

# MECHANICAL ENGINEERING SECTION

## STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME



DIPLOMA IN

PLASTIC  
TECHNOLOGY

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	BKE-501	Basic Chemical Engg.	Compulsory	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

I	Introduction – Classification of Unit Operations, Examples and applications of key unit operations in the plastic industry.	15
II	Mechanical size reduction - Description of equipment for size reduction such as Jaw crusher, gyratory crusher, roller crusher and hammer mill. Law of Conservation of Mass - fundamentals of material balance, material balance in batch and continuous process without chemical reactions.	20
III	Heat Exchangers - Concept of heat exchanger, types of heat exchanger by flow design: counter flow and parallel flow and their graphical representations.	20
IV	Screening and standard screen series. Drying - Description of natural draft tray dryer, forced draft tray dryer, fluidized bed and rotary dryer.	20

**Text Book and/or Reference Material**

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BPT-501	Polymer Processing-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

I	Extrusion: Introduction and principle of extrusion, types of extruders-screw extruder, ram extruder, screw less extruder, Components of screw extruder such as screw, barrel, feed system, heating systems, cooling systems, screen packs, breaker plate, die-adapter etc.	15
II	Screw Design: Screw and its design, L/D ratio and its significance, compression ratio and its significance Selection of screw for different materials, Manufacturing processes for pipe, sheets, blown film, cable and wire covering and monofilaments by extrusion. Thermoforming: Concept of thermoforming, materials for thermoforming. Methods of forming – (i) Vacuum forming (ii) Pressure forming (iii) Plug Assist forming (iv) Free forming (v) Drape forming (vi) Matched mould forming (vii) Plug-and-Ring forming, Thermoforming defects and their remedies.	20
III	Calendering: Introduction to Calendering, basic principle, materials for Calendering, application of calendaring process, Calender rolls, Calender Designs, Roll heating and cooling systems, Production process with brief description, merits and limitations.	20
IV	Rotational Molding: Basic process and materials, types of rotational molding machine i.e. batch type machine, carousel type machine, straight line machine, jacketed-mould type machine, Application of rotational molding, Material selection for rotational moulding.	20

### Text Book and/or Reference Material

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BPT-502	Advance Polymer Processing	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

I	Introduction to control system: Importance of control system in polymer processing, Various control devices used in moulding machines, thermocouple, limit switches, reed switches, pressure measuring devices- strain gauge, bourdon tube etc. tachometer, brief introduction to microprocessor control system.	15
II	Introduction to advanced injection moulding techniques: hot-runner injection moulding process, Gas assisted injection moulding process and its application, Multi-colour injection moulding process, Reaction injection moulding process and its applications. Injection molding defects and remedies. Introduction to advanced extrusion techniques: Mechanism of twin screw extrusion and its advantages, counter rotating and co-rotating screws, intermeshing and non-intermeshing screws, advantage of twin screw extrusion, Co-extrusion process, Types of co-extrusion, applications of co-extrusion.	20
III	Introduction to advanced blow-moulding techniques: Blow moulding with multi-parison system, injection stretch blow moulding process, extrusion stretch blow moulding process, advantage and applications of stretch blow moulded products, Defects and remedies of blow moulding.	20
IV	Plastic waste recycling: Sources of plastic waste, plastic waste composition, recycling of plastics: Introduction of primary recycling, secondary recycling, tertiary recycling and quaternary recycling of plastics materials.	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-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-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	<b>GRINDING MACHINES</b> 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	<b>JIGS AND FIXTURES:</b> 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 <b>CAPSTAN AND TURRET LATHES</b> Introduction; Principal Parts of Capstan and Turret lathes; Differences between a Turret and a Capstan Lathe; Tool layout. <b>BROACHING AND BROACHING MACHINES</b> Introduction; Classification of Broaches; Principle of Broaching; Methods of Broaching; Classification of Broaching machines; Broaching versus other machining operations; Applications of Broaching.	20
III	<b>NUMERICAL CONTROL MACHINE TOOLS:</b> Introduction; Elements of NC machine tool system; Brief description and classification of NC systems; Basic concept of manual and computer assisted part-programming. <b>ROBOTS:</b> Introduction; Main components of a robot; Applications of robot.	20
IV	<b>UNCONVENTIONAL METHODS OF MACHINING</b> Introduction; Classification of unconventional machining methods; Common unconventional machining methods; Brief description of Electro-Discharge machining (EDM) and Electro-Chemical machining. <b>POWDER METALLURGY:</b> 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	BKE-591	Basic Chemical Engg Lab	Compulsory	Practical	-	-	2

