

**DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
AURANGABAD**

[FACULTY OF SCIENCE AND TECHNOLOGY]



**PROPOSED SYLLABUS
Of
Final Year B. Tech. (Plastic and Polymer Engineering)
(w.e.f. academic year 2019-2020)**

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
FACULTY OF SCIENCE & TECHNOLOGY
Proposed Structure w.e.f. 2019-2020
Final Year B. Tech (Plastic and Polymer Engineering)

Course Code	SEMESTER-VII	Contact Hrs / Week				Examination Scheme						
	Course	L	T	P	Total	CT	TH	TW	PE	Total	Credits	Duration of Theory Exam
PPE401	Mould and Product Design	4	-	-	4	20	80	-	-	100	4	3 Hours
PPE402	Polymer Blends and Composites	4	-	-	4	20	80	-	-	100	4	3 Hours
PPE403	Polymer Reaction Engineering and Plant Design	4	-	-	4	20	80	-	-	100	4	3 Hours
*	Open Elective-II	4	-	-	4	20	80	-	-	100	4	3 Hours
PPE441-443	Elective-III	4	-	-	4	20	80	-	-	100	4	3 Hours
PPE444-446	Elective-IV	2			2	10	40			50	2	2 Hours
PPE421	Lab: Polymer Reaction Engineering	-	-	2	2	-	-	25	25	50	1	NA
PPE422	Lab: CAE for Plastics	-	-	2	2	-	-	50	-	50	1	NA
PPE423	Lab: Plant Design	-	-	2	2	-	-	25	25	50	1	NA
PPE424	Lab: Polymer Blends and Composites	-	-	2	2	-	-	50	50	100	1	NA
PPE425	Project-II	-	-	4	4	-	-	100	100	200	4	NA
	Total of semester-VII	22	-	12	34	110	440	250	200	1000	30	-

Sub Code	SEMESTER-VIII	Contact Hrs /week				Examination Scheme						
	Course	L	T	P	Total	CT	TH	TW	PE	Total	Credits	Duration of Theory Exam
PPE471	In-Plant Training (IPT)	-	-	-	-	-	-	300	300	600	24	NA
	Total of semester-VIII	-	-	-	-	-	-	300	300	600	24	-
	Grand Total of VII & VIII	22	-	12	34	110	440	550	500	1600	54	-

L: Lecture hours per week T: Tutorial hours per week P: Practical hours per week
CT: Class Test TH: University Theory Examination TW: Term Work
PE: Practical/Oral Examination

Elective-III

Sr. No.	Name of the course	Course code
1	Plastic Packaging Technology	PPE441
2	Chemical Project Economics	PPE442
3	Advanced Characterization and Analysis	PPE443

Elective-IV

Sr. No.	Name of the course	Course code
1	Functional Core-Shell Hybrid Nanomaterials	PPE444
2	Rubber Technology for Automotive Applications	PPE445
3	Entrepreneurship Development	PPE446

***Open Elective-II**

Sr. No.	Name of the course	Department	Course code
1	Fundamentals of Bioenergy	AED	AED431
2	Big Data Analytics	CSED	CSE431
3	Solid Waste Management	CED	CED431
4	Energy Planning and Conservation	EED	EED431
5	Data Science	ETC	ETC431
6	Operations Research	MED	MED431
7	Polymer Recycling and Waste Management	PPED	PPE431

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
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Syllabus of Final Year B. Tech. (Plastic and Polymer Engineering) Semester-VII

Course Code: PPE401
Teaching Scheme: 4 Hrs/week
Theory: 4 Hrs/week
Credits: 04

Course: Mould and Product Design
Class Test (Marks): 20
Theory Examination (Duration): 03 Hrs
Theory Examination: 80 Marks

Prerequisite	:	<ul style="list-style-type: none"> Knowledge of plastic materials, engineering drawing, tooling and CAD.
Objectives	:	<ul style="list-style-type: none"> To impart the knowledge about basic concepts of mould and plastic product design. To provide knowledge about detailed structure of moulds and various products, bill preparation and material selection criteria for end use application.
Unit-I	:	<p>Designing of injection moulds:</p> <ul style="list-style-type: none"> Design of two and three plate moulds, core side pin withdrawal, sprue removal and ejection system arrangement, tonnage and area calculations, CTP, CTQ. Cavity, gate, runner balancing, flow calculations, types of gates, types of cooling systems, MTC, HRC Systems, PWRHC unit and its utilization. Gas channels for gas assisted IM, special feature required for thermoset moulds. Selection of suitable m/c for suitable mould, types of heating systems available for moulds. Mould designing for threaded articles and inserts, multi-day light mould. Factors affecting quality and durability of mould. Bill of materials and specifications. Costing of mould and product. <p style="text-align: right;">12 Hrs</p>
Unit-II	:	<p>Designing of compression moulds:</p> <ul style="list-style-type: none"> Design of flash, positive and semi-positive mould with pin ejection, sleeve ejection, stripper plate ejection systems. Design of two-plate and three-plate moulds, split moulds, tonnage and area calculations. Mould designing for threaded articles and inserts. Types of cooling systems and their selection criteria, balancing of cooling. Bill of material, costing. <p style="text-align: right;">06 Hrs</p>
Unit-III	:	<p>Design of transfer moulds, blow moulds and extrusion dies:</p> <p>Details of ejection methods and heating systems for transfer and blow moulds. Blow moulds and their design features. Design features of film, sheet and pipe die.</p> <p style="text-align: right;">06 Hrs</p>
Unit-IV	:	<p>3D-printing technology and DFMA analysis:</p> <ul style="list-style-type: none"> Types of 3D-printing machines and its working principle, application and costing of product. Introduction to DFMA analysis. <p style="text-align: right;">06 Hrs</p>
Unit-V	:	<p>Product design features:</p> <ul style="list-style-type: none"> Effect of wall thickness, flat surfaces corners, radius, drafts, fillets, shrinkage,

	<p>warpage, parting line tolerances.</p> <ul style="list-style-type: none"> Rim, rib, design, gussets, bosses, radii/fillets holes and its types, under cuts, collapsible types of cores, types of inserts and threads, types jigs and fits, shapes of male and female inserts. Product costing with reference to number of cavities, cycle time and raw materials for products. <p style="text-align: right;">12 Hrs</p>
Unit-VI	<p>: Component design:</p> <p>Design of components like:</p> <ol style="list-style-type: none"> Plastic chair Plastic gear Plastic bearing Plastic bottles Pipe Overhead water tank <p style="text-align: right;">06 Hrs</p>

Reference Books	Sr. No.	Title	Author	Publication	Edition
	1	Plastic Product Design	Ronold D. Beck	Van Nostrand Reinhold	2 nd
	2	Plastics Product design Hand book: Part A	Edward Miller	Marcel Dekker Inc.	-
	3	Plastics Design Hand Book	Dominic and Donald V. Rosato	Kauwer Academic Publisher	2 nd
	4	Dies for Extrusion of Plastics	M.V. Joshi	MacMillan India Limited	-
	5	Injection Mould Design	R.G.W. Pye	East-West Press Pvt. Ltd., New Delhi	4 th

Section A: Units I, II and III; **Section B:** Units IV, V, and VI

Pattern of Question paper:

The 6 units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 Marks Paper:

- Ten questions.
- Five questions in each section
- Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section for 10 marks each.
- Remaining questions will be of 15 marks each.
- Any two questions of 15 marks from remaining questions in each section are to be solved.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
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Course Code: PPE402
Teaching Scheme: 4 Hrs/week
Theory: 4 Hrs/week
Credits: 04

Course: Polymer Blends and Composites
Class Test (Marks): 20
Theory Examination (Duration): 03 Hrs
Theory Examination: 80 Marks

Prerequisite	: <ul style="list-style-type: none"> • Fundamental concept on structure-property relationship of polymer. • Basic concept of processing, testing and characterization methods for polymers.
Objectives	: <ul style="list-style-type: none"> • To understand the mechanisms and strategies of preparation of polymer blends and composites. • Analysis of polymer blends and composites.
Unit-I	: Introduction to polymeric blends and composites: Significance of polymeric blends and composites, miscellaneous materials used in blending and preparation of composites, rubber toughened polymer blends, applications of polymeric blends and composites. <p style="text-align: right;">04 Hrs</p>
Unit-II	: Polymer blending: Interface and interphase, miscible and immiscible blends, thermodynamic criteria of polymer blending, UCST and LCST, phase diagrams of polymer blends, polymer-solvent and polymer-polymer systems, Flory-Huggins theory, phase separation mechanisms, case study on phase separation of binary and ternary blends. <p style="text-align: right;">12 Hrs</p>
Unit-III	: A) Compatibilization: Polymer-polymer interface interaction, interphase formation, strategies to improve interface interactions, compatibilization mechanisms, compatibilizers and coupling agents. B) Interpenetrating network: Introduction, classification, methods of preparation and applications of interpenetrating network. <p style="text-align: right;">08 Hrs</p>
Unit-IV	: Fillers and reinforcement: Reinforcing and non-reinforcing fillers, effect of shape and size of fillers. Classification, properties and applications of short fiber, continuous fiber (natural and synthetic), particulate filler and nanofiller. Rules of reinforcement (Guth and Gold equation, critical fiber length, calculation of modulus of fiber reinforced composites). <p style="text-align: right;">08 Hrs</p>
Unit-V	: Polymer composites: Polymer composite preparation methods (melt and solution mixing), mechanisms (intercalation, exfoliation, dispersion, distribution, orientation, percolation etc.) and processing techniques (hand lay-up, spray-up, pultrusion, filament winding, resin transfer molding, vacuum bagging). Isotropic and anisotropic composites, rules of mixture. <p style="text-align: right;">10 Hrs</p>

