

MECHANICAL ENGINEERING SECTION

STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME



DIPLOMA IN

MECHANICAL
ENGINEERING

(REF. & A/C)

V AND VI
SEMESTER

INCHARGE:

Dr. SHAHNAWAZ MOHSIN

w.e.f.

2019-2020

UNIVERSITY POLYTECHNIC, AMU, ALIGARH, UP, INDIA

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BME-501	Industrial Engineering	Compulsory	Theory	4	-	-

Course Assessment Method

1. Course Work: 10 Marks
2. Mid Semester Exam: 15 Marks, 01 Hour
3. End Semester Exam: 75 Marks, 02 Hour

UNIT	Topics Covered	Marks
I	INDUSTRIAL MANAGEMENT: Introduction to industrial management, Management of men material and machines, Scientific management and its principles, Functions of management, Structure of industrial organization, Types and applications. INDUSTRIAL OWNERSHIP: Introduction to Ownership and its types: Partnership organization, Joint Stock Company, Private Limited Companies, Public Limited Companies, Private sector and Public sector organization, Concept of the heavy, medium, small scale, cottage and village industries.	15
II	FINANCIAL MANAGEMENT: Sources of finance, Elements of costs, Prime cost, Factory cost, Other overheads, Total cost, selling price and problems on them Depreciation, Classification and methods of providing depreciation, Problems. WAGES AND INCENTIVES: Job evaluation and merit ratings, Definition and objectives, Ranking and point rating methods, Introduction to wages, Types of wages, Introduction to incentives, Types of incentives, Problems based on Halsey and Rowan systems.	20
III	HUMAN RESOURCE MANAGEMENT: Objectives of HRM, Staff development, Training strategies and methods. LABOUR AND INDUSTRIAL LAWS: Importance and necessity, Types of Labour laws and disputes, Brief description of the Acts such as Factories Act 1948, Workmen's Compensation Act 1923, Minimum wage Act 1948, Employee's provident fund Act 1952. ACCIDENTS: Introduction, Classification, Causes and Effects of accidents, Types of industrial hazards.	20
IV	ENTREPRENEURSHIP DEVELOPMENT: Concept of entrepreneurship, Characteristics of entrepreneur, Role of Entrepreneur, Role of entrepreneurs in Economic Development; Entrepreneurship in India, Entrepreneurship – its Barriers, Preparation of project report, Steps of planning a small to medium enterprises. (SMEs). MOTIVATION AND LEADERSHIP: Definition of motivation, Methods for improving motivation, Definition of leadership, Functions of leadership, Manager as a leader.	20

Text Book and/or Reference Material

1. Industrial Engineering and Production Management by Mart and Telsang (S. Chand Pub.)
2. Industrial Engineering and Management by D. Ravi Shankar (Galgotia Pub.)
3. Industrial Engineering and Production Management by M. Mahajan (Dhanpat Rai Pub.)
4. Industrial Engineering by N.J. Manek (Laxmi Pub.)
5. Industrial Engineering and Management by O.P. Khanna (Dhanpat Rai Pub.)

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BME-502	Hydraulics & Pneumatics	Compulsory	Theory	4	-	-

Course Assessment Method

1. Course Work: 10 Marks
2. Mid Semester Exam: 15 Marks, 01 Hour
3. End Semester Exam: 75 Marks, 02 Hour

UNIT	Topics Covered	Marks
I	Introduction: Fluid, types of fluids, Difference between fluid mechanics and hydraulics. Properties of Fluid: Mass density, weight density (specific weight), specific volume, specific gravity, viscosity, kinematic & dynamic viscosity, surface tension, and their units. Intensity of pressure, pressure head, center of pressure, total pressure on horizontal & vertical flat surfaces (without proof) and simple problems on them. Pressure Measurement: Pressure (Atmospheric, Gauge, Absolute, Vacuum), Pascal's law and its paradox. Pressure Measuring Devices: Piezometric tube, simple manometer, differential manometer, inverted differential manometer, simple problems on them.	15
II	Flow of fluids: Types of fluid flow, steady & unsteady, uniform & non-uniform, laminar & turbulent flows, rate of flow & its units, continuity equation for I-D steady flow, Reynolds no & its significance, Energy of liquid in motion total energy, velocity head, pressure head, potential head, Bernoulli's theorem (Statement & proof), its applications & assumptions, discharge measurement with the help of venturimeter, problem on the same.	20
III	Flow through Orifices: Types of orifices, hydraulic coefficients, relationship between C_c , C_v & C_d , Vena-contracts. Flow through Pipes: Minor & major losses, loss of head in pipes due to sudden enlargement, sudden contraction, obstruction in flow path and pipe fitting (without proof), problems, water hammering in pipes & surge tanks.	20
IV	Hydraulic Machines: Concept of hydraulic pumps, construction and working of centrifugal pumps and reciprocating pumps, Selection of pumps. Concept of hydraulic Turbines- Classification, construction & description of main components of Pelton, Francis & Kaplan Turbines. Description and application of hydraulic ram, hydraulic accumulator and hydraulic press. Pneumatic System: Basic elements of pneumatic system and their functions such as- Air Compressor (Types & selection), generation of compressed air, Air-filters, Pressure regulators and Lubricators, their necessity in pneumatic circuits, Application of Pneumatics, Characteristic / features of pneumatic system. Pneumatic valves, pneumatic actuators (Brief idea only), pneumatic system safety, cleanliness and preventive maintenance.	20