**Course Assessment Method**

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

**Topics Covered**

## LIST OF EXPERIMENTS

1. Analysis of various sizes of given material by sieve analysis
2. Drying of solids in a tray dryer under natural draft conditions
3. Drying of solids in a tray dryer under forced draft conditions
4. Study of fluidized bed dryer
5. Study of continuous flow rotary dryer
6. Determination of overall heat transfer co-efficient in double pipe heat exchanger-parallel flow
7. Determination of overall heat transfer co-efficient in double pipe heat exchanger-counter flow

Note: No of experiments depend upon availability of equipment in the Lab.

**Text Book and/or Reference Material**

- 1.

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BPT-591	Polymer Processing Lab-II	Compulsory	Practical	-	-	3

**Course Assessment Method**

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

**Topics Covered**

Practical Exercises on the following

1. To make a bag, identity card, file cover of different polymeric sheet by heat sealing method and prepare a quality control chart.
2. To study and operate of the plastic granulator.
3. To calculate the energy consumed in grinding the given plastic material and to draw the graph energy versus time.
4. Repair and maintenance of scrap grinding machine.
5. To study and operate the single screw extruder.
6. To make a plastic strip of 5 metre length from the given material.
7. To study the effect of screw rpm over output rate of the given single screw extruder (Barrel dia: 19.0 mm).
8. To change the die in a single screw extruder.
9. To assemble the blown-film die and film take-off unit with the extruder.
10. To make a blown-film of 5 metre length from the given material.
11. To study the effect on quality of polyethylene blow film by the variation in speed of screw, barrel temperature, cooling at the die and speed of take off device.
12. Maintenance of single screw extruder.
13. To study and operate vacuum forming machine.
14. To make 20 numbers of plastic cup from the given sheet by the vacuum forming machine.

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	BPT-592	Project	Compulsory	Practical	-	-	3

**Course Assessment Method**

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

**Topics Covered****GUIDELINES**

- Project will have to be done by a group comprising of maximum ten students only in their area of interest.
- Each group has to select a contemporary topic that will use the technical knowledge of their program of specialization.
- Allocation of the guides preferably in accordance with the expertise of the faculty.
- 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.
- The number of projects that a faculty can guide would be limited to two groups.
- The project can be carried out on-campus or in an industry or an organization with prior approval from the Principal through Section Incharge.
- 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.
- 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.
- 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.

Projects related to designing new dies, moulds jigs and fixtures.

Project related to increasing productivity.

Project related to quality assurance.

Project related to estimation and economics.

Project connected with repair and maintenance of plant and equipment.

Project related to recycling of raw material thereby reducing the wastage.

Project related to suggesting substitutes of the polymer being used.

Any other related problems of interested of host industry.

**Assessment criteria will be as under:-**

Attendance and Punctuality	15% weightage
Initiative in problem solving	30% weightage
Relationship with people	10% weightage
Report Writing	45% weightage

**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. Pelton Turbine.
9. Francis Turbine.
10. Centrifugal Pumps.
11. Reciprocating Pump.
12. Pneumatic Bench.