Unit-VI	:	Analysis of polymer blends and composites: Selection of suitable characterization methods, selection and sample preparation techniques (surface, bulk, tensile fracture, cryo-fracture, solvent etching, cryo-grinding, selective staining, solvent systems etc.). Basic idea about morphological and thermal properties of blend and composites.	06 Hrs
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Reference Books		Sr. No.	Title	Author	Publication	Edition
	:	1	Polymer Blends Handbook	Leszek A. Utracki, Charles A. Wilkie	Springer	2 nd
		2	Polymer Blends (Vol. 1)	D. R. Paul, Seymour Newman	Academic Press	1978
		3	Polymer matrix composites and technology	Ru-Min Wang, Shui-Rong Zheng and Ya-Ping Zheng	Woodhead Publishing	2011
		4	Manufacturing techniques for polymer matrix composites (PMCs)	Suresh G. Advani, Kuang-Ting Hsiao	Woodhead Publishing	2012
		5	Particulate-Filled Polymer Composites	Roger N. Rethon	Rapra Technology	2 nd
		6	Processing of Polymer Matrix Composites	P. K. Mallick	CRC Press	2018

Section A: Units I, II and III; **Section B:** Units IV, V, and VI

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For 80 Marks Paper:

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Course Code: PPE403 Teaching Scheme: 4 Hrs/week Theory: 4 Hrs/week Credits: 04	Course: Polymer Reaction Engineering and Plant Design Class Test (Marks): 20 Theory Examination (Duration): 03 Hrs Theory Examination: 80 Marks
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Prerequisite	:	<ul style="list-style-type: none"> • Knowledge of heat transfer, process calculations and mass transfer. 	
Objective	:	<ul style="list-style-type: none"> • To study kinetics of various reactions. • To focus on engineering problems and solving using scientific and mathematical principles • To design process equipment which are then tested to ensure effectiveness and maximize the production 	
Unit-I	:	Introduction to chemical kinetics: Molecularity and order of chemical reaction, rate constant and its representation, temperature dependence in terms of rate expression, theories of temperature dependency: Arrhenius theory, bimolecular theory and transition state theory.	08 Hrs
Unit-II	:	Types of reactors: Batch, CSTR, Plug flow reactors, merits and demerits, catalytic reactors, autocatalytic reactors, reactors in series and parallel.	12 Hrs
Unit-III	:	Reactor design considerations: Reactors for PS, PVC, LDPE.	04 Hrs
Unit-IV	:	Process design aspects: Importance of process development and plant design, selection of process, significance of pilot plant, safety measures in process equipment design.	08 Hrs
Unit-V	:	Selection of process equipment: Standard versus special equipment, material standards, material of construction for process equipment and their selection criteria, plant layout.	08 Hrs
Unit-VI	:	Process auxiliaries and process utilities: Piping design, layout, supports for piping, pipe fittings, types of valves and selection criteria. Process control and instrumentation, insulation and material of construction.	08 Hrs

Reference Books	Sr. No.	Title	Author	Publication	Edition
:	1	Chemical reaction Engineering	Levenspiel	John Wiley & Sons	3 rd
	2	Chemical Engineering Volume I & II	Richardson & Coulson	Elsevier Butterworth-Heinemann	3 rd
	3	Elements of Chemical Reaction Engineering,	H. Scott Fogler	Prentice Hall International	4 th
	4	Introduction to Polymer science & Technology	Dr. Shrikant Dawande	Denett & Co	-
	5	Chemical Reaction Kinetics	J. M. Smith	McGraw-Hill Inc.	3 rd
	6	Plant Design and Economics for Chemical Engineers	Max Peters, Klaus Timmerhaus, Ronald West	McGraw-Hill International Editions	5 th
	7	Chemical Engineering: Vol.6	Coulson J. M. and Richardson J. F.	Pergamon Press	-
	8	Process Design of Equipments	Dawande S. D.	Central Techno Publications	-
	9	Chemical Reaction Engineering- I	K. A. Gavhane	Nirali Prakashan	-

Section A: Units I, II and III; **Section B:** Units IV, V, and VI

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Syllabus of Final Year B. Tech. (All) Semester-VII

Course Code: AED431

Teaching Scheme: 4 Hrs/week

Theory: 4 Hrs/week

Credits: 04

Course: Open Elective-II: Fundamentals of Bioenergy

Class Test (Marks): 20

Theory Examination (Duration): 03 Hrs

Theory Examination: 80 Marks

Objectives	:	<ul style="list-style-type: none">• Understand bioenergy technologies, processes, reactions and energy conversion rates for anaerobic digestion, gasification, pyrolysis (fast, intermediate and slow) and combustion.• To study the wells, bore wells and well development.• Know what constitutes a suitable feedstock for bioenergy applications
Unit-I	:	Introduction to bioenergy: Introduction, Unit of Energy and Introduction of Bioenergy, How Biomass Formed on the Earth, Road Map of Bioenergy, Basic Biomass Technology (Resources and Production) Exploration of Photosynthesis Process, In Photosynthesis Oxygen Comes from Water Molecule. 08 Hrs
Unit-II	:	Bioethanol: Basic concept of Cellulosic Bioethanol Process, Pretreatment and Enzyme treatment of Cellulosic Bioethanol Process, Fermentation and Distillation in Cellulosic Bioethanol Production, Basic concept of Plant Design, Pilot Plant and Scale-up. 08 Hrs
Unit-III	:	Biogas: Basic concept in anaerobic digestion and biogasification, Biochemical methane potential assay and calculations for biogasification feasibility analysis, Design and operation of biogasification systems, Biogas utilization, Biomass production System and their Categorization, Important Parameters for Selecting Biomass Crops, Factors Determining the Conversion Process - I. 08 Hrs
Unit-IV	:	Biodiesel: Biodiesel production processes, Biodiesel characterization, Biodiesel feedstocks, Environmental permitting and safety considerations for biodiesel production. 08 Hrs
Unit-V	:	Thermo chemical processes: Basic concepts in gasification and pyrolysis, Gasification and pyrolysis systems, Spark Ignition Engine, Compression Ignition Engine, Gasification Types - Up Drift Gasifier. 08 Hrs
Unit-VI	:	Bioenergy distribution and end use for a sustainable future: Down Draft and cross flow gasifier, operation and performance of gasifier, fluidized bed gasification, its operation and performance, Biological root of gasification. 08 Hrs

Section A: Units I, II and III; **Section B:** Units IV, V, and VI

Reference Books	Sr. No.	Title	Author	Publication	Edition
	1	Introduction to Bioenergy (Energy and the Environment)	Vaughn C. Nelson (Author), Kenneth L. Starcher	-	-
	2	Bioenergy: Biomass to Biofuels	Anju Dahiya	-	-
	3	Bioenergy: Principles and Applications	Yebo Li and Samir Kumar Khanal	-	-

Pattern of Question paper:

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For 80 Marks Paper:

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2. Five questions in each section
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Syllabus of Final Year B. Tech. (All) Semester-VII

Course Code: CED431

Course: Open Elective-II: Solid Waste Management

Teaching Scheme: 4 Hrs/week

Class Test (Marks): 20

Theory: 4 Hrs/week

Theory Examination (Duration): 03 Hrs

Credits: 04

Theory Examination: 80 Marks

Unit-I	:	Introduction to solid waste management (SWM): Need and Objectives of SWM, Waste Management Hierarchy, Functional elements, Environmental impact of mismanagement. Solid waste: Sources, types, Composition, Quantities, Physical, chemical and Biological properties. 08 Hrs
Unit-II	:	Generation of solid waste: Factors affecting. Storage and collection: General considerations for waste storage at source, Types of collection systems. Collection System, Transfer station: Meaning, Necessity, Transportation of solid waste: Means and Methods, Routing of vehicles. 08 Hrs
Unit-III	:	Segregation and material recovery: Objectives, Stages of segregation, sorting operations, Guidelines for sorting for materials recovery, E waste management, Biomedical waste management. 08 Hrs
Unit-IV	:	Waste processing: Processing technologies: Composting, thermal conversion technologies incineration, treatment of biomedical wastes. Energy recovery from solid waste: Parameters affecting energy recovery, Bio-methanation, Fundamentals of thermal processing, Pyrolysis, Incineration, Advantages and disadvantages of various technological options. 08 Hrs
Unit-V	:	Disposal: Landfills and its introduction, Definition, Essential components, Site selection, Land filling methods, Leachate analysis and landfill gas management, treatment and disposal, Determination of capacity of landfill disposal site 08 Hrs
Unit-VI	:	Hazardous waste management: Types of hazardous waste (such as nuclear, biomedical and industrial waste,), problems and issues related to hazardous waste management, Need for hazardous waste management, Legislations on management and handling of HW, Hazardous Characteristics, reduction of wastes at source, Recycling and reuse, labeling and handling of hazardous wastes, incineration, solidification and stabilization of hazardous waste. 08 Hrs