Text Book and/or Reference Material

1. Fluid Mechanics by Frank M White (McGraw Hill Publication).
2. Introduction to Fluid Mechanics and Fluid Machines by S K Som and Gautam Biswas (McGraw Hill Publication).
3. A text book of Fluid Mechanics and Hydraulic Machines by R. K Rajput (S. Chand Publishers).
4. Fluid Mechanics and Hydraulic Machines by S.S. Rattan, (Khanna Publishers).
5. Pneumatic Systems Principles and maintenance by S.R Majumar. (McGraw Hill Publications.)
6. Hydraulic and Pneumatic- A Technician's and Engineer's Guide by Andrew Parr, (Jaico Publication House).
7. Hydraulic & Hydraulic Machines by Bansal.
8. A text book of Hydraulics by Bawa

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BME-503	Applied Thermodynamics	Compulsory	Theory	4	-	-

Course Assessment Method

1. Course Work: 10 Marks
2. Mid Semester Exam: 15 Marks, 01 Hour
3. End Semester Exam: 75 Marks, 02 Hour

UNIT	Topics Covered	Marks
I	Gas Power and Vapour Power Cycles Gas power cycles: Air standard efficiency, Description of Otto cycle, Diesel cycle and Dual combustion cycles. Air standard efficiency of Otto cycle and Diesel cycle (without derivation). Problems. Vapour power cycles: Carnot cycle and Rankine cycle. Comparison of Rankine cycle with Carnot cycle. Use of Mollier diagram, Problems.	15
II	Steam Nozzles, Turbines and Condensers Steam nozzles: Introduction. Types of nozzles, velocity of steam at exit of the nozzle, mass of steam discharge through nozzle, condition of maximum discharge through a nozzle, maximum discharge through a nozzle. Problems Steam turbines: Principal of operation of impulse and reaction turbines. Pressure, Velocity and Pressure-velocity compounding, their advantages. Steam condensers: Functions of condenser in a steam power plant. Types of condenser. Comparison of jet and surface condenser. Quantity of cooling water required. Effects of air leakage in condenser. Problems.	20
III	Air Compressors Industrial uses of compressed air. Classification of air compressors. Description of single reciprocating compressors. Effect of clearance, work done and volumetric efficiency. Description of multi-stage compressors. Advantages of multistage compression. Condition for maximum efficiency. Problems. Introduction to rotary compressors. Description of axial flow and centrifugal compressor.	20
IV	I.C. Engine and Gas Turbine Heat engines, Introduction and classification of I.C. engines, Basic terminology, Working principles of two stroke and four stroke cycles. Petrol and diesel engines and their comparison. Measurement of indicated power and brake power, Performance parameters, Morse test and Heat balance sheet. Gas turbines: Descriptive treatment of gas turbines, operation of gas turbine, open and closed gas turbine cycles. Performance and efficiency. Gas turbine versus reciprocating engines. Problems	20

Text Book and/or Reference Material

1. Onkar Singh, Applied Thermodynamics, New Age International Publishers, New Delhi
2. R. Joel, Basic Engineering Thermodynamics, Pearson's Education, New Delhi.
3. D. S. Kumar, Engineering Thermodynamics, S. K. Kataria and Sons Publishers, New Delhi.
4. R. Basu, Thermal Engineering- Heat Power, Dhanpat Rai & Co. Pvt. Ltd., New Delhi.
5. T. Roy Choudhary, Basic Engineering Thermodynamics, Tata McGraw Hill Publishing Company Limited, New Delhi.