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-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><b>Introduction to Industrial Engg.:</b> Definition, Application and Industry Classification.</p> <p><b>Production and Productivity:</b> Definition, Production system, its characteristics, Product Life Cycle, Factors influencing productivity and measurement of productivity.</p> <p><b>Plant Location:</b> Introduction, Factors affecting plant location.</p> <p><b>Plant Layout:</b> Definition, Types of layouts, advantages and disadvantages of different layouts.</p> <p><b>Material Handling:</b> Introduction, Material handling equipment, their types, functions and selection.</p>	15
II	<p><b>Work Study</b></p> <p><b>Method Study:</b> 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><b>Time Study:</b> Definition, Objectives and procedure of conducting time study, System of performance rating, various allowances, Calculation of standard time.</p> <p><b>Ergonomics:</b> Definition, objectives and applications, Design of workplace layout, Man-Machine system, Role of work environment on human performance.</p>	20
III	<p><b>Planning and Control:</b> 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><b>Break Even Analysis:</b> Introduction, Break-even chart, Break-even point, Margin of safety, Simple problems on them.</p>	20
IV	<p><b>Forecasting:</b> Introduction to sales forecasting, definition, types, applications, need and limitations.</p> <p><b>Inventory Control:</b> 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	BPT-601	Mould 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	<b>POLYMER PRODUCT DESIGN</b> Brief idea of polymer product design, Product design features such as surface finish, texturing, positioning of holes, ribs and bosses, radii and fillets, taper and draft, wall thickness, moulded threads, inserts, external and internal undercuts, mould selection for a particular product.	<b>15</b>
II	<b>EXTRUSION DIES</b> Introduction to extrusion dies and its features. Die design for rods, pipes, wire coating and sheets. Types of dies- hollow die, offset dies and co-axial dies. Die land, die swell, die head mandrel, breaker plate. <b>INJECTION MOULD</b> Introduction, parting line. Feed system- sprue, gate, types of sprue and gate, runner, types of runners. Runner balancing. Product ejection system, mould cooling system. Types of moulds: two plates mould, three plates mould, split mould and hot runner mould	<b>20</b>
III	<b>BLOW MOULD &amp; COMPRESSION MOULD</b> Blow Mould: Introduction, Extrusion Blow Mould, Cavity venting, pinch off, parison, parison thick control, injection blow moulds. Preform, neck design, heating of moulds and ejection system. Compression Mould: Introduction to compression moulds. Technical requirement, construction of compression moulds. Types of compression moulds: Positive type, semi positive type, flash type and landed positive type compression mould.	<b>20</b>
IV	<b>THERMOFORMING MOULDS:</b> Introduction, Moulds for thermoforming, female mould, split female mould, male mould, clamping frame, plugs, multi-cavity mould, vacuum channels	<b>20</b>

**Text Book and/or Reference Material**

1. Injection mould design engineering: By David Kazmer
2. The Mould Design Guide: By Peter Jones
3. Fundamentals of Plastic Mould Design: By Sanjay K Nayak, Pratap Chandra Padhi & Y. Hidayathullah

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BPT-602	Rheology & Testing of Polymers	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	Rheology:- Introduction to polymer rheology, types of deformation and flow, elastic deformation, plastic deformation and Viscous flow – Newtonian and non-Newtonian flow, Time dependent and time independent fluids, Pseudo plastics and dilatants behavior, Thixotropic fluid and Rheopectic fluids.	15
II	Testing of Plastics: - Scope of polymer testing, Basic concept of plastic testing, specification and standards, Brief introduction to various testing organizations, testing method for measuring mechanical. Mechanical Properties: Tensile Strength, Elongation, Hardness, Impact test like Izod impact test, Charpy impact test and falling-dart method.	20
III	Thermal Properties– Melt flow index (MFI), Heat deflection temperature (HDT), Vicat softening point (VSP)	20
IV	Testing methods for measuring properties such as Specific gravity and density, Water absorption, Optical properties such as transmittance & haze secular gloss.	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-604	Machine Tools & 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	<b>MILLING MACHINE</b> Introduction, classification and specifications. Description of main parts of column & Knee type, Horizontal and vertical spindle milling machines. Milling cutters: types and specifications. Operations performed on milling machines.	15
II	<b>INDEXING:</b> Dividing Head, common methods of indexing. Simple, compound and differential indexing giving suitable examples. Manufacture of Gears: Application of milling, hobbling, hot rolling hot forging and casting. Micro Finishing Processes: Principle and application of lapping and honing. Polishing, Superfinishing, Burnishing, Galvanizing, Anodizing and Tin Plating.	20
III	<b>INSTALLATION AND TESTING OF MACHINES</b> Introduction, reading of information manual, Location, Foundation for machine tools, Different types of machine foundations, Factors affecting the type and size of foundation, Foundation plan (Erection drawing), Preparing the foundation, Damping and isolation of vibration, Erection and transportation, Levelling and aligning. Introduction, Sites for testing, Measuring instruments used for alignment test, Alignment test on lathe machine, drilling machine and milling machine.	20
IV	<b>RELIABILITY ENGINEERING</b> Basic concept and importance of reliability, failure rate, mean time to failure (MTTF), mean time between failures (MTBF), System reliability, Reliability analysis, Reliability improvement, availability and maintainability of mechanical system; Types and causes of failure. Failure analysis <b>MAINTENANCE</b> Maintenance objectives and types, Role of maintenance engineer, Maintenance procedure, need of planned maintenance, recent developments in maintenance engineering, maintenance of various machine parts (belt drive, chain drive, gear drive and shaft coupling). Maintenance stages of Pipes and pipe joints, pumps and lathe machine, Maintenance records, Computerization of maintenance. Reasons of equipment replacement, group replacement, replacement in anticipation of failure. Guidelines in replacement studies and methods of replacement studies.	20