Reference Books	Sr. No.	Title	Author	Publication	Edition
:	1	Integrated Solid Waste Management	Hilary Theisen and Samuel A, Vigil, George Tchobanoglous	McGraw- Hill, New York	1993
	2	Manual on Municipal Solid waste management	CPHEEO	Central Public Health and Environmental Engineering Organization, Government of India, New Delhi	2000
	3	Hazardous waste management	Michael D. LaGrega, Philip L Buckingham, Jeffrey C. Evans	Waveland Press, Inc.	2 nd , 2001
	4	Solid waste Engineering	Vesilind P.A., Worrell W and Reinhart	Thomson Learning Inc., Singapore	2002
	5	Hazardous Waste Management	Charles A. Wentz	McGraw Hill International Edition, New York	2 nd , 1995

Section A: Units I, II and III; **Section B:** Units IV, V, and VI

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For 80 Marks Paper:

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4. Remaining questions will be of 15 marks each.
5. Any two questions of 15 marks from remaining questions in each section are to be solved.

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Syllabus of Final Year B. Tech. (All) Semester-VII

Course Code: CSE431 **Course: Open Elective-II: Big Data Analytics**
Teaching Scheme: 4 Hrs/week **Class Test (Marks): 20**
Theory: 4 Hrs/week **Theory Examination (Duration): 03 Hrs**
Credits: 04 **Theory Examination: 80 Marks**

Prerequisites	:	<ul style="list-style-type: none"> • Knowledge of Programming Language (Java preferably), SQL.
Objectives	:	<ul style="list-style-type: none"> • To understand the Big Data Platform and its Use cases. • To understand the basics of Apache Hadoop and HDFS. • To apply analytics on Structured, Unstructured Data.
Unit-I	:	<p>Fundamentals of Big Data: The Evolution of Data Management, Understanding the Waves of Managing Data, Defining Big Data, Four Vs, Big Data Management Architecture. Big Data Types: Defining Structured Data, Defining Unstructured Data, Big Data Applications.</p> <p style="text-align: right;">08 Hrs</p>
Unit-II	:	<p>Big Data technology landscape: Big Data Technology Components: Exploring the Big Data Stack, Virtualization, Understanding the Basics of Virtualization, Managing Virtualization with the Hypervisor, Abstraction and Virtualization, Implementing Virtualization to Work with Big Data.</p> <p style="text-align: right;">08 Hrs</p>
Unit-III	:	<p>Data analytics: Predictive Analytics: Linear Regression, Logistic Regression, Decision Trees, Descriptive Analytics: Association Rules, Sequence Rules, Segmentation, Social Network Analytics: Social Network Definitions, Social Network Metrics, Social Network Learning, Relational Neighbor Classifier, Business Process Analytics, Web Analytics.</p> <p style="text-align: right;">08 Hrs</p>
Unit-IV	:	<p>Hadoop and map reduce: History of Hadoop, Analyzing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, Hadoop Storage, Common Hadoop Shell commands, Hadoop Architecture, Hadoop Map Reduce Paradigm: Map and Reduce tasks , Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats.</p> <p style="text-align: right;">08 Hrs</p>
Unit-V	:	<p>HDFS (Hadoop Distributed File System): The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Sqoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.</p> <p style="text-align: right;">08 Hrs</p>

Unit-VI	<p>Hadoop eco system: Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS.</p> <p style="text-align: right;">08 Hrs</p>
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Reference Books	Sr. No.	Title	Author	Publication	Edition
:	1	Big Data Analytics	Seema Acharya, Subhasini Chellappan	Wiley	2015
	2	Hadoop: The Definitive Guide	Tom White	O'reily Media	3 rd , 2012
	3	Analytics in a Big Data World: The Essential Guide to Data Science and its Applications	Bart Baesens	Wiley	2014
	4	Intelligent Data Analysis	Michael Berthold, David J. Hand	Springer	2007
	5	Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics	Bill Franks	John Wiley & Sons	2012
	6	Making Sense of Data	Glen J. Myat	John Wiley & Sons	2007
	7	Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses	Michael Mineli, Michele Chambers, Ambiga Dhiraj	Wiley	2013

Section A: Units I, II and III; **Section B:** Units IV, V, and VI

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For 80 Marks Paper:

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Syllabus of Final Year B. Tech. (All) Semester-VII

Course Code: EED431

Teaching Scheme: 4 Hrs/week

Theory: 4 Hrs/week

Credits: 04

Course: Open Elective-II: Energy Planning and Conservation

Class Test (Marks): 20

Theory Examination (Duration): 03 Hrs

Theory Examination: 80 Marks

Prerequisites	:	<ul style="list-style-type: none">• Should have knowledge of Electrical/ Mechanical Appliances, various types of energy utilization.
Objectives	:	<ul style="list-style-type: none">• Identify the demand supply gap of energy in Indian scenario.• Understanding basics of energy audit.• Understand various opportunities in energy saving for industry.
Unit-I	:	Energy Policy: National & State Level Energy Issues, National & State Energy Policy, Industrial Energy Policy, Energy Security, Energy Vision. Energy Pricing & Impact of Global Variations. Energy Productivity (National & Sector wise productivity). 08 Hrs
Unit-II	:	Energy Action Planning: Energy Action Planning: Key elements, Force field analysis, Energy policy purpose, perspective, Contents, Formulation, Ratification, Organizing - location of energy management, Top management support, Managerial function, Roles and responsibilities of energy manager, Accountability. Motivating-motivation of employees. 08 Hrs
Unit-III	:	Importance of Energy Management: Energy Management: Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance. 08 Hrs
Unit-IV	:	Elements of Energy Conservation: General energy problem, Scope for energy conservation and its benefits, Energy conservation Principle – Maximum energy efficiency, Maximum cost effectiveness, Mandatory provisions of Energy Conservation act 2001, Features of Energy Conservation act-Standards and labelling, designated consumers, Energy Conservation Building Codes (ECBC). 08 Hrs
Unit-V	:	Energy Audit and Measuring Instruments: Basic measurements – Electrical measurements, Light, Pressure, Temperature and heat flux, Velocity and Flow rate, Vibrations. Instruments Used in Energy systems: Load and power factor measuring equipments, Wattmeter, flue gas analysis, Temperature and thermal loss measurements, air quality analysis etc. 08 Hrs

Unit-VI	<p>Lighting and Lighting System: Lightings Levels, Fixtures Lighting techniques – Natural, CFL, LED lighting sources and fittings, Day lighting, Timers, Energy Efficient Windows.</p> <p style="text-align: right;">08 Hrs</p>
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Text Books	:	Sr. No.	Title	Author	Publication	Edition
		1	Bureau of Energy efficiency hand books No 1 & 2	BEE OF INDIA	BEE OF INDIA	-
		2	Energy Management Handbook	Wayne C. Turner	Tata McGraw Hill	-
		3	Energy management	Paul O Callaghan	-	-
		4	Bureau of Energy efficiency hand books No 3	BEE OF INDIA	BEE OF INDIA	-
Additional References	:	1	https://www.beeindia.gov.in/content/energy-auditors information as & when available.			

Section A: Units I, II and III; **Section B:** Units IV, V, and VI

Pattern of Question paper:

The 6 units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 Marks Paper:

1. Ten questions.
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section for 10 marks each.
4. Remaining questions will be of 15 marks each.
5. Any two questions of 15 marks from remaining questions in each section are to be solved.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of Final Year B. Tech. (All) Semester-VII

Course Code: ETC431 **Course: Open Elective-II: Data Science**
Teaching Scheme: 4 Hrs/week **Class Test (Marks): 20**
Theory: 4 Hrs/week **Theory Examination (Duration): 03 Hrs**
Credits: 04 **Theory Examination: 80 Marks**