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BME-504	Refrigeration & Air Conditioning	Elective	Theory	4	-	-

Course Assessment Method

1. Course Work: 10 Marks
2. Mid Semester Exam: 15 Marks, 01 Hour
3. End Semester Exam: 75 Marks, 02 Hour

UNIT	Topics Covered	Marks
I	Refrigeration Cycles: Principles of refrigeration, unit of refrigeration, various methods of refrigeration. Air refrigeration systems – Reversed Carnot and Bell Coleman cycles. Vapour compression refrigeration system and analysis of its cycle. Effects of sub cooling and superheating, Vapour absorption refrigeration system.	15
II	Refrigeration Components and Refrigerants: Refrigeration components and controls such as Compressor, Condenser, Evaporator and Throttling valve and Thermostat. Introduction to refrigerants and their desirable properties, primary and secondary refrigerants. Nomenclature of refrigerants. Important properties of some common refrigerants such as R-11, R-22, R-502, R-134a and NH ₃ .	20
III	Psychrometric: Psychrometric properties of air, psychrometric processes and their representation on psychrometric chart. Bypass factor, Mixing of air streams. Brief idea of metabolism 20 in human body. Introduction to human comfort and comfort air conditioning.	20
IV	Load Calculations, HVAC and Air-distribution Systems. Air conditioning load calculations; Cooling and heating load calculations. Description of various types of loads – sensible and latent heat loads, sensible heat factor, Apparatus dew point. HVAC classification of air conditioning systems. Air distribution systems; Simple description of filters, dampers, fans, blowers, air resisters (Grilles).	20

Text Book and/or Reference Material

1. Anathanarayan, “Basic Refrigeration and Air Conditioning”, Tata McGraw Hill.
2. R. K. Rajput, “A Textbook of Refrigeration and Air Conditioning”, S. K. Kataria and Sons.
3. Arora & Domkundwar, “Refrigeration & Air Conditioning”, Dhanpat Rai & Sons P.S.

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BME-505	Production Technology-III	Compulsory	Theory	4	-	-

Course Assessment Method

1. Course Work: 10 Marks
2. Mid Semester Exam: 15 Marks, 01 Hour
3. End Semester Exam: 75 Marks, 02 Hour

UNIT	Topics Covered	Marks
I	GRINDING MACHINES Introduction; Classification of Abrasives; Basic concept of Bond, Grit, Structure and Grade of Abrasives; Selection of grinding wheel; Trueing and Dressing of Grinding wheel; Specification of grinding wheels; Grinding Machines: Brief description of Cylindrical grinder, Centre-less grinder; Surface grinder, Tool and Cutter grinder.	15
II	JIGS AND FIXTURES: Introduction; Difference between a jig and a fixture; Important considerations in jig and fixture design; Main elements of jigs and fixtures. Clamping & locating devices types of jigs. Brief idea of milling & grinding fixture CAPSTAN AND TURRET LATHES Introduction; Principal Parts of Capstan and Turret lathes; Differences between a Turret and a Capstan Lathe; Tool layout. BROACHING AND BROACHING MACHINES Introduction; Classification of Broaches; Principle of Broaching; Methods of Broaching; Classification of Broaching machines; Broaching versus other machining operations; Applications of Broaching.	20
III	NUMERICAL CONTROL MACHINE TOOLS: Introduction; Elements of NC machine tool system; Brief description and classification of NC systems; Basic concept of manual and computer assisted part-programming. ROBOTS: Introduction; Main components of a robot; Applications of robot.	20
IV	UNCONVENTIONAL METHODS OF MACHINING Introduction; Classification of unconventional machining methods; Common unconventional machining methods; Brief description of Electro-Discharge machining (EDM) and Electro-Chemical machining. POWDER METALLURGY: Brief description; Applications, advantages and disadvantages of powder metallurgy	20

Text Book and/or Reference Material

1. Workshop Technology Vol-II: By S. K. Hajra Chaudhry.
2. Production Engg Sciences: By P.C. Panday & C. K. Singh
3. Mfg. Engg & Technology: By Kalpakjian
4. Mfg. Engg: By P.C. Sharma
5. CNC machines: By M. Adithan
6. Production, Automation and computer integrated manufacturing: By Groover.

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BME-591	Workshop Practice-V	Compulsory	Practical	-	-	6

Course Assessment Method

1. Course Work: 80 Marks
2. End Semester Exam: 40 Marks, 02 Hour

Topics Covered**MACHINE SHOP**

Demonstration and study of lathe and shaper.

1. Step turning, parallel Turning, Taper turning and Grooving.

WELDING SHOP

1. Study of various Gas cutting and welding equipment: -Welding transformer, Generator/rectifier, Gas cylinder, Gas cutting machines, Cutting torches etc., various electrodes and filler metals and fluxes.
2. TIG Welding practice of Non-Ferrous metals, like Copper, Brass and Aluminium.
3. Practice of Gas cutting manually.
4. Practice of MIG welding
5. Practice of stud welding
6. Practice of gas welding.
7. Practice of Arc cutting.

