arc welding, TIG, MIG, Submerged arc welding, Equipment of arc welding, Types of welding sets, Applications, Different types of electrodes ISI code for electrodes, Standard welding positions, Defects and inspection of Arc welds, Details study of electrical resistance welding, Different methods, Types and applications		20
UNIT-VI	FABRICATION TECHNOLOGY –II :-	08	16
	Principle of gas welding, Advantages, Limitations and Applications, Oxy acetylene, Oxy Hydrogen, Gas cutting equipment of welding, Welding of stainless steel and other special metals, Thermit welding, Limitations and Applications, Theory of soldering and brazing, Advantages, Limitations and Applications, Types of welded joints, Defects and inspection of welds.		
UNIT-VII	FORGING	05	7
	Forging Introduction, Types of Forging Process, Application and Comparison with Casting		
UNIT-VIII	HOT AND COLD WORKING OF METALS	05	7
	Theory of hot and cold working, Rolling, Extrusion: Direct and indirect, Broaching. Effect on mechanical properties.		
REFERENCES			
1.	Elements of Work Shop Technology – Vol.-I – Hajra & Chaudhari		
2.	Elements of Work Shop Technology – Vol.-II – Raghuvanshi		
3.	Production Technology – R.K. Jain		
4.	Workshop Technology I, II & III - W.A.J. Chapman		
5	Welding Engineering - B. E. Rossi		
6	Foundry Engineering - P. L. Jain		

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First Semester Second Year Diploma Mechanical			
Year: II	MATERIAL TECHNOLOGY (MEC3309)	MARKS	100(T)+50(T.W/ VIVA)
Semester: I		HOURS	60(L)+30(P)
Course Outcomes	CO1 Interpret material property, structures and metallurgy of pure metals and alloys CO2 Produce different alloys and powder metallurgy as per need of design and international standards. CO3 Recognize the need for specific materials and their usefulness in different engineering applications. CO4 Apply metal protection methods by various coating technology. CO5 Perform Non-destructive testing in mechanical engineering.		

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Unit No.	Content	Contact hours	Theory Marks
UNIT-I	INTRODUCTION AND PROPERTIES OF ENGINEERING MATERIAL	03	5
	Introduction, need, classification of metals and non-metals, Materials Properties, Mechanical, Chemical Properties, Thermal Properties, Electrical / Electromagnetic, Stress and strain-concept, relationship.		
UNIT-II	METALLURGICAL CONSIDERATION OF METALS	08	13
	The concept of crystalline structure of metal, BCC, FCC, HCP., Types of solid solutions, concept of phase diagram and cooling curves, The concept of solidification of metals, crystal, grain, grain boundaries, dendritic solidification, Equilibrium diagrams, TTT Curve, applications, effect of cooling rates on material properties. TTT curve for stainless steel Iron-carbon equilibrium diagram and its characteristic		
UNIT-III	FERROUS METALS AND ITS ALLOYS	08	12
	Introduction and classification of ferrous metals, Flow diagram for production of Iron and steel. Ferrous metals – standards & designations (According to BIS, EN, ASME, JIS, DIN), composition, properties and uses, Alloying of metals-properties and effect, Shape memory alloys-concepts, materials, properties, applications Coding of alloy steels as per BIS, DIN, ASME, EN and JIS, comparisons and equivalents. Introduction and designation/standards (as per BIS, DIN,ASME,EN and JIS) of sponge iron, properties and applications Microstructures study of ferrous metals		
UNIT-IV	NON FERROUS METALS AND ITS ALLOYS	05	10
	Role of nonferrous metals and its alloys related to engineering, field. Types, properties, capabilities, designations (According to BIS,EN,ASME,JIS, DIN),composition, and industrial applications of : copper alloys, aluminium alloys, bearing metals, Microstructure study of all non ferrous metals.		
UNIT-V	NON-METALLIC AND COMPOSITE MATERIALS	06	10
	Introduction, main composition and applications of non-metallic, material -Plastic, rubbers, ceramic, refractories, insulators, abrasives, lubricants, adhesives, fibre and Teflon. Composite materials-concept, structure, common materials, properties, advantages and industrial applications.		
UNIT-VI	SELECTION AND SPECIFICATION OF MATERIALS	03	07
	Types of commercially available materials, Specification of metals as per BIS, EN,ASME,JIS, and DIN, Factors to be considered while selecting material		
UNIT-VII	HEAT TREATMENT	08	12
	Introduction to heat treatment, Types, method /process, process parameters and applications of various heat treatment processes/methods, Study of quenching medias and their properties		
UNIT-VIII	NON-DESTRUCTIVE TESTING	08	12
	Working principle, working, equipment specification, process parameters, procedure , and applications of various non-destructive testing methods.		
IX	POWDER METALLURGY	06	11
	Basic concept of powder metallurgy and its applications, advantages and limitations. Manufacturing process of powder metallurgy, characteristic of metal powder, production of metal powder, blending, mixing of powder, compacting, presintering and sintering		
X	SURFACE COATINGS	05	08
	Needs and scope of surface coatings Procedure and method of preparing surface Procedure of various surface coating methods, Types of surface coatings and applications		
1.	Material Science and Engineering- William D Callister, David G Rethwisch		
2.	Material Science and Metallurgv- O. P. Khanna.		

