

Third Year, Second 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	
Second Semester Third Year Diploma Mechanical				
Year: III	INDUSTRIAL ENGINEERING – II (MEC3611)	MARKS	100(P)+50(T.W/ VIVA)	
Semester: II		HOURS	60(L)+30(P)	
Course Outcomes	CO1 Classify and select material handling equipment according to layout and site of the plant. CO2 Calculate and reduce project duration using CPM and PERT. CO3 Study and improve existing quality levels of manufacturing system using quality system tools, statistical tools and optimization techniques. CO4 Estimate the direct cost and indirect cost in various manufacturing processes and products.			

Unit	Topic	Contact Hours	Theory Marks
1	ORGANISATION	04	08
	Scope and function of organization, types of organization, principle of organization, Apprentice act and factory act.		
2	MATERIAL HANDLING AND PLANT LAYOUT	06	08
	Principle of material handling, Functions, Method of material handling, Selection of material handling equipment, Importance and objectives of plant layout, Techniques of preparing layout, Types of layout, comparisons and factors affecting layout.		
3	NETWORK ANALYSIS	12	24
	Introduction project planning construction of network. Rules of constructing network & Fulkerson's rule, P.E.R.T. & C.P.M. Time estimation, definitions, determining T & T _L -critical path analysis updating of network and crashing.		
4	OPERATIONS RESEARCH	12	20
	Phases and definitions and applications- (A) Introduction to L.P. Problem formulation and graphical solution (B) Transportation (i) North west corner (ii) V.A.M. (iii) Steppingstone method (iv) Modi (C) Assignment		
5	STATISTICAL QUALITY CONTROL	10	24
	Definition and advantages, Conformance limit, Tools of SQC, Control charts for variable and attributes, Acceptance sampling, O.C. curve, I.S. code, Introduction to ISO.		

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6	ESTIMATING AND COSTING	10	10
	Cost and value of production, Elements of cost, Estimation of labour cost of product involving process such as machining, casting, fabrication, etc. value and value analysis.		
7	MODERN TRENDS IN INDUSTRY	06	06
	Total quality management (T.Q.M.), Concept and implementation, Concept of 5'S, Theory and implementation.		

REFERENCES			
Industrial Engineering & Economics – Banga & sharma			
Operation Research – R.C. Patel			
Industrial Engineering & Management – Dalela & Mansoor Ali			
Modern Production and Operation Management- Bafana and Sarin			
Total Quality Management- S K Sharma			

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Year: III	THERMAL ENGINEERING – III (MEC3612)	MARKS	100(P)+50(T.W/ VIVA)	
Semester: II		HOURS	60(L)+30(P)	
Course Outcomes	CO1 Understand and compute various parameters of different refrigeration cycles using P-V and T-s diagrams. CO2 Analyze the performance of refrigeration system using standard procedures. CO3 Identify salient features of psychrometric chart & Airconditioning systems. CO4 Calculate the power requirement and volumetric efficiency of air compressors. CO5 Identify & explain various modes of heat transfer and determine heat transfer parameters related to heat exchangers for different situations.			

Unit No.	Content	Contact hours	Theory Marks
UNIT-I	REFRIGERATION	17	28
	Definition of refrigeration, Comparison between engine, refrigerator and heat pump, ☐ Methods of refrigeration – ice refrigeration, evaporative refrigeration, refrigeration by expansion of air, refrigeration by throttling of gas, vapour refrigeration, steam jet refrigeration, refrigeration by using liquid gases, dry ice refrigeration, ☐ Units of refrigeration, C.O.P. ☐ Air refrigeration system, Reverse Carnot and Bell-Coleman cycle,		