Note: Any three jobs to be completed

FOUNDRY SHOP

1. Making sands moulds of different forms with different types of pattern using- (i) Floor Moulding. (ii) Three Box (or more) Moulding.
2. Making and setting of cores of different types.
3. Casting practice of Nonferrous metals.

CNC MACHINE TOOLS LAB

1. Study and sketch of CNC lathe and milling machine.
2. Study of G codes and M codes.
3. Part programming, for different operations.

Programme editing & simulation on CNC lathe and milling machine.

Text Book and/or Reference Material

1. Workshop Technology Vol-II: By S. K. Hajra Chaudhry.
2. Production Engg Sciences: By P.C. Panday & C. K. Singh
3. CNC machines: By M. Adithan

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BRA-591	Refrigeration & Air Conditioning Lab-I	Compulsory	Practical	-	-	3

Course Assessment Method

1. Course Work: 50 Marks
2. End Semester Exam: 30 Marks, 02 Hour

Topics Covered

Practical Exercises on the following

1. Refrigeration Cycle Demonstrator.
2. Window Air Conditioning Trainer.
3. Domestic Refrigeration Trainer.
4. Vapour Absorption Refrigeration Trainer.
5. Refrigeration Control Display Board.
6. Refrigeration & Air Conditioning Tools such as.
 - Gus Charging Unit
 - Capillary Tube Cutter
 - Pipe Cutter
 - Tubing tool kit (flaring tools and tools for expending tube).
 - Pinch Off Plier.
 - Curving Pliers.
 - Pipe Bender Set.
 - Flexible Gas charging Line.
 - Pressure Gauge.
 - Vacuum Gauge.
 - Tong Tester.
 - Gas Wilding Kit.

Note: Number of Experiments depends upon the availability of equipment and time.

Text Book and/or Reference Material

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BME-594	Project	Compulsory	Practical	-	-	3

Course Assessment Method

1. Course Work: 80 Marks
2. End Semester Exam: 40 Marks, 02 Hour

Topics Covered

GUIDELINES

- i. Project will have to be done by a group comprising of maximum ten students only in their area of interest.
- ii. Each group has to select a contemporary topic that will use the technical knowledge of their program of specialization.
- iii. Allocation of the guides preferably in accordance with the expertise of the faculty.
- iv. The student will be assigned a faculty guide who would be the supervisor of the student. The faculty would be identified before the end of the IV semester.
 - v. The number of projects that a faculty can guide would be limited to two groups.
- vi. The project can be carried out on-campus or in an industry or an organization with prior approval from the Principal through Section Incharge.
- vii. The project shall be finalized by the students before the start of the V semester and shall be completed and submitted at least one month before the last teaching day of the VI semester, date of which shall be notified in the academic calendar.
- viii. The assessment of performance of students should be made at least twice in each semester i.e. V and VI and each internal assessment shall be for 80 marks. The student shall present the final project live as also using overheads project or power point presentation on LCD to the internal examiners as also the external examiner.
- ix. The evaluation committee shall consist of faculty members constituted by the college which would comprise of at-least three members comprising of the student's guide, one internal examiner & one external examiner passed by Board of studies. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each member of the committee separately to the controller of examinations in a sealed envelope.

Text Book and/or Reference Material

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BME-595	Hydraulics Lab	Compulsory	Practical	-	-	2

Course Assessment Method

1. Course Work: 50 Marks
2. End Semester Exam: 30 Marks, 02 Hour

Topics Covered

Practical Exercises on the following

1. Bernoulli's Theorem
2. Orifice Meter / Venturi Meter.
3. Sudden Expansion & Contraction.
4. Coefficient friction of Pipe Line.
5. Reynolds Experiments.
6. Mouth piece.
7. Easy & Sharp bend.
8. Rectangular / Triangular Notch.
9. Impact of Jet.
10. Pelton Turbine.
11. Francis Turbine.
12. Centrifugal Pumps.
13. Reciprocating Pump.
14. Hydraulic Ram.
15. Pneumatic Bench.