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3	Materials & Metallurgy - G.B.S. Narang
4	Analysis and Performance of Fiber Composites -Bhagwan Agarwal, Lawrence J. Broutman, K. Chandrashekhara
5	Non-Destructive Testing- Barry Hull And Vernonjohn
6	B.I.S., ASME.DIN.JIS for materials

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Year: II	MECHANICAL MEASUREMENT & METROLOGY (MEC3310)	MARKS	100(T)+50(T.W/ VIVA)	
Semester: I		HOURS	60(L)+30(P)	
Course Outcomes	CO1 Understand the basic concept of various mechanical parameters of measurement system and metrology. CO2 Understand the construction and working of instruments associated with pressure, temperature, flow and power measurement. CO3 Operate various measuring, precision, non-precision and layout instruments used for different engineering components CO4 Inspect various engineering components through gauges using the concept of limits, fits and tolerances. CO5 Use various measuring instruments and comparators to measure and compare the geometrical parameters of machined components such as fasteners, gears and plain surfaces.			

Unit No.	Content	Contact hours	Theory Marks
UNIT-I	MEASUREMENT AND MEASUREMENT SYSTEMS	2	5
	Significant of measurement, Mechanical parameters to be measured, Methods of measurement- direct and indirect		
UNIT-II	PRESSURE MEASUREMENT	10	20
	Definition and units of pressure terms, Types of pressure measuring devices, Manometer, Piezometer, U tube Double column, single column, Barometer, Mechanical displacement gauges, Ring balance bell type, Bourdon tube gauge, Bellow gauge.		
UNIT-III	FLOW MEASUREMENT	7	12
	Basic idea about flow measurement and measuring devices like venture meter, orifice meter, Rotameter, Pitot static tube etc.		
UNIT-IV	TEMPERATURE MEASUREMENT	6	8
	Temperature scales, Liquids in glass thermometer, Vapour pressure gauge thermometer, Gas filled system, thermocouples, Pyrometer.		
	MEASUREMENT OF POWER	2	

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UNIT-V	Elementary idea about various methods for the measurement of power.		2
UNIT-VI	POWER TRANSMISSION	3	3
	Types of mechanical drives, Difference between friction drive(belt) and gear drive, Types of belt, Types of belt drive, Calculation of power transmitted with derivation of tension in belt, Centrifugal tension, Condition for maximum power transmission, Total tension, Creep and slip in belt and examples on it, Correction factor for angle of lap, Variable speed drives.		
UNIT-VII	INTRODUCTION OF METROLOGY	3	5
	Objectives of metrology, Application of metrology, units and standards, System of measurement		
UNIT-VIII	LINEAR MEASUREMENT	8	6
	Instruments used, non-precision devices like simple scale, steel rule, Carpenter scale, Try square, Simple spring loaded calipers, outside and inside caliper, Precision linear measuring instruments		
UNIT IX	LAYOUT INSTRUMENTS	2	6
	Surface plate, Marking gauge, V block, Angle plates, Parallel strips spirit level tool makers, Clamps , Bevel protector, Combination square		
UNIT X	LIMITS FITS AND TOLERANCES	5	6
	Limits, Deviations, Tolerances, Types of tolerances, Grades of tolerances, Allowances, Type of fits, Classes of holes and shafts as per the Indian standard holes basic and shaft basis system of assembly, Hand fitting, Selective and interchangeable assembly		
UNIT XI	GAUGES	12	27
	General inspection procedure in mass production: Different types of limit gauges, Comparators, Dial gauge, Types of pocket gauges like- Feeler gauge, Radius gauge, thickness gauge, Wire gauge, Screw pitch gauge etc., Telescopic gauge Pneumatic gauging, Slip gauges, Surface measurements, Measurements of thread and gear		
REFERENCES			
Mechanical Measurement – D.S. Kumar			
Engineering Metrology – R.K. Jain			
Metrology – M. Mahajan			
Mechanical Measurement & Metrology- Dr. R.K. Rajput			
Production Technology – P.C.Sharma			
Production Technology – R.K.Jain			