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	☐ Vapor compression refrigeration cycle ☐ Vapor absorption refrigeration cycle for refrigeration – H2O-LiBr absorption system and NH3-H2O absorption system ☐ Desirable properties of refrigerant, Refrigerants commonly used and their properties		
UNIT-II	AIR CONDITIONING	08	14
	General principles of air conditioning, Air conditioning systems- Unitary and Central, ☐ Psychometry and psychometric properties of air, psychometric relations, psychometric chart, psychometric processes, requirement of comfort air conditioning, summer air conditioning, winter air conditioning system and year round air conditioning system		
UNIT-III	RECIPROCATING AIR COMPRESSORS	12	21
	Classification of air compressors ☐ Reciprocating air compressor – Single stage and multi stage air compressor,Power required to drive the compressor, Volumetric efficiency		
UNIT-IV	ROTARY COMPRESSOR	10	18
	Comparison and reciprocating and rotary compressor ☐ Types of rotary air compressor – root blower, vane blower and centrifugal compressor ☐ Work done by centrifugal compressor with velocity triangle ☐ Axial flow air compressor ☐ Comparison of centrifugal and axial flow air compressor and velocity diagram for axial compressor		
UNIT-V	PRINCIPLE OF HEAT TRANSFER	05	08
	Basic modes of heat transfer ☐ Conduction –mechanism of conduction heat transfer, thermal conductance in solid, Fourier’s law of conduction, coefficient of thermal conductivity, Temperature gradient, heat transfer through plain wall, composite wall and legged pipe, critical radius, examples ☐ Convention – ☐ Radiation – thermal radiation, distrubution of incident radiation, concept of black body, stefanboltzman law, emissive power of non black body Heat transfer insulators as per application		
UNIT-VI	HEAT EXCHANGER	08	11
	Types of heat exchanger ☐ Mean temperature difference ☐ Overall heat transfer coefficient ☐ Fauling and scaling of heat exchanger ☐ Calculation of parallel flow and counter flow heat exchanger with LMTD method ☐ Examples		
REFERENCES			
Thermal engineering by P. L. Bellany			
Refrigeration and air conditioning by C. P. Arora			
Refrigeration and air conditioning by Domkundwar			
Heat and mass transfer by D. S. Kumar			
Heat transfer by D. Q. Kern			
Thermal Engineering by Mathur and Sharma			
Elements of Heat Engine Vol. III by R.C. Patel			
Thermal engineering by R. S. Khurmi			
Thermal Engineering by N.C. Pandya			

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Second Semester Third Year Diploma Mechanical				
Year: III	ADVANCED MACHINE DESIGN (MEC 3613)	MARKS	100(P)+50(T.W/ VIVA)	
Semester: II		HOURS	60(L)+60(P)	
Course Outcomes	CO1 Learn about importance of standardization and preferred number CO2 Identify and design different types of basic mechanical assemblies like shaft couplings, lever, power screw, laminated spring and spur gear. CO3 Understand design criteria, material selection and specifications of brakes and clutch. Recognize the need for specific materials and their usefulness in different engineering applications.			

Unit No.	Content	Contact hours	Theory Marks
UNIT-I	STANDARDISATION	4	06
	Objectives, Preferred numbers, Introduction to series- R5 to R10 and R20, Use of important I.S. standards, Production, Inspections and design standards, Standard of surface roughness, Machining and symbol		
UNIT-II	DESIGN OF SIMPLE PARTS	12	24
	Design of simple parts subjected to direct and bending loads, Puller arm, Axle, Leaf springs, Levers, Connecting rods		
UNIT-III	DESIGN COUPLINGS	10	20
	Functions, Types, Design of flange coupling, Muff coupling and flexible coupling		
UNIT-IV	CLUTCHES	02	04
	Introduction, Specification, Selection, Working of simple cone and centrifugal clutches, Design criteria of simple clutches		
UNIT-V	BRAKES	02	04
	Specification and selection of materials, Design criteria of simple brakes		
UNIT-VI	POWER SCREWS	06	14
	Introduction, Types of threads, Terminology, Force analysis, Application, Design of Railway coupler, Screw jack, C-clamps.		
UNIT-VII	DESIGN OF BEARINGS	06	12
	Introduction, Classification, Properties of sliding contact bearing, Properties of lubricants, Hydrodynamics bearing, Anti friction bearing selection.		
	DESIGN OF SPUR GEAR	08	

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UNIT-VIII	Introduction, Classification, Gear terminology, Selection of gears and gear materials, general design criteria for gears.		16
REFERENCES			
Machine Design – R. S. Khurmi			
Machine Design Vol.I & II – R.C. Patel			
Machine Design – Shah and Pandya			
Design of Machine Elements- V B Bhandari			