Note:

1. Number of Experiments depend upon the availability of equipment and time.
2. Any eight experiments to be completed in Production/ R.A.C / Plastic Tech

Text Book and/or Reference Material

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BME-601	Industrial Management & Entrepreneur Development	Compulsory	Theory	4	-	-

Course Assessment Method

1. Course Work: 10 Marks
2. Mid Semester Exam: 15 Marks, 01 Hour
3. End Semester Exam: 75 Marks, 02 Hour

UNIT	Topics Covered	Marks
I	<p>Introduction to Industrial Engg.: Definition, Application and Industry Classification.</p> <p>Production and Productivity: Definition, Production system, its characteristics, Product Life Cycle, Factors influencing productivity and measurement of productivity.</p> <p>Plant Location: Introduction, Factors affecting plant location.</p> <p>Plant Layout: Definition, Types of layouts, advantages and disadvantages of different layouts.</p> <p>Material Handling: Introduction, Material handling equipment, their types, functions and selection.</p>	15
II	<p>Work Study</p> <p>Method Study: Definition, objectives and need of method study, Role of method study in improving productivity, Procedure of conducting method study, Process charts and diagrams, Process chart symbols, (Flow process chart, Multi-activity chart, Right and Left-hand chart and flow diagram), Examples. Introduction to Therbligs.</p> <p>Time Study: Definition, Objectives and procedure of conducting time study, System of performance rating, various allowances, Calculation of standard time.</p> <p>Ergonomics: Definition, objectives and applications, Design of workplace layout, Man-Machine system, Role of work environment on human performance.</p>	20
III	<p>Planning and Control: An introduction to production, planning and control, its need and objectives, comparison between production planning and production control, Concept of Scheduling, Routing, Dispatching and Expediting, Techniques/methods of PPC like CPM and PERT, terminology related with CPM and PERT, Simple problems on them.</p> <p>Break Even Analysis: Introduction, Break-even chart, Break-even point, Margin of safety, Simple problems on them.</p>	20
IV	<p>Forecasting: Introduction to sales forecasting, definition, types, applications, need and limitations.</p> <p>Inventory Control: Introduction, types, objectives, need, terminology used in inventory control, Economic Order Quantity (EOQ), Lot size of production for minimum cost, simple problems on EOQ.</p>	20

Text Book and/or Reference Material

1. Industrial Engineering and Management by D. Ravi Shankar (Galgotia Pub.)
2. Industrial Engineering and Production Management by M. Mahajan (Dhanpat Rai Pub.)
3. Industrial Engineering and Management by O.P. Khanna (Dhanpat Rai Pub.)
4. Industrial Management by H.S. Bawa
5. Industrial Management by Mittal

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BME-602	Machine Design	Compulsory	Theory	4	-	-
Course Assessment Method							
1. Course Work: 10 Marks 2. Mid Semester Exam: 15 Marks, 01 Hour 3. End Semester Exam: 75 Marks, 02 Hour							
UNIT	Topics Covered						Marks
I	INTRODUCTION Design: Definition, type of designs, necessary of design Design procedure. Practical Examples related with design procedure. Characteristics of a good designer. Design terminology: Stress, strain, factor of safety, factors affecting factor of safety, stress concentration, methods to reduce stress concentration, fatigue, endurance limit. General design considerations, codes and standards. Selection of materials						15
II	DESIGN OF SHAFT Design of shaft: Types of shaft materials, types of loading, effect of keyway on shaft strength, design of shaft under various types of loading. DESIGN OF KEYS AND COUPLINGS Design of keys: Types, Materials, function and design of keys. Necessity, advantages and types of couplings, design of Oldham and flanged couplings (Protected and unprotected)						20
III	DESIGN OF JOINTS Types of joints, Temporary and permanent, utility of joints, design of simple cotter and Knuckle joint. Welded Joints: Types of welded joints, strength of parallel and transverse fillet welds, strength of combined parallel and transverse welds under axial loading. Riveted Joints: Leak proofing of riveted joints caulking and fullering Different modes of failure of riveted joint. Design of riveted joints: lap and butt joints. Design of boiler joints .i.e circumferential and longitudinal joints						20
IV	SPRINGS Introduction, Types of spring, Material for helical spring, standard size of spring wire, Terms used in compression spring, end connection for compression helical springs, end connection for tension helical springs, stresses in helical springs of circular wire, energy stored in helical string of circular wire, stress & deflection in helical spring of non-circular wire, construction of leaf spring, eqvalved stresses in spring levers (Nipping) length of leaf spring leaves, simple problems						20
Text Book and/or Reference Material							
1. Machine Design by S.K. Bhandari 2. Machine Design by R.S. Khurmi							

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BRA-601	Refrigeration air conditioning-II	Compulsory	Theory	4	-	-