Prerequisites	:	<ul style="list-style-type: none"> • Programming Concepts, Data Structure, Basic Linear Algebra, Basic Probability and Statistics
Objectives	:	<ul style="list-style-type: none"> • Describe what Data Science is and the skill sets needed to be a data scientist • Explain the significance of exploratory data analysis in data science • Apply basic machine learning algorithm. • Identify approaches used for feature generation. • Create effective visualization of given data.
Unit-I	:	<p>Introduction: Introduction, big data and data science hype, datafication, current landscape of perspective.</p> <p style="text-align: right;">08 Hrs</p>
Unit-II	:	<p>Statistical inference and exploratory data analysis: Populations and samples, statistical modelling, probability distributions, fitting a model, Introduction to R. Basic Tools (Plots, Graphs and summary statistics) of EDA, philosophy of EDA, the data science process, Case Study.</p> <p style="text-align: right;">08 Hrs</p>
Unit-III	:	<p>Machine learning algorithm and its usage: Linear Regression, k-nearest Neighbors(k-NN), k-means. Spam filtering, naïve Bayes and its application for spam filtering, Data Wrangling: Tools and API for scrapping the web.</p> <p style="text-align: right;">08 Hrs</p>
Unit-IV	:	<p>Feature generation and selection: Feature generations algorithms, feature selection algorithms: filters, wrappers, decision trees, random forest. Algorithmic ingredients of a recommendation engine, dimensionality reduction, singular value decomposition, principal component analysis.</p> <p style="text-align: right;">08 Hrs</p>
Unit-V	:	<p>Mining social network: Social Networks as graphs, clustering of graphs, direct discoveries of communities in graphs, portioning of graphs, neighborhood properties of graphs.</p> <p style="text-align: right;">08 Hrs</p>
Unit-VI	:	<p>Data visualization and ethical issues: Basic principles, ideas and tools for data visualization, creation of visualization for complex data set. Case study. Privacy, security and ethics of data science.</p> <p style="text-align: right;">08 Hrs</p>

Text Books		Sr. No.	Title	Author	Publication	Edition
	:	1	Doing Data Science, Straight Talk From The Frontline	Cathy O’Neil and Rachel Schutt	O’Reilly	2014
Reference Books	:	1	Mining of Massive Datasets. v2.1	Jure Leskovek, Anand Rajaraman and Jeffrey Ullman	Cambridge University Press	2014
		2	Machine Learning: A Probabilistic Perspective.	Kevin P. Murphy	ISBN 0262018020	2013
		3	Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking.	Foster Provost and Tom Fawcett	ISBN 1449361323	2013

Section A: Units I, II and III; **Section B:** Units IV, V, and VI

Pattern of Question paper:

The 6 units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 Marks Paper:

1. Ten questions.
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section for 10 marks each.
4. Remaining questions will be of 15 marks each.
5. Any two questions of 15 marks from remaining questions in each section are to be solved.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of Final Year B. Tech. (All) Semester-VII

Course Code: MED431 **Course: Open Elective-II: Operations Research**
Teaching Scheme: 4 Hrs/week **Class Test (Marks): 20**
Theory: 4 Hrs/week **Theory Examination (Duration): 03 Hrs**
Credits: 04 **Theory Examination: 80 Marks**

Unit-I	:	Introduction to operations research: Basics definition, scope, objectives, phases, models, applications and limitations of Operations Research.	02 Hrs
Unit-II	:	Linear programming problem: Formulation of LPP, Graphical solution of LPP, Simplex Method, Artificial variables, Big-M method, two-phase method, degeneracy and unbound solutions.	12 Hrs
Unit-III	:	Transportation model: Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel’s approximation method. Optimality test – the stepping stone method or MODI method. Degeneracy in Transportation Problem. Assignment Problem: Hungarian Method to solve Assignment Problem, Travelling Salesman as an Extension of Assignment Problem.	10 Hrs
Unit-IV	:	Inventory control, replacement analysis and theory of games: Inventory Models: Economic Order Quantity Models, Quantity Discount Models, Stochastic Inventory Models, Multi Product Models, Inventory Control Models in Practice. Replacement Analysis: Replacement of Items that Deteriorate, Replacement of Items that Fail Suddenly. Theory of Games: Introduction, Minimax and Maximin Principle, Solution of Game with Saddle Point, Solution by Dominance.	08 Hrs
Unit-V	:	Queuing model and sequencing model: Queuing Systems And Structures, Notation Parameters, Single Server and Multi Server Models, Poisson Input, Exponential Service, Constant Rate Service, Infinite Population Sequencing Model: Introduction, n jobs through two machines, n jobs through three machines, two jobs through m machines and n jobs through m machines.	11 Hrs
Unit-VI	:	Network models: Fulkerson’s rule, concept and types of floats, float calculations, CPM and PERT, crashing cost and crashing network.	05 Hrs

Reference Books, e-books, e-Journals	Sr. No.	Title	Author	Publication	Edition
	1	Operations Research	Taha H.A.	Prentice Hall Of India	9 th
	2	Introduction to Operations Research	Frederick S. Hillier and Gerald J. Lieberman	Tata McGraw-Hill	7 th
	3	Operations Research	P.K. Gupta, D.S Hira	S. Chand & Co.	4 th
	4	Operations Research	Man Mohan, P. K. Gupta, Kanti Swarup	S. Chand & Co.	12 th
	5	Operations Research Principles and Practice	Ravindran, Phillips and Solberg	Mc. WSE Willey	2 nd
	6	Operations Research: Applications and Algorithms	Wayne L. Winston, Jeffrey B. Goldberg	Thomson Brooks	4 th
	7	Operations Research: Theory, Methods and Applications	S. D. Sharma, Himanshu Sharma	Kedar Nath Ram Nath	-
	8	PERT and CPM: Principles and Applications	L. S. Srinath	Affiliated East-West Press Pvt. Ltd.	3 rd
	9	Project Planning and Control with PERT & CPM	Dr. B.C. Punmia & K.K. Khandelwal	Firewall Media	4 th
Additional references	1	nptel.iitm.ac.in			
	2	ocw.mit.edu			
	3	https://www.journals.elsevier.com/journal-of-operations-management			
	4	https://pubsonline.informs.org/journal/opre			
	5	https://www.theorsociety.com/			

Section A: Units I, II and III; **Section B:** Units IV, V, and VI

Pattern of Question paper:

The 6 units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 Marks Paper:

1. Ten questions.
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section for 10 marks each.
4. Remaining questions will be of 15 marks each.
5. Any two questions of 15 marks from remaining questions in each section are to be solved.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

(Faculty of Science & Technology)

Syllabus of Final Year B. Tech. (All) Semester-VII

Course Code: PPE431

Course: Open Elective-II: Polymer Recycling and Waste Management

Teaching Scheme: 4 Hrs/week

Class Test (Marks): 20

Theory: 4 Hrs/week

Theory Examination (Duration): 03 Hrs

Credits: 04

Theory Examination: 80 Marks

Prerequisite	:	• Fundamental about types of polymers and properties of polymers.
Objective	:	• To learn need for polymer recycling and techniques employed for recycling of polymers and the applications of recyclates. • To learn the need and various method/techniques involved in polymer waste management.
Unit-I	:	Significance of recycling: Global plastics production and composition, global plastics waste composition, quantities and disposal, identification codes of plastics for recycling. Recycling process: collection, sorting and segregation of waste, recycling methods: Primary, secondary, tertiary and quaternary recycling, landfilling. 08 Hrs
Unit-II	:	Recycling equipment/machinery: Equipment for primary and secondary recycling: shredder, granulator, pulverizer, cutter, extruder. Classification and types of reactors for tertiary recycling. 09 Hrs
Unit-III	:	Recycling of plastics from urban waste: Rheology, density and mechanical behavior of recycled plastics, hydrolytic treatment of plastics waste containing paper, processing of mixed plastics waste, recycling additives. 07 Hrs
Unit-IV	:	Recycling techniques: Recycling techniques of PE packaging films and woven sacks, PET bottles and films, PP battery cases, PVC products and thermosetting plastics. 08 Hrs
Unit-V	:	Municipal solid waste management and treatment techniques: Collection, storage, transportation and disposal of municipal solid waste, sorting of MSW, types of vehicles and equipment for primary collection, secondary collection and transport. Different treatment techniques: a) Composting: techniques such as windrow, aerated static pile, in vessel, decentralized, bin and vermicomposting. b) Bio-methanation: merits, applicability, process and types of anaerobic digester systems. c) Refuse derived fuel: classification, composition, production process and uses. d) Sanitary landfilling: requirements, layout, leachate management, waste placement and inspection. 11 Hrs

Unit-VI	:	Tools for combating polymer waste: Combating tools for waste management: extended producer responsibility, product stewardship, shared producer responsibility, usage of green products and usage of biodegradable or environmentally degradable polymers for waste reduction.	05 Hrs
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Reference Books		Sr. No.	Title	Author	Publication	Edition
	:	1	Plastics Fabrication and Recycling	Manas Chanda and Salil K. Roy	CRC Press	4 th , 2007
		2	Introduction to Plastics Recycling	Vannessa Goodship	Smithers Rapra	2 nd , 2006
		3	Recycling of Polymers	Raju Francis	Wiley-VCH	1 st , 2016
		4	Recycling of Plastic Materials	Francesco Paolo La Mantia	Chemtec Publishing	2 nd , 1993
		5	Feedstock Recycling and pyrolysis of waste plastics	John Schiers & W. Kaminsky	John Wiley and Sons	1 st , 2006
		6	Mixed Plastic Recycling Technology	B. Hegberg, G. Brenniman	Noyes Data Corporation	1 st , 1992
		7	Plastics Waste: Recovery of Economic value	Jacob Leidner	Marcel Decker Inc.	2 nd , 2001
		8	Management of municipal solid waste	T. V. Ramchandra	TERI Press	1 st , 2009
		9	Waste Management	Martin F. Lehmann	I. A. Publishers	1 st , 2008
		10	Environmental Waste Management	Ram Chandra	CRC Press	1 st , 2015
		11	Plastic Waste	Jacob Leidner	Marcel Decker Inc.	1 st , 1981