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Year: II	STRENGTH OF MATERIAL – II	MARKS	100(T)+50 (T.W./VIVA)
Semester: I		HOURS	45(L)+30(P)=75
Course Outcomes	CO1 Infer the strength of various structural elements internal forces such as compression, tension, shear, bending and torsion. CO2 Compute the normal and shear stresses on a plane inclined on two planes analytically and graphically as well. CO3 Associate the behaviour and the strength of structural elements under the action of compound stresses and thus understand failure concepts. CO4 Use of their knowledge of joining of plates, which is an important requirement of manufacturing industry. CO5 Apply the basic concept of analysis and design of structural elements such as column and strut.		

Unit No.	Content	Contact hours	Theory Marks
UNIT-I	PRINCIPLE PLANES AND PRINCIPAL STRESSES	10	20
	Revision of simple stress and strains, Stress condition on inclined plane, two-dimensional stress system, Determination of stress conditions on inclined planes, Definition of principal planes and principal stresses with the help of a simple illustration, Location of principal planes and calculations of principal stresses, Constructions and use of Mohr's circular stress diagram, Principal strains		
UNIT-II	COLUMN OF UNIFORM SECTION	04	12
	Definition, Axial loading, Failure of column short and long columns, Euler's theory for long column, Statement of Euler's formula for crippling load and its application, Factor affecting the crippling load, Limitation, Empirical formula, Rankings formula, Derivation and application		
UNIT-III	DIRECT AND BENDING STRESSES	04	12
	Illustration of bracketed column with eccentric loading, Combined bending and direct stresses, effect of eccentric loading, Limit of eccentricity for symmetrical sections, Application to columns and chimney sections (Simple cases only)		
UNIT-IV	SLOPE AND DEFLECTION OF BEAMS	08	12
	Definition and importance of study, bending into an arc of circle, The maximum slope and deflection, Application to the laminated spring, Design of simple laminated carriage springs, Basic differential equation, Study and application to simple cases of cantilevers and simply supported beams, Relation between maximum deflection and maximum bending stress in simply supported beams		
UNIT-V	TORSION IN SHAFT	04	08

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	Concepts of torsion, Shear due to pure torque in a shaft of circular section, Keys and coupling, Power transmitted by shafts, Combined bending and torsion, Combined bending, torsion and axial thrust		
UNIT-VI	SPRINGS	04	08
	Definition and importance, Types of spring, Closely coiled helical spring under axial load and twist, Derivation of formula and application, Illustrations		
UNIT-VII	CYLINDRICAL AND SPHERICAL SHELLS	04	12
	Radial pressure in shells, Hoops stress in spherical shells, Thick cylindrical shells, Statement and application of formula only		
UNIT-VIII	DISTRIBUTION OF SHEAR STRESS	03	06
	Derivation of general equation for shear stress, Distribution of shear stress in rectangular and symmetrical “I” sections		
UNIT-IX	ECCENTRIC RIVETED JOINT AND WELDED JOINT	04	10
	Types of Riveted joint, its failure and efficiency of riveted joints, Design Examples; Types of Welded joint, its failure and efficiency of Welded joint, Design examples; Advantages and disadvantages of welded joint over riveted joint		
REFERENCES			
Strength of material - R. S. Khurmi			

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Year: II	ELCTRICAL TECHNOLOGY	MARKS	100(T)+50(T.W/PRA./VIVA)
Semester: I		HOURS	60(L)+30(P)
Course Outcomes	CO1 Understand the basics of D.C. Fundamentals		
	CO2 Understand the basics of A.C. Fundamentals		
	CO3 Learn & Understand the Principle, working of of DC Motors and Starters		
	CO4 Learn & Understand the Principle, working of different types of DC Generators		
	CO5 Learn & Understand the Principle & working of AC machine like induction motor, Alternators and transformer.		