Course Assessment Method

1. Course Work: 10 Marks
2. Mid Semester Exam: 15 Marks, 01 Hour
3. End Semester Exam: 75 Marks, 02 Hour

UNIT	Topics Covered	Marks
I	<p>COMPRESSORS</p> <p>RECIPROCATING COMPRESSORS: Construction and arrangement of cylinders, types and contraction of piston, suction and discharge valve (types and construction), poppet valves, ring plate valves, flexing valves, valve location, bore and stroke relation of a compressor. Construction of cranks, connecting rod, crank shaft seal and gaskets, lubricants, their properties, Lubrication recommendations, (Small systems, industrial refrigeration, miscellaneous equipment) methods of lubrication, Liquid refrigerant in compressor crank case. Method of reducing oil foaming at the compressor start.</p> <p>ROTARY COMPRESSORS: Construction and working, cylinder construction and fitting rotor construction, blade construction, crank shaft construction, valve construction, crank shaft seal and gaskets. Lubrication of rotary compressors.</p> <p>CENTRIFUGAL COMPRESSORS: Construction and working of compressor, sealed unit ruffles and their advantages hermetic rotary compressor, regulation of compressor capacity, starting of compressor, Shutting down of a compressor.</p> <p>COMPRESSOR DRIVES: Reciprocating compressor drives, open and hermetic compressor drives, compressor drive. Compressor performance.</p>	15
II	<p>CONDENSERS</p> <p>Definition, type of condensers, air cooled water cooled and evaporator type.</p> <p>Air cooled condensers- Natural convection, mechanically cooled finned tube, Plate type, Wire mesh, induced and forced type, Chassis mounted and remote type, air quantity and velocity for an air cooled condenser and rating and selection of air cooled condensers.</p> <p>WATER COOLED CONDENSERS: Waste water system, re-circulated water system, effect of fouling on condensers. Types of water cooled condenser, Double tube, shell and coil and shell and tube. Rating and selection of water cooled condensers, simplified rating, Bleed "Off" and "Drift" make up water. Classification and design of cooling tower. Tower efficiency of a cooling tower. Cooling tower rating and selection.</p> <p>EVAPORATIVE CONDENSERS: Induced and forced type rating and selection of evaporative condenser. By pass and its advantages, water regulating valves, condenser controls, winter starts, condenser and tower maintenance.</p> <p>REFRIGERANT FLOW CONTROLS: Type of expansion valves, hand expansion valve, automatic expansion valves, pressure limiting valve gas charge expansion valve multi-outlet valves and distributors, multi distributor, pressure drop type.</p> <p>EVAPORATORS AND COOLERS: Definition, design, over all heat transfer co-efficient, L.M.T.D., Evaporator T.D., Effect of evaporator selection. Types space humidity, other factor of construction, Bare tube, plate surface and finned natural convection evaporators. Rating and selection of natural convection evaporator evaporators. Forced convection evaporators rating and selection of unit coolers, liquid chilling evaporators (chillers), double pipe coolers, advantage, disadvantage, application.</p> <p>AIR CONDITIONING SYSTEM</p> <ul style="list-style-type: none"> • Unit air conditioning system (window air conditioning system), remote and split air conditioning. • Package air conditioning system. <ol style="list-style-type: none"> i. Package A.C. with water cooled condenser. ii. Package A.C. with air cooled condenser. <ul style="list-style-type: none"> • Central Air Conditioning System <ol style="list-style-type: none"> i. D.X system with air handling unit. ii. Chilled and hot water system with fan coil unit. 	20
III	<p>FLUID FLOW, DUCT DESIGN AND AIR DISTRIBUTION SYSTEM.</p> <p>Pressure drop through duct, conversion from circular section to rectangular section to rectangular section duct design –Equal friction loss (pressure drop) method, the static regain method, velocity reduction method, Advantages and Disadvantages of the above methods.</p> <p>AIR DISTRIBUTION SYSTEM.: Duct system the perimeter system, perimeter loops system and radial perimeter system.</p> <p>AIR CONDITIONING EQUIPMENTS: Air contaminants, purpose and methods of air cleaning, Different types of air filters and humidifiers, Fans and Blowers, grills and registers.</p>	20
IV	<p>HEAT RECOVERY SYSTEM AND HEAT PUMP</p> <ul style="list-style-type: none"> • Hot gas heat reclaim with de-superheter. • Heat recovery with parallel condensers. • Heat well, basic principle of heat pump, heat source and sink, Handling of peak heating loads. Application of heat pump, co-efficient of performance of heat. <p>AIR FILTERS: Dry filter, viscous filter, wet filters, centrifugal dust collector, electric filter.</p> <p>HUMIDIFIERS: Steam humidifier, Atomization, type humidifiers, forced Evaporation humidifier, air washer humidifier capillary type humidifier.</p> <p>FAN AND BLOWERS: Axil flow Radial flow fan, fan laws, selection of fan.</p> <p>EVAPORATIVE COOLING: Evaporative cooling –Thermodynamic of evaporative cooling, types of evaporative collars- Spray type, Pad type, Rotating type, Efficiency of evaporative cooling, Limitation of evaporative cooling, Indirect or, Modified evaporative cooling system.</p>	20

Text Book and/or Reference Material

1. Refrigeration & Air Conditioning by S.C Arora.
2. Basic Refrigeration & Air Conditioning By P.N. Ananthanarayanan.
3. Refrigeration & Air Conditioning by C.P.Arora.
4. A text book Refrigeration & Air Conditioning by R.S.Khurmi.