Section A: Units I, II and III; **Section B:** Units IV, V, and VI

Pattern of Question paper:

The 6 units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 Marks Paper:

1. Ten questions.
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section for 10 marks each.
4. Remaining questions will be of 15 marks each.
5. Any two questions of 15 marks from remaining questions in each section are to be solved.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of Final Year B. Tech. (Plastic and Polymer Engineering) Semester-VII

Course Code: PPE441

Teaching Scheme: 4 Hrs/week

Theory: 4 Hrs/week

Credits: 04

Course: Elective-III: Plastic Packaging Technology

Class Test (Marks): 20

Theory Examination (Duration): 03 Hrs

Theory Examination: 80 Marks

Prerequisite	:	<ul style="list-style-type: none"> Fundamental knowledge on polymeric materials, processing and testing.
Objective	:	<ul style="list-style-type: none"> To impart knowledge and skills related to packaging system for various products, to understand the concepts of materials used in packaging, machinery in packaging and testing of packaging material.
Unit-I	:	<p>Introduction of packaging: History, need and evolution, elements, approach, functions of packaging, advantages of plastic packaging, applications. Elements of package design, importance of a good design, software used for designing package. Packaging hazards and their control.</p> <p style="text-align: right;">08 Hrs</p>
Unit-II	:	<p>Plastic packaging materials: Selection criteria, origin, types, properties, applications and limitations of plastic packaging materials, bio degradable material. Packaging wastes and its management.</p> <p style="text-align: right;">08 Hrs</p>
Unit-III	:	<p>Packaging forms: Bottle, strip, skin, blister, shrink, box, vacuum, gas, CAP, MAP, tubes, woven sack etc.</p> <p style="text-align: right;">08 Hrs</p>
Unit-IV	:	<p>Specialty packages: Aseptic, tetra, types of pouches/sack; Stand up pouch, Retort pouch, gusseted pouch, 2-seal, 3 side sealed pouch. Flexible Packaging, forms of flexible packaging. Wrapping, FORM-FILL-SEAL (FFS), sealing methods, metalizing.</p> <p style="text-align: right;">08 Hrs</p>
Unit-V	:	<p>Food and agro based Packaging: Requirements and their selection for raw and processed foods, meat, fish, poultry, eggs, milk and dairy products, fruits and vegetables, cereal grains and baked food products, beverages, snacks, ready to eat food, packaging of horticultural crops. Packaging of drugs and cosmetics.</p> <p style="text-align: right;">08 Hrs</p>
Unit-VI	:	<p>Printing: Surface treatment, printing processes, printing inks. Packaging quality control: criteria, physical, chemical, mechanical test procedure for packaging materials and packaged products. Introduction to packaging laws and regulations.</p> <p style="text-align: right;">08 Hrs</p>

Reference Books	Sr. No.	Title	Author	Publication	Edition
:	1	Understanding Plastic Packaging Technology	Susan E.M. Seleke	Hanser publications - Munich	1 st , 1997
	2	Plastics in Packaging	A.S. Althalye	Tata McGrawHill publishing Co. Ltd., New Delhi.	1 st Ed. 1992
	3	Food Packaging Technology Hand Book	NIIR	Asia-Pacific publication.	1 st , 2012
	4	Package Engineering	Honlon J F	McGraw Hill	1 st , 1984
	5	Plastics Packaging	Turtle Ivor	Pira International	1 st , 1990
	6	Handbook of Packaging-Plastics	A.S. Althalye	Multi-tech Plastics publishing co. Mumbai.	1 st , 2013
	7	The Wiley Encyclopedia of Packaging Technology	Kit L Yam	John Wiley & Sons Inc. Publication	2009
	8	The Packaging User's Handbook	F.A. Paine	Blackie Academic & Professional.	1 st , 1999

Section A: Units I, II and III; **Section B:** Units IV, V, and VI

Pattern of Question paper:

The 6 units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 Marks Paper:

1. Ten questions.
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section for 10 marks each.
4. Remaining questions will be of 15 marks each.
5. Any two questions of 15 marks from remaining questions in each section are to be solved.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of Final Year B. Tech. (Plastic and Polymer Engineering) Semester-VII

Course Code: PPE442

Teaching Scheme: 4 Hrs/week

Theory: 4 Hrs/week

Credits: 04

Course: Elective-III: Chemical Project Economics

Class Test (Marks): 20

Theory Examination (Duration): 03 Hrs

Theory Examination: 80 Marks

Prerequisite	: • Fundamental concept of project management.
Objective	: • To learn the basic concepts used in the selection of process and site for the project, deal comprehensively with procedures frequently used for estimation of the project cost and measuring the financial viability of projects.
Unit-I	: Introduction: Types of projects, chemical project classification, project conception to commissioning. 04 Hrs
Unit-II	: Process and site selection: Viability and profitability parameters for process selection, gross cost of production, process evaluation, site selection, site evaluation based on profitability and productivity, land selection based in site data and geographical features, site clearances. 06 Hrs
Unit-III	: Project cost: Elements of project cost: land and site development, building and civil works, plant and machinery, know-how and engineering, expenses on foreign technicians or Indian technicians trained abroad, miscellaneous fixed assets, contingencies, pre-operative expenses, preliminary and capital issue expenses and margin money, project cost schedule, plant and machinery. 14 Hrs
Unit-IV	: Cost of production: Elements of cost of production, gross cost of production, normative cost of production, cost of production schedule. 04 Hrs
Unit-V	: Project financing, interest and depreciation: Project financing for greenfield project, add on project and ongoing business, working capital. Types of interest, loan repayment, nominal and effective interest rates, working capital borrowing and periodic payments: installments. Depreciation concept in chemical projects, depreciation methods: straight line method and written down value method, rate of depreciation, depreciation schedule. 10 Hrs
Unit-VI	: Project profitability, evaluation and pricing: Estimate of working results: sales, gross profit, operating profit, profit for corporate tax, corporate tax, dividend, net cash accruals break even analysis, incremental analysis, ratio analysis, discounted profit flow technique. Project product pricing, economy of scale, market considerations. 10 Hrs

Reference Books	Sr. No.	Title	Author	Publication	Edition
:	1	Chemical Project Economics	V. V. Mahajani and S. M. Mokashi	Laxmi Publications	2 nd , 2015
	2	Process Plant Layout and Piping Design	Ed Bausbacher, Roger Hunt	Prentice Hall	1 st , 2006
	3	Effective Project Management	Robert K. Wysocki	Wiley Publishing Inc.	5 th , 2009
	4	Project Management	Sadhan Choudhary	Tata McGraw Hill	1 st , 1988
	5	Project Management	Vasant Desai	Himalaya Publishing House	4 th , 2013
	6	Count Your Chickens before They Hatch	Arindham Choudhari	Vikas Publishing House	1 st , 2001

Section A: Units I, II and III; **Section B:** Units IV, V, and VI

Pattern of Question paper:

The 6 units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 Marks Paper:

1. Ten questions.
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section for 10 marks each.
4. Remaining questions will be of 15 marks each.
5. Any two questions of 15 marks from remaining questions in each section are to be solved.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of Final Year B. Tech. (Plastic and Polymer Engineering) Semester-VII

Course Code: PPE443

Course: Elective-III: Advanced Characterization and Analysis

Teaching Scheme: 4 Hrs/week

Class Test (Marks): 20

Theory: 4 Hrs/week

Theory Examination (Duration): 03 Hrs

Credits: 04

Theory Examination: 80 Marks

Prerequisite	:	• Fundamental knowledge on properties of polymers and characterization methods.
Objectives	:	<ul style="list-style-type: none"> • To understand about the mechanisms of different advanced characterization methods. • To acquire knowledge about analysis of materials from different characterization results.
Unit-I	:	<p>Elemental analysis: Introduction, basic working principle, strategy of analysis with examples and applications of MS, AAS, ICP, XRF.</p> <p style="text-align: right;">10 Hrs</p>
Unit-II	:	<p>Light scattering: Introduction, basic working principle, strategy of analysis with examples and applications of DLS and SLS (Zimm plot, Rayleigh ratio, scattering from macromolecules, particle size analysis). Significance of MALS, RALS and LALS.</p> <p style="text-align: right;">06 Hrs</p>
Unit-III	:	<p>Electrical characterization: Basic principle and strategy of analysis of electrical characterization: surface & volume resistivity; electrically conductive and antistatic product; conductivity (two probe and four probe method, transport property analysis), insulation (breakdown voltage and surface tracking) and dielectric characterization (permittivity, loss, $\tan \delta$, Cole-Cole analysis).</p> <p style="text-align: right;">08 Hrs</p>
Unit-IV	:	<p>Electrochemical characterization: Introduction, basic working principle, strategy of analysis with examples and applications of cyclic voltammetry, potentiostatic and galvanostatic methods, EIS (Nyquist analysis).</p> <p style="text-align: right;">08 Hrs</p>
Unit-V	:	<p>Miscellaneous characterization methods: Introduction, basic working principle, strategy of analysis with examples and applications of BET (Determination of surface area and pore size), EPR.</p> <p style="text-align: right;">06 Hrs</p>
Unit-VI	:	<p>Correlation of different instrumental analysis: Harnessing of different instrumental methods for analysis of polymeric materials by correlation to determine structural aspects. Examples with correlating combinations of NMR, FTIR, UV-VIS, DSC, TGA, TEM, MS etc.</p> <p style="text-align: right;">10 Hrs</p>