**Text Book and/or Reference Material**

1. B. S. Raghuwanshi, A Course in Workshop Technology Vol. II Machine Tools, Dhanpat Rai and Co. (P) Ltd., Delhi.
2. M. Y. Khan, Installation, Testing and Maintenance, S. K. Kataria and Sons Publishers, New Delhi.

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BCE-605 (A)	Industrial pollution & control	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**

1. S.P.Mahajan , Pollution control in industries, Tata McGraw Hill Company.
2. Rao & Dutta, Wastewater Treatment, Oxford & IBH Publishers.
3. Wark & Warner, "Air Pollution- origin and control, Harper and Collins.
4. S.C. Bhatia, 2003, Managing Industrial Pollution, McMillan India Ltd.

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BPT-603 (B)	Rubber technology	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	Sources and history of natural and synthetic rubber, Advantages and disadvantages of natural rubber, Differences in natural rubber versus Synthetic rubber. Ageing of rubber.	15
II	(a) Preparation of pale crape and smoke sheet rubber from latex. (b) Mastication of rubber – Mastication, Machine used for Mastication, Chemistry of Mastication.  (a) Compounds of rubber – Different compounding ingredients such as plasticizers, fillers, accelerators, anti-oxidants and curing agents. (b) Vulcanization – Sulpher and non-sulpher vulcanization.	20
III	(a) Manufacturing process of synthetic rubber such as SER, Nitrile rubber, Neoprene rubber, Butyl rubber and their properties and application. (b) Elementary knowledge of other synthetic rubber such as Thiokal or polysulphide rubber, Hypalone rubber, polyurethane and silicon rubber.	20
IV	(a) Reclaiming of rubber – Manufacturing process properties and limitation. (b) Industrial fabrication of rubber products such as conveyer belt, Hose pipe, cycle tubes.	20

**Text Book and/or Reference Material**



Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BPT-603 (C)	Polymer composite	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	Introduction:- Basic concepts of polymer composites, Types of polymer composites, fiber reinforced plastic, history & development of Fiber Reinforced Plastics. Comparison of Reinforced Plastic and metals.	15
II	Materials of reinforced Plastics:- (a) Resin – preparation, properties and application of (i) Unsaturated Polyester Resin (ii)Epoxy Resin (iii) Polypropylene (iv) ABS (Acrylonitrile butadiene Styrene). (b) Reinforcing materials –Glass fibre, carbon, asbestos, nylon, graphite and aramid Fibre. (a) Miscellaneous additives for reinforced plastic such as catalyst, Accelerator, Fillers, pigment monomer, moulds release agents and its functions in moulding. (b) Design and Fabrication of moulds for Reinforced plastic, Types of moulds	20
III	Moulding Technique of Reinforced Plastics:- (a) Hand lay – up (b) Spray Lay – up (c) Vacuum bag (d) Pressure bag (e) Autoclave (f) Filament winding (g) Pultrusion	20
IV	Commercial applications of composite in various fields such as chemical industry, automotive industry, games and recreational items, marine ship, and aero space.	20