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BRA-602	Erection, servicing and maintenance	Compulsory	Theory	4	-	-

Course Assessment Method

1. Course Work: 10 Marks
2. Mid Semester Exam: 15 Marks, 01 Hour
3. End Semester Exam: 75 Marks, 02 Hour

UNIT	Topics Covered	Marks
I	Layout and Erection of Refrigeration Plant: Need based layout of the plant, installation of different components, Estimation & costing of the need based of refrigerant & water piping, pipe fittings & valves, observation of safety codes of refrigeration & air-conditioning plants (ISI).	15
II	<p>Servicing and Maintenance of the Refrigeration Plant: Dehydrating, charging, pump down, Simple gas and electric welding, soldering, brazing etc., servicing, overhauling and testing of compressors (open and sealed type) maintenance of condenser, receiver, servicing of expansion and solenoid valves, servicing & overhauling of refrigerators, installation care & maintenance of ice cream making plant & milk cooling plant.</p> <p>Maintenance of Equipments: Maintenance, objectives and types (Routine and preventive maintenance) maintenance of centrifugal pump & accessories, repair & maintenance of cooling tower, refrigerated trucks, fluid chillers, blast freezers, multiple plate freezers, contact freezers, Window and split air-conditioners.</p>	20
III	Layout And Erection of Air-Conditioning Plant: Need based layout of Residential air-conditioning, Industrial air-conditioning: textile air-conditioning, humidification, hospital air-conditioning, restaurant air-conditioning, Theater air-conditioning, railway air-conditioning, library air-conditioning, workshop air-conditioning, Installation of AHUs and package units, ducts, grills & diffusers, selection of insulating materials, laying procedure of insulation on ducts and chilled water pipes.	20
IV	Commissioning & Performance of an Air-conditioning plant: General building construction, occupancy and other loads, check room temperature, proper cooling outside temperature conditions, air noise level, foundation of Refrigeration plant vibrations, primary & secondary chilled water circuits, Testing of air-conditioning plant. Balancing of Air & waterside systems, balancing of grills, Adjustment of dampers, check return air to unit, performance evaluation, actual capital cost, operation and maintenance cost.	20

Text Book and/or Reference Material

1. Refrigeration & Air Conditioning by S.C Arora.
2. Refrigeration & Air Conditioning by W.F. Stroecker.
3. Basic Refrigeration & Air Conditioning By P.N. Ananthanarayanan.
4. Refrigeration & Air Conditioning by C.P.Arora.
5. A text book Refrigeration & Air Conditioning by R.S.Khurmi.
6. Refrigeration & Air Conditioning by R.K Pajput.

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BCE-605 (a)	Environmental Science and Management	Elective	Theory	3	-	-

Course Assessment Method

1. Course Work: 10 Marks
2. Mid Semester Exam: 15 Marks, 01 Hour
3. End Semester Exam: 75 Marks, 02 Hour

UNIT	Topics Covered	Marks
I		15
II		20
III		20
IV		20

Text Book and/or Reference Material

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BME-605 (b)	Non-Conventional Energy Sources	Elective	Theory	3	-	-

Course Assessment Method

1. Course Work: 10 Marks
2. Mid Semester Exam: 15 Marks, 01 Hour
3. End Semester Exam: 75 Marks, 02 Hour

UNIT	Topics Covered	Marks
I	Conventional and Non-conventional energy Sources The need of Non-Conventional Energy Sources. Introduction to various renewable energy sources. Comparison of NCES with the conventional sources – their merits and demerits. Advancements made in recent time.	15
II	Nuclear Power Reactors Introduction to Nuclear Energy. Nuclear Reactions – Fission and Fusion. Chain reactions. Nuclear power reactor. Various elements of nuclear reactor. Nuclear fuels, control devices and shielding materials etc. Types of nuclear reactors- Pressurized water reactor, boiling water reactor, liquid metal reactors. Their comparative merits and de -merits. Solar Energy Introduction to solar energy and solar radiation. Solar radiation at the earth's surface – beam and diffused radiation. Measurement of solar radiation. Physical principles of the conversion of solar radiation into heat. Solar thermal collectors – Flat Plate and Concentrator. Applications of solar energy.	20
III	Wind and Tidal Energy Introduction and basic principles of wind energy conversion. Wind data and energy estimation. Wind energy conversion systems. Site selection considerations. Application of wind energy Basics principles of tidal energy, components of tidal power plants, site requirements, Advantages and limitations of tidal power generation.	20
IV	Geothermal Energy and MHD Systems Introduction and estimation of Geothermal Energy. Nature of geothermal fields and applications of geothermal energy Principles of MHD power generation. MHD systems and their applications. Materials for MHD systems.	20