Reference Books	Sr. No.	Title	Author	Publication	Edition
:	1	Undergraduate Instrumental Analysis	James W. Robinson, Eileen M. Skelly Frame, George M. Frame II	Marcel Dekker	2005
	2	Modern Instrumental Analysis	S. Ahuja, N. Jespersen	Elsevier	2005
	3	Polymer characterization - laboratory techniques and analysis	Nicholas P. Cheremisinoff	Noyes Publications	1996
	4	Analytical Methods for Polymer Characterization	Rui Yang	CRC Press	2018
	5	Characterization of Solid Polymers: New techniques and developments	S.J. Spells	Chapman & Hall	1994

Section A: Units I, II and III; **Section B:** Units IV, V, and VI

Pattern of Question paper:

The 6 units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 Marks Paper:

1. Ten questions.
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section for 10 marks each.
4. Remaining questions will be of 15 marks each.
5. Any two questions of 15 marks from remaining questions in each section are to be solved.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of Final Year B. Tech. (Plastic and Polymer Engineering) Semester-VII

Course Code: PPE444

Course: Elective-IV: Functional Core-shell Hybrid Nanomaterials

Teaching Scheme: 2 Hrs/week

Class Test (Marks): 10

Theory: 2 Hrs/week

Theory Examination (Duration): 02 Hrs

Credits: 02

Theory Examination (Marks): 40

Prerequisite	:	<ul style="list-style-type: none"> • Basic concept of nanomaterials.
Objectives	:	<ul style="list-style-type: none"> • To study the fundamentals of core-shell hybrid nanomaterials and the factors affecting it. • To study the types and synthesis methods of core-shell hybrid nanomaterials. • To study the characterizations of core-shell hybrid nanomaterials. • To study the different applications of core-shell hybrid nanomaterials.
Unit-I	:	<p>Introduction: Fundamentals of nanotechnology, different shaped nanoparticles, surface modification of nanoparticles, classes of core-shell hybrid nanoparticles, different approaches for core-shell hybrid nanoparticle synthesis, Importance of core-shell hybrid nanoparticles.</p> <p style="text-align: right;">03 Hrs</p>
Unit-II	:	<p>Classification of core-shell hybrid nanomaterials: Inorganic-Inorganic core-shell hybrid nanomaterials, inorganic-organic core-shell hybrid nanomaterials, organic-organic core-shell hybrid nanomaterials, organic-inorganic core-shell hybrid nanomaterials, core-multishell hybrid nanoparticles, movable core/hollow shell hybrid nanoparticles.</p> <p style="text-align: right;">06 Hrs</p>
Unit-III	:	<p>Synthesis methods of core-shell hybrid nanomaterials: Sol-gel, In-situ Polymerization, Microemulsion, Hydrothermal, Surface-initiated atom transfer radical polymerization (SI-ATRP).</p> <p style="text-align: right;">03 Hrs</p>
Unit-IV	:	<p>Factors affecting the size and distribution of core-shell hybrid nanomaterials: Synthesis media, effect of temperature, effect of reactant concentration, effect of ph, effect of an external force.</p> <p style="text-align: right;">04 Hrs</p>
Unit-V	:	<p>Characterization of core-shell hybrid nanomaterials: X ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), energy dispersive X-ray (EDX) mapping, differential scanning calorimetry (DSC), thermo gravimetric analysis (TGA), small angle x-ray scattering (SAXS).</p> <p style="text-align: right;">04 Hrs</p>
Unit-VI	:	<p>Applications of core-shell hybrid nanomaterials: Impact modifier, reinforcing agent, water remediation, sensors, joint replacement, self-healing agent, controlled drug delivery and specific targeting, electronic and other applications.</p> <p style="text-align: right;">04 Hrs</p>

Reference Books	Sr. No.	Title	Author	Publication	Edition
	1	Encyclopaedia of Nanoscience and Nanotechnology	Hari Singh Nalwa	American Scientific publishers	
	2	Processing of Polymer Matrix Composites	P. K. Mallick	CRC Press	2018
	3	Core-Shell Nanostructures for Drug Delivery and Theranostics Challenges, Strategies and Prospects for Novel Carrier Systems	Maria Letizia Focarete, Anna Tampieri	Woodhead Publishing (Elsevier)	2018
Reference Articles	1	Surface modification of inorganic nanoparticles for development of organic–inorganic nanocomposites—A review	Susheel Kalia et al.	Progress in Polymer Science, Elsevier	-
	2	Core/Shell Nanoparticles: Classes, Properties, Synthesis Mechanisms, Characterization, and Applications	Rajib Ghosh, Chaudhuri and Santanu Paria	Chemical Reviews, American Chemical Society	-
	3	Polymer Based Hybrid Nanocomposites; A Progress Toward Enhancing Interfacial Interaction and Tailoring Advanced Applications	Chang-Sik Ha	The Chemical Record, Wiley	-

Section A: Units I, II and III; **Section B:** Units IV, V, and VI

Pattern of Question paper:

The 6 units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 40 Marks Paper:

1. Ten questions.
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section for 6 marks each.
4. Remaining questions will be of 7 marks each.
5. Any two questions of 7 marks from remaining questions in each section are to be solved.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of Final Year B. Tech. (Plastic and Polymer Engineering) Semester-VII

Course Code: PPE445

**Course: Elective-IV: Rubber Technology
for Automotive Applications**

Teaching Scheme: 2 Hrs/week

Class Test (Marks): 10

Theory: 2 Hrs/week

Theory Examination (Duration): 02 Hrs

Credits: 02

Theory Examination (Marks): 40

Prerequisite	:	<ul style="list-style-type: none"> Knowledge on properties and processing of elastomers.
Objective	:	<ul style="list-style-type: none"> To acquire knowledge about the fundamentals about the rubber products used in automotive applications.
Unit-I	:	<p>Rubber products in automobiles: Rubber Technology in automotive products (tyre, hose, seal, anti-vibration mount, brake-shoe, air bag, bellow, diaphragm, floor mat, mud flap etc.).</p> <p style="text-align: right;">02 Hrs</p>
Unit-II	:	<p>Rubber Industry and Environment: Registration, evaluation, authorization and restriction of chemicals (REACH). Guidelines for automotive rubber industries, rubber waste disposal, pollution control in rubber industry–effluent generation and effluent treatment.</p> <p style="text-align: right;">03 Hrs</p>
Unit-III	:	<p>Tyre: Construction of tyre, nomenclature, properties and compounding formulation of different components. Radial and bias tyre. Different types of tread design, tread nomenclature, tyre manufacturing process. Tyre magic triangle. Quality control of tyre-specific testing methods (e.g., load/speed, plunger energy, noise, endurance, rolling resistance, traction).</p> <p style="text-align: right;">07 Hrs</p>
Unit-IV	:	<p>Rubber seals: Working Principle. Properties for functional seal requirements, Formulation and compounding of O-rings and seals, performances of different rubbers for use in seal including formulation.</p> <p style="text-align: right;">04 Hrs</p>
Unit-V	:	<p>Rubber-coated fabric and anti-vibration mount: Preparation, properties and applications of rubber-coated fabrics and its application in automotive (e.g. air bag). Damping and vibration isolation. Performances of different rubbers for damping and vibration isolation. Formulation and working principle of anti-vibration mount and use of rubber.</p> <p style="text-align: right;">04 Hrs</p>
Unit-VI	:	<p>Miscellaneous rubber products: Manufacturing process, properties and formulations of different components of cables, v-belt and fan belts, and hoses.</p> <p style="text-align: right;">04 Hrs</p>

Reference Books	Sr. No.	Title	Author	Publication	Edition
:	1	Handbook of Elastomers	Anil K. Bhowmick, Howard Stephens	CRC Press	2 nd , 2000
	2	Science and Technology of Rubber	James E. Mark, Burak Erman, Frederick R. Eirich	Elsevier	3 rd , 2005
	3	Hose Technology	C W Evans	Elsevier Applied Science	1 st , 1979
	4	Rubber Technology	Maurice Morton	Van Nostrand Company Inc.	3 rd , 1987
	5	The Rubber Formulary	P A Ciullo, N. Hewitt	Noyes/William Andrew Publishing	1 st , 1999
	6	Rubber Seals for Fluid Hydraulic systems	V. C. Chandrasekaran	Elsevier	1 st , 2010
	7	Rubber Technologist Handbook	Sadhan K. De, Jim. R. White	Rapra	1 st , 2001
	8	Textile for Industrial Applications	R. Senthil Kumar	CRC Press	1 st , 2014