UNIT NO.	TOPIC	Contact Hours	Theory Marks
1	Ohm's law, Resistance, Specific Resistance, effect of temperature on resistance, Conductor, Insulator and semiconductors, Series and parallel circuits, Kirchhoff's laws, Solutions of simple network, related examples. Relationship between electrical and mechanical units	6	8
2	AC Fundamentals :		

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	Generation of Alternating voltages and currents, Equations of Alternating voltages and currents, Simple waveforms, Complex waveforms, Definition of various terms such as Emf, Voltage, Current, Cycle, Time period, Frequency, Amplitude, Different forms of Emf equation, Phase, Phase difference, Rms value (full wave & half wave) and its Analytical method, Average value (full wave & half wave), Form factor (full wave & half wave), Peak factor (full wave & half wave). AC circuit : Purely resistive circuit, Purely inductive circuit, Purely capacitive circuit, AC through R-L & AC through R-C circuit, Apparent power, True power, Reactive power & power factor. Balance star and delta connection, Relation between current, voltage and power	10	16
3	D.C.GENERATORS: Generator principle, Simple loop generator, Practical generator i.e. its parts Yoke, Pole-shoe, field coils, armature core, armature windings, conductors, commutators, brushes & bearings., Types of generators i.e. Separately & self excited generators (including shunt, series, long shunt & short shunt etc.), Brush contact drop. Generated EMF Equation of a generator. Iron loss in armature, Total loss in dc generator, stray & constant losses, power stages, condition of maximum efficiency. Characteristics of D.C. Generators, Uses of D.C. Generators.	6	16
4	D.C.MOTORS: Motor principle, Comparison of Generator and motor action, significance of the back emf, Voltage equation of a motor, condition for maximum power, Conditions for Maximum Power, Torque, Armature Torque of a Motor, related examples, Shaft Torque, Speed of a D.C. Motor, Speed Regulation Torque, and Speed of a D.C. Motor, Motor Characteristics, Characteristics of Series Motors, Characteristics of Shunt Motors, Comparison of Shunt and Series Motors, Factors Controlling Motor Speed, Speed Control of Shunt Motors, Speed Control of Series Motors.	6	16
5	TRANSFORMER-T/R Transformer working principle, Faraday's Law of Electromagnetic Induction, T/R Construction i.e. Core & Shell type, Step-Up & Step-Down T/R, Elementary theory of an ideal transformer Types of Cooling Employed, EMF equation of a transformer, voltage transformation ratio (K), Transformer with losses but no magnetic leakage, transformer on no-load, Efficiency of a transformer, Condition for maximum efficiency, Ideal T/R.	8	16
6	INDUCTION MOTOR-I.M. Classification of A.C. Motors, advantages & disadvantages, Principle, Construction, Squirrel-cage & phase wound rotor, Why does rotor rotate, Slip, Frequency of rotor current, Starting torque of Squirrel cage & slip-ring motor, Production of rotating magnetic field for 2-	8	14

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	phase & 3-phase,		
7	ALTERNATOR: principle, stationary armature, construction of rotors, Damper windings. SYNCHRONOUS MOTOR: Principle of operation, Method of starting, Application	6	4
8	Working principle, General construction of following type of measuring instruments, Moving coil, Moving iron, Voltmeter, and ammeters, Dynamometer type ampere meter, Wattmeter induction type, Instrument transformers C.T and P.T, Study of connection diagram only 3 phase energy meter, Frequency meter, Synchro scope, Single phase and three phase power factor meters	6	10
REFERENCES			
1.	Electrical Technology Vol. I & II – B.L. Theraja		
2.	Fundamentals of Electrical Technology – B.L.Theraja		