Text Book and/or Reference Material

1. "Non-conventional energy sources", G. D. RAI, Khanna Publisher, New Delhi.
2. "Non-conventional resources of energy", G. S. SAWHNEY, PHI Learning Pvt. Ltd.
3. "Solar energy", S P Sukhatme, J K Nayak, Tata Mc Graw-Hill Education.
4. "Solar Energy: Fundamentals and Applications", H. P. Garg, J. Prakash, Tata McGraw-Hill

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BME-605 (c)	Total Quality Management	Elective	Theory	3	-	-

Course Assessment Method

1. Course Work: 10 Marks
2. Mid Semester Exam: 15 Marks, 01 Hour
3. End Semester Exam: 75 Marks, 02 Hour

UNIT	Topics Covered	Marks
I		15
II		20
III		20
IV		20

Text Book and/or Reference Material

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BRA-691	Refrigeration & Air Conditioning Lab-II	Compulsory	Practical	-	-	6

Course Assessment Method

1. Course Work: 80 Marks
2. End Semester Exam: 40 Marks, 02 Hour

Topics Covered

Practical Exercises on the following.

1. General Cycle Refrigeration Trainer (medium temp. application)
2. Industrial Refrigeration Trainer Bench.
3. Windows Air Conditioning Trainer.
4. Air Conditioning Trainer Recalculating type.
5. Centralized Air Conditioning Trainer.
6. Ice Plant Absorption Refrigeration Trainer.
7. Water Cooler Trainer.
8. Domestic Refrigeration Trainer.
9. Vapour Absorption Refrigeration Trainer.
10. Air Expansion Refrigeration Trainer.
11. Cascade Refrigeration Trainer
12. Desert Cooler Trainer.
13. Water Cooling Tower Apparatus.
14. Cold Storage Trainer.
15. Steam Jet Refrigeration Test Rig.

Note: Number of Experiments depend upon the availability of equipment and time.

Text Book and/or Reference Material

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BRA-692	Erection, Servicing & Maintenance Lab	Compulsory	Practical	-	-	3

Course Assessment Method

1. Course Work: 80 Marks
2. End Semester Exam: 40 Marks, 02 Hour

Topics Covered

Erection /Installation of the following.

1. Centralize Air Conditioner.
2. Window Air Conditioner.
3. Cascade Air Conditioner.
4. Industrial Refrigeration System.
5. Variable Refrigerant Flow Air Conditioner
6. Split Air Conditioner.

Servicing and Maintenance of the following.

1. All of above.
2. Water Cooling systems.
3. Chiller Plant.

Note: Number of Experiments depend upon the availability of equipment and time

Text Book and/or Reference Material

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BME-694	Project	Compulsory	Practical	-	-	3

Course Assessment Method

1. Course Work: 80 Marks
2. End Semester Exam: 40 Marks, 02 Hour

Topics Covered

1. Students shall complete the project work as they have allotted in V semester.
2. The project shall be completed and submitted at least one month before the last teaching day of the VI semester, date of which shall be notified in the academic calendar.
3. The assessment of performance of students should be made in VI semester and shall be of 80 marks. The student shall present the final project live as also using overheads project or power point presentation on LCD to the internal examiners as also the external examiner.
4. The evaluation committee shall consist of faculty members constituted by the college, which would comprise of at-least three members, the student's guide, one internal examiner & one external examiner passed by Board of studies. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each member of the committee separately to the controller of examinations in a sealed envelope.

Text Book and/or Reference Material

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BME-695	CAD LAB-II	Compulsory	Practical	-	-	3

Course Assessment Method

1. Course Work: 80 Marks
2. End Semester Exam: 40 Marks, 02 Hour

Topics Covered

This course is aiming to provide hands on training in AutoCAD/CREO/Solid Edge/NX (Solid Edge/NX-Combined or Optionally Available)
 AUTOCAD: 2D Drawing, Isometric and 3D Drawing. / CREO: Sketcher, Part and Surface Modeling, Assembly and Sheet Metal Design, Drafting and Detailing. / SOLID EDGE: Sketcher, Part Modeling, Surface Modeling, Sheet Metal Design, Assembly, Drafting and Detailing. /NX: Sketcher, Part Modeling, Surface Modeling, Sheet Metal Design, Assembly, Drafting and Detailing.

Text Book and/or Reference Material