Section A: Units I, II and III; **Section B:** Units IV, V, and VI

Pattern of Question paper:

The 6 units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 40 Marks Paper:

1. Ten questions.
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section for 6 marks each.
4. Remaining questions will be of 7 marks each.
5. Any two questions of 7 marks from remaining questions in each section are to be solved.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of Final Year B. Tech. (Plastic and Polymer Engineering) Semester-VII

Course Code: PPE446

Teaching Scheme: 2 Hrs/week

Theory: 2 Hrs/week

Credits: 02

Course: Elective-IV: Entrepreneurship Development

Class Test (Marks): 10

Theory Examination (Duration): 02 Hrs

Theory Examination (Marks): 40

Prerequisite	:	<ul style="list-style-type: none"> • Basic knowledge of industrial management.
Objective	:	<ul style="list-style-type: none"> • To understand the role and importance of entrepreneurship for economic development. • To develop personal creativity and entrepreneurial initiative. • To adopt key steps in the elaboration of business idea. • To understand the stages of the entrepreneurial process and the resources needed for the successful development of entrepreneurial ventures.
Unit-I	:	<p>Introduction to entrepreneur: Entrepreneur, difference between entrepreneur and intrapreneur, functions of entrepreneur in economic development, concept and characteristics of entrepreneurship factors affecting entrepreneurial growth, role of entrepreneur in relation to enterprise.</p> <p style="text-align: right;">04 Hrs</p>
Unit-II	:	<p>Entrepreneurship development programme: Concept, need and objectives, stages and components of entrepreneurship development programme.</p> <p style="text-align: right;">04 Hrs</p>
Unit-III	:	<p>Business: Ownership structures, steps involved in setting up a business, creativity and innovation, identifying, selecting a good business opportunity, market survey and research, techno economic feasibility assessment, preparation of preliminary project reports.</p> <p style="text-align: right;">04 Hrs</p>
Unit-IV	:	<p>Business finance and accounting: Need of finance, sources of finance, term loans, capital structure, working capital, break even analysis, taxation, income tax, excise duty, sales tax, GST.</p> <p style="text-align: right;">05 Hrs</p>
Unit-V	:	<p>Entrepreneur support: Definition, classification and characteristics of small enterprises, government policy for small scale enterprises, growth strategies in small industries.</p> <p style="text-align: right;">05 Hrs</p>
Unit-VI	:	<p>Case studies: Historical perspective, global Indian entrepreneurs case studies.</p> <p style="text-align: right;">02 Hrs</p>

Section A: Units I, II and III; **Section B:** Units IV, V, and VI

Reference Books	Sr. No.	Title	Author	Publication	Edition
:	1	Environment and Entrepreneur	Tendon C.	Clugh Publications, Allahabad	-
	2	Entrepreneurial Megabuks	Siner A David	John Wiley and Sons, New York.	-
	3	Venture Capital - The Indian Experience	Paudey I.M	Prentice Hall of India. New Delhi	-
	4	Entrepreneurial Development”	S.S. Khanka	S.Chand & Co. Ltd. Ram Nagar New Delhi, 1999	-
	5	Entrepreneurship – Theory, Process and Practice	Donald F Kuratko	Cengage Learning	9 th , 2014
	6	Enterpreneurship Theory at Cross Roads: Paradigms and Praxis	Mathew J Manimala	Dream Tech	2 nd , 2005
	7	Entrepreneurship	Rajeev Roy	Oxford University Press	2 nd , 2011

Pattern of Question paper:

The 6 units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 40 Marks Paper:

1. Ten questions.
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section for 6 marks each.
4. Remaining questions will be of 7 marks each.
5. Any two questions of 7 marks from remaining questions in each section are to be solved.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of Final Year B. Tech. (Plastic and Polymer Engineering) Semester-VII

Course Code: PPE421

Course: Laboratory: Polymer Reaction Engineering

Teaching Scheme:

Term Work: 25 Marks

Practical: 02 Hrs/week

Practical Examination: 25 Marks

Credits: 01

Objectives	:	<ul style="list-style-type: none"> • To study the order and kinetics of various chemical reactions.
List of Practical	:	<ol style="list-style-type: none"> 1. To study the zero order reaction. 2. To study the hydrolysis of an ester in presence of hydrochloric acid. 3. To determine the order of reaction by hydrolysis of ethyl acetate in presence of sodium hydroxide. 4. To determine energy of activation of the reaction. 5. Residence time distribution of CSTR. 6. Residence time distribution of PFR. 7. To study effect of monomer concentration on rate of polymerization. 8. To study effect of change in initiator concentration on rate of polymerization 9. Reaction kinetic studies in a mixed flow reactor <p>At least any 8 experiments from the above-mentioned list of experiments should be performed.</p>

Reference Books:	:	Sr. No.	Title	Author	Publication	Edition
		1	Chemical reaction Engineering	Levenspiel	John Wiley & Sons	3 rd
		2	Chemical Engineering Volume I & II	Richardson & Coulson		3 rd
		3	Reaction Engineering of Step Growth Polymerization	Gupta S. & Anilkumar	Plenum Press, New York 1987.	1 st
		4	Encyclopedia of Polymer Science & Engg.			2 nd
		5	Polymer Reactor Engineering	McGreavy,	Blackie Academic & Professional (Chapman & Hall)	1 st , 1994

The assessment of term work shall be done on the basis of the following.

1. Continuous assessment.
2. Performing the experiments in the laboratory.
3. Oral examination conducted on the syllabus and term work mentioned above.

Practical Examination

The practical examination shall consist of performing an experiment based on the practical work done during the course, the record of the experiment performed by the candidate and viva-voce based on the syllabus. The assessment will be based on

1. Performing the experiment.
2. Record of experiment performed by the candidate.
3. Viva-voce on the syllabus.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of Final Year B. Tech. (Plastic and Polymer Engineering) Semester-VII

Course Code: PPE422
Teaching Scheme:
Practical: 02 Hrs/week
Credits: 01

Course: Laboratory: CAE for Plastics
Term Work: 50 Marks

Objectives	:	<ul style="list-style-type: none"> • To impart the knowledge of design analysis using computer aided engineering packages and to enhance injection mould and product design capabilities.
List of Practical	:	<ol style="list-style-type: none"> 1. Introduction to CAE for Plastics and software startup with user interface. 2. To practice fill analysis for given plastics product for single cavity mould. 3. To practice fill analysis for given plastics product for multi cavity mould. 4. To practice packing analysis for given plastics product for single cavity mould. 5. To practice packing analysis for given plastics product for multi cavity mould. 6. To practice cooling analysis for given plastics product for single cavity mould. 7. To practice cooling analysis for given plastics product for multi cavity mould. 8. To practice warping analysis for given plastics product for single cavity mould. 9. To practice warping analysis for given plastics product for multi cavity mould. 10. To create a report based on analysis results. <p>At least any 8 experiments from the above-mentioned list of experiments should be performed.</p>

Reference Books:	:	Sr. No.	Title	Author	Publication	Edition
		1	Plastics Design Handbook	D. V. Rosato	Kluwer Academic Publishers	1 st
		2	Mould Flow Design Guide	Jay Shoemaker	Mould Flow Corporation	1 st
		3	Injection Mould Design	R. G. W. Pye	East West Press Pvt. Ltd	4 th

The assessment of term work shall be done on the basis of the following.

1. Continuous assessment.
2. Performing the experiments in the laboratory.
3. Oral examination conducted on the syllabus and term work mentioned above.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of Final Year B. Tech. (Plastic and Polymer Engineering) Semester-VII

Course Code: PPE423
Teaching Scheme:
Practical: 02 Hrs/week
Credits: 01

Course: Laboratory: Plant Design
Term Work: 25 Marks
Practical Examination: 25 Marks

Objectives	:	<ul style="list-style-type: none"> • To get knowledge of designing the equipment using instrumentation and control diagrams.
List of Practical	:	<ol style="list-style-type: none"> 1. Different instrumentation diagrams showing measurement & control of various parameters like temperature, pressure level, flow etc. 2. Design of jacketed batch reactor. 3. Design of distillation column for binary system. 4. Plant layout of at least one polymer industry. 5. Design of double pipe heat exchanger. 6. Design of shell and tube heat exchanger. 7. Various pipe fittings, bends and supports. 8. Design of cooling towers. 9. Packed columns and various packings. 10. P & I diagram of polymer industry. <p>At least any 8 experiments from the above-mentioned list of experiments should be performed.</p>

Reference Books:	:	Sr. No.	Title	Author	Publication	Edition
		1	Process Design of Equipments	Dawande S. D.	Central Techno Publications	
		2	Chemical Engineering: Vol.6	Coulson J. M. and Richardson J. F	Pergamon Press	
		3	Perry's Chemical Engineering Handbook	Robert Perry	Mc-Graw Hill	8 th

The assessment of term work shall be done on the basis of the following.