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	Year: III Semester: II	POWER PLANT ENGINEERING (MEC3614) MARKS 100(P)+50(T.W/ VIVA) HOURS 60(L)+30(P)	
Course Outcomes	CO1 Apply concept of various power plants with economy, generation cost and tariff plans. CO2 Recognize scope of non-conventional power plants and understand components of solar, wind, geothermal, tidal and hydro power plants. CO3 Apply concepts of thermodynamics in steam, gas and diesel power plants and understand systems of power plants. CO4 Apply concepts of nuclear science and understand systems of nuclear power plant. CO5 Apply concept of fuel handling, waste management, operation, maintenance and environment protection in various power plants.		

Unit No.	Content	Contact Hours	Theory Marks
UNIT -I	INTRODUCTION	05	12
	Concept of power station, Conventional and unconventional source of energy, Energy conversion processes, Classification of power station, Central and captive power stations, Present power position in India and future planning of power production, Economics and Tariff of Power Plant- Introduction, The cost of Electrical energy, Tariff method of Electrical Energy.		
UNIT -II	NON-CONVENTIONAL POWER PLANT:	05	12
	Solar Power Plant, Wind power plant, Geo Thermal Power Plant, Tidal Power Plant-Construction and Working of all power plant.		
	HYDRO ELECTRIC POWER PLANTS	08	

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UNIT -III	Introduction, Comparison of hydroelectric power plants with thermal power plant, Site selection, Basic elements of hydel plants, Classification, Operation, Maintenance, Advantages and disadvantages of hydel plants.		10
UNIT -IV	GAS TURBINE POWER PLANT Introduction to Gas Turbine system, Components of gas turbine plant, Classification of gas turbines, Working of a constant pressure gas turbine, Open cycle and closed cycle, Advantages and disadvantages of open cycle and closed cycle gas turbine plant, Advantages of gas turbine over I.C. Engine as a prime mover, Work Done, Thermal efficiency, Methods of improving thermal efficiency of open cycle gas turbine, Types of fuel used in gas turbine plant, Gas turbine power plant components and their arrangements, Advantages and disadvantages, Recent trends in Gas turbine Plant, combined steam- gas turbine power plants, Cogeneration Power Plant. Examples.	12	16
UNIT -V	STEAM POWER PLANTS Introduction, Rankine Power Cycle, Modified Rankine Cycle, Efficiency improvement methods and Its Calculations. General layout of modern steam power plant, Working modern steam power plant, General ideas of coal and ash handling, Storage of Coal, In plant and Out plant coal handling, Coal preparation, Coal Burning methods, Various stockers and Pulverization, Pulverized fuel burners, Ash handling systems, Dust collection and its disposal Condenser, cooling ponds and cooling towers, Feed water treatment	12	20
UNIT -VI	NUCLEAR POWER PLANTS Site selection Criteria for Nuclear Power Plant, Nuclear Physics, Atomic mass unit, Radio activity and Radioactive Decay, Mass Energy Equivalence, Binding Energy, Calculations, Types of Nuclear Reaction, Nuclear Cross Section, Moderation, Nuclear Materials, Components of Nuclear Reactors, Different Types-PWR, BWR, CANDU, Gas cooled Reactor, Advance Gas Cooled Reactor and Liquid Metal Cooled Reactor, Comparison of Nuclear power plants with thermal power plants, Radiation hazard and waste disposal problem.	08	15
UNIT -VII	DIESEL ELECTRIC POWER PLANT Introduction, Essential components of Diesel electric power plant, Different types of diesel power plants, Starting, Stopping, Fuel system, Cooling System, Governing, Advantages and Disadvantages.	05	10
UNIT -VIII	POWER PLANT MAINTENANCE AND SAFETY MEASURES Necessity of maintenance, Preventive maintenance stages e.g. Inspection, small repairs, medium repairs, complete overhauling,		

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	Predictive maintenance, Breakdown maintenance, General safety measures for different types of power plants, Personal Protective equipments	05	05
REFERENCES			
Power Plant Engineering by S.Domkundwar.			
Power Plant Engineering by V.A.Voput.			
Power Plant Engineering by Stuertzy.			
Power Plant Engineering by P K Nag			