**Text Book and/or Reference Material**

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BPT-603 (D)	Foams and adhesives	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	Foam- Introduction to foam, meaning, applications, types of foams, flexible and rigid foams, chemistry and physics of foam formation, foaming ingredients such as blowing agents etc. and their effects on foam morphology and physical properties of cellular foam,	15
II	Formation, manufacturing processes and properties of thermoplastic foam such as expanded polystyrene, polyethylene foams, LDPE & HD, Introduction to adhesives, mechanism of adhesion, types of adhesives, natural and synthetic, pressure sensitive adhesives, contact adhesives, hot melt adhesives, drying adhesives. PE, PVC foams.	20
III	Thermoplastic and thermosetting adhesives properties, structure, chemistry and method of manufacture adhesives based on: Poly vinyl chloride (PVC), Polyurethane (PU), Ethylene vinyl Acetate (EVA), Melamine Formaldehyde, Epoxy	20
IV	Natural Rubber solution, its composition, chemical structure, properties and method of production. Polychloroprene (Neoprene), composition, chemical structure, properties and method of production. Hot melt Adhesives, Polyester & Polyamide its composition, chemical structure, properties and method of production.	20

**Text Book and/or Reference Material**

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BPT-691	Mould Construction Lab	Compulsory	Practical	-	-	6

**Course Assessment Method**

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

**Topics Covered**

Practical exercises on manufacture of polymer processing moulds for:

1. Injection Moulding.
2. Compression Moulding.
3. Extrusion Moulding.
4. Thermo Forming.

Note:

1. At least two moulds should be prepared.
2. If the mould is complicated then, one mould will be sufficient.
3. Students have to use the facilities in CNC and Machine Shop (and other workshop facilities if needed) for production of moulds.

**Text Book and/or Reference Material**

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BPT-692	Rheology & testing of polymers 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. To study about the testing codes used for characterization of plastic materials by ASTM.
2. To calculate the melt flow index (MFI) of the given polystyrene sample.
3. To calculate the melt flow index (MFI) of the given polyethylene sample.
4. To study and operate of the universal testing machine.
5. To perform tensile test over the given tensile specimen and to draw the graph applied load versus elongation.
6. To calculate the modulus, yield stress, break stress and % elongation at break of the given tensile specimen.
7. To evaluate the engineering properties of plastics materials by stress-strain diagram.
8. To verify the stress relaxation phenomenon in polymeric materials using tensile testing machine.
9. To determine vicat softening point of the given plastic material by using vicat softening apparatus and to draw the graph penetration versus temperature.
10. To determine the heat deflection temperature of the given polymer sample by HDT apparatus and to draw the graph penetration versus temperature.
11. To calculate the coefficient of friction of the given polymer film by friction tester.
12. To determine the impact failure weight of the given polymer film with the help of falling dart impact tester.

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

**Text Book and/or Reference Material**

1. F. W. Billmeyer, "Text Book of Polymer Science", John. Wiley & Sons, 1990.
2. V. R. Gowariker, "Polymer Science", New Age International, 1986.
3. Outlines Polymer Technology by R. Sinha
4. Premamoy Ghosh, "Polymer Science and Technology, Plastics, Rubbers, Blends and Composites", McGraw Hill Education (India) Private Limited, 2013.
5. Brydson, J.A "Plastics Material"

Department	Course No.	Course Title	Course Designation	Course Type	Contact Hours		
					L	T	P
MES, University Polytechnic	BPT-693	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.

Some of the project activities are given below:-

Projects related to designing new dies, moulds jigs and fixtures.

Project related to increasing productivity.

Project related to quality assurance.

Project related to estimation and economics.

Project connected with repair and maintenance of plant and equipment.

Project related to recycling of raw material thereby reducing the wastage.

Project related to suggesting substitutes of the polymer being used.

Any other related problems of interested of host industry.

Assessment criteria will be as under: -

Attendance and Punctuality 15% weightage

Initiative in problem solving 30% weightage

Relationship with people 10% weightage

Report Writing 45% weightage

**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	Theory	-	-	2

**Course Assessment Method**

1. Course Work: 30 Marks
2. End Semester Exam: 50 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**