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	Year: III Semester: II	THEORY OF MACHINES (MEC3615) MARKS 100(P)+50(T.W/ VIVA) HOURS 60(L)+30(P)	
Course Outcomes	CO1 Understand Kinematics and Dynamics of different machines and mechanisms. Calculate the velocity and acceleration of mechanism analytically and graphically. CO2 Understand different types of Cams and their motions along with the drawing ability of Cam profiles for various motions CO3 Apply the Knowledge of rotational dynamics, energy storage and speed control in machines. CO4 Identify different types of vibration, its effect and calculation of balancing mass, position. CO5 Define and understand the basic principles of mechanical power transmission		

Unit No.	Content	Contact hours	Theory Marks
UNIT-I	INTRODUCTION TO SIMPLE MACHINES	03	7
	Need, Scope & Importance of subject in design & analysis. Basic terms related to mechanisms and machines, Different mechanisms & their applications with inversions.		
UNIT-II	VELOCITY & ACCELERATION DIAGRAMS	7	15
	Basic terms & rules to be used in solving velocity & acceleration problems. Approach to solve velocity & acceleration problems related to slider crank chain & four bar chain mechanisms using (a) Relative velocity Method (RVM) (b) Klein's Construction and (c) analytical method	10	

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UNIT-III	CAMS & CAM PROFILES Basic concept, function and types of cams and followers with their applications. Types of motions and displacement for different types of cams and followers. Problems on construction of cam-angle displacement diagrams and cam profiles for various combinations of disc type of cam and radial/offset knife-edge/roller follower.		16
UNIT-IV	TURNING MOMENT, FLY-WHEEL AND GOVERNORS Introduction on turning moment diagram with its use, turning moment diagrams for different types of machines & torque determination. Basic terms like piston effort, crank effort etc. and their relations with turning moment, expressions & problems. Functions of flywheel, types of flywheels and their constructions, coefficient of fluctuation of speed and energy, moment of inertia, size and weight of flywheel and related expressions and problems. Functional aspect of Governor, types of governors, Basic of Watt & Porter Governors, Expressions and examples on them.	10	18
UNIT-V	BALANCING & VIBRATION Introduction, types of balancing, balancing operations, balancing of a single and multi- masses in one plane, balancing of revolving masses in different planes, problems on above, basic of balancing of reciprocating masses. Basic terms of vibration such as frequency, amplitude, phase angle, free & forced vibrations, degree of freedom. Types of vibrations, causes and remedies of vibrations, study of free, damped and forced vibrations	10	14
UNIT-VI	POWER TRANSMISSION Introduction, need, modes and applications, Rope drive-Types and applications. Belt drive- Types, terms, ratio of belt tensions, effect of centrifugal forces and initial tension, condition for maximum power transmission, total tension, creep and slip phenomena, examples. Gear trains: Types and applications and examples on simple/compound/reverted/epi-cyclic gear trains	10	16
UNIT-VII	FRICTION Introduction & basic concept of friction related to body in motion. Introduction and Role of friction in thrust bearing, pivot bearing, and collar bearing considering uniform wear and uniform pressure conditions. Function and working of different types of clutches. Types & working of friction brakes with its derivation and examples	10	14
REFERENCES			
Theory of Machines- Jagdishlal			
Theory of Machines- C.S.Shah & N.C.Pandya			
Theory of Machines- Abdulla Shariff			
Theory of Machines- Shah & Jadvani			
Theory of Machines- R.S.Khurmi			
Theory of Machines- R.C.Patel, B.M.Patel			
Theory of Machines simplified- K.C.Narang			

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Year: III	PROJECT WORK-II (MEC3616L)		MARKS	50
Semester: II			HOURS	30
Course Outcomes	CO1 Prepare project planning to execute proposed solution identified in Project-I			
	CO2 Prepare and execute methodology/experimental procedure.			
	CO3 Evaluate the results of testing the solution / experimental work.			
	CO4 Report the conformity / non-conformity and root cause in case of non-conformity.			
	CO5 Prepare final project report in addition to Project-I.			