1. Continuous assessment.
2. Performing the experiments in the laboratory.
3. Oral examination conducted on the syllabus and term work mentioned above.

Practical Examination

The practical examination shall consist of performing an experiment based on the practical work done during the course, the record of the experiment performed by the candidate and viva-voce based on the syllabus. The assessment will be based on

1. Performing the experiment.
2. Record of experiment performed by the candidate.
3. Viva-voce on the syllabus.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of Final Year B. Tech. (Plastic and Polymer Engineering) Semester-VII

Course Code: PPE424

Course: Laboratory: Polymer Blends and Composites

Teaching Scheme:

Term Work: 50 Marks

Practical: 02 Hrs/week

Practical Examination: 50 Marks

Credits: 01

Objectives	:	<ul style="list-style-type: none"> • To prepare polymer blends and composites by using different materials. • To analyze polymer blends and composites.
List of Practical	:	<ol style="list-style-type: none"> 1. Prepare a polymer blend without compatibilizer. 2. Prepare a polymer blend with compatibilizer. 3. Prepare a ternary polymer blend. 4. Prepare an elastomeric composite with untreated filler (e.g., carbon black, silica etc.). 5. Prepare a nanofiller-based composite. 6. Prepare a PVC-based composite. 7. Comparative analysis of tensile strength, elongation at break and hardness of different blends. 8. Analysis of T_g, T_m and T_c of polymeric blends. 9. Thermal degradation analysis of polymer blends and composites. 10. Prepare a polymeric blend to achieve a targeted tensile strength. 11. Prepare a polymeric composite to achieve targeted tensile strength and hardness. 12. Identify continuous and discrete phase of polymer blend by solvent etching method. <p>At least any 8 experiments from the above-mentioned list of experiments should be performed.</p>

Reference Books:	:	Sr. No.	Title	Author	Publication	Edition
		1	Polymer Blends Handbook	Leszek A. Utracki, Charles A. Wilkie	Springer	2 nd
		2	Polymer Blends (Vol. 1)	D. R. Paul, Seymour Newman	Academic Press	1978
		3	Manufacturing techniques for polymer matrix composites (PMCs)	Suresh G. Advani, Kuang-Ting Hsiao	Woodhead Publishing	2012
		4	Particulate-Filled Polymer Composites	Roger N. Rethon	Rapra Technology	2 nd
		5	Processing of Polymer Matrix Composites	P. K. Mallick	CRC Press	2018

The assessment of term work shall be done on the basis of the following.

1. Continuous assessment.
2. Performing the experiments in the laboratory.
3. Oral examination conducted on the syllabus and term work mentioned above.

Practical Examination

The practical examination shall consist of performing an experiment based on the practical work done during the course, the record of the experiment performed by the candidate and viva-voce based on the syllabus. The assessment will be based on

1. Performing the experiment.
2. Record of experiment performed by the candidate.
3. Viva-voce on the syllabus.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of Final Year B. Tech. (Plastic and Polymer Engineering) Semester-VII

Course Code: PPE425
Teaching Scheme:
Practical: 04 Hrs/week
Credits: 04

Course: Project-II
Term Work: 100 Marks
Practical Examination: 100 Marks

Objectives

- :
- The practical implementation of theoretical knowledge gained during the study to till date is important for engineering education. The student should be able implement their ideas/real time industrial problem/ current application of their engineering branch which they have studied in curriculum.
 - To motivate students for creativity.
 - To create awareness regarding latest technology
 - To have common platform for interaction about emerging technology.
 - To inculcate qualities of team work.
 - To explore related information using books, research papers, journals & websites.
 - To improve presentation and communication skills.

Guidelines For Students And Faculty:

1. Students shall complete the Project-II in continuation of the work planned in third year under the course Project-I.
2. Each student/group is required to-
 - a. Submit a report with latest status of the project work.
 - b. Give a 10 minutes presentation through OHP, PC, and Slide projector followed by a 10 minute discussion in the second week of their academic semester.
 - c. Submit a report on the project topic with a list of required hardware, software or other equipment for executing the project in the third week of their academic semester.
 - d. Start working on the project and submit initial development and CPM/PERT planning drawing in the fourth week of their academic semester.
 - e. Preparation of PCB layout, wiring diagram, purchase of components, software demo, flowchart, algorithm, program/code, assembling, testing, etc. should be submitted by student/s within next five/Six weeks and minimum one page report should be there for each major activity.
 - f. Overall assembling, wiring, code writing, testing, commissioning along with performance analysis, should be completed within next two weeks.
 - g. In the last week, student/group will submit final project report to the guide.
3. Every assigned faculty/s should maintain record of progress of each student or group.

The format and other guidelines for the purpose of the Project Submission in hard bound copies should be as follows,

REPORT STRUCTURE

Index/Contents/Intent
List of Figures
List of Tables
List of Symbols / Abbreviations

	<p>1. Introduction 2. Literature survey 3. System development 4. Performance analysis 5. Conclusions References Appendices Acknowledgement</p>
	<p>1. INTRODUCTION</p> <p>1.1. Introduction 1.2. Necessity 1.3. Objectives 1.4. Theme 1.5. Organization</p> <p>2. LITERATURE SURVEY</p> <p>Literature Survey</p> <p>Related information available in standard Books, Journals, Transactions, Internet Websites etc. till date (More emphasis on last three to five years)</p> <p>3. SYSTEM DEVELOPMENT</p> <ul style="list-style-type: none"> • Model Development • Mechanical / Fabricated • Analytical • Computational • Experimental • Mathematical • Software <p>(out of above methods at least one method is to be used for the model development). Some mathematical treatment or related information is required to be embodied</p> <p>4. PERFORMANCE ANALYSIS</p> <ul style="list-style-type: none"> • Analysis of system developed either by at least two methods depending upon depth of standard. • These methods normally used are Analytical/ Computational/ Statistical/ Experimental/ or Mathematical. • Results at various stages may be compared with various inputs. • Output at various stages with same waveforms or signals or related information/parameters.

	<ul style="list-style-type: none"> • Comparison of above results by at least two methods and justification for the differences or error in with theory or earlier published results. <p>5. CONCLUSIONS</p> <p>5.1. Conclusions 5.2. Future Scope 5.3. Applications 5.4. Contributions (if any)</p> <p>The innovative work/invention/new ideas generated from the analysis of the work which can be taken from the conclusions.</p> <p>6. REFERENCES</p> <ul style="list-style-type: none"> • Author, “Title”, Name of Journal/Transactions/ Book, Edition/ Volume, Publisher, Year of Publication, page to page (pp.__). <p>These references must be reflected in text at appropriate places in square bracket.</p> <p>In case of web pages complete web page address with assessing date has to be enlisted.</p> <p>List of references should be as per use in the text of the report.</p> <p>7. APPENDICES</p> <p>Related data or specifications or referred charts, details computer code/program, etc.</p> <p>8. ACKNOWLEDGEMENTS</p> <p>Expression of gratitude and thankfulness for helping in completion of the said task with name& signed by the candidate.</p>
	<p>General Guidelines</p> <p>Text should be printed on front and correct side of the watermark on quality bond paper.</p> <p>Paper size- A4, 75 to 85 gsm paper</p> <p>Left Margin-1.5”</p> <p>Right Margin-3/4”</p> <p>Top Margin-1”</p> <p>Bottom Margin-1”</p>

	<ul style="list-style-type: none"> • Pagination First page of every chapter need not be printed but counted, second page onwards page number to printed at bottom center place. All Greek words must be italic Report Heading -ALL CAPITAL—16 Font Chapter heading -ALL CAPITAL—14 Font Subchapter –Title Case-12 Font Sub-Subchapter –First Alphabet Capital case-12 Font Page numbers for Index/Contents/Intent should be in roman All text should be in times new roman Cover page should have complete symbol of institute Suitable flap (bookmark) with name of the candidate, Department and Institute name and symbol can be used with nylon strip.
	<p><i>For more information and sample of hard copy please contact the respective Head of the Department.</i></p>

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of Final Year B. Tech. (Plastic and Polymer Engineering) Semester-VIII

Course Code: PPE471
Credits: 024

Course: In-Plant Training (IPT)
Term Work: 300 Marks
Practical Examination: 300 Marks

(a)	:	<p>Rationale:</p> <p>The techniques and processes of production of goods and services do not demand only technical skills, but also a cluster or conglomerate of skills. A significant part of which is related to the total humanistic growth of the man. Such conglomerate skills technical and humanistic cannot obviously be acquired through pure academic learning of concepts in formalized and institutional courses and in isolation of the actual work situation. It, therefore, naturally follows that no technical education will be complete till it has two components, one learning of concepts vis-a vis acquiring conceptual skill and other application of the concepts in real work situation vis-a vis acquiring manipulative or practicing skills. Technical education needs to have a complement of learning of the techniques of applying the concepts within the industry and business.</p>
(b)	:	<p>Objectives:</p> <ol style="list-style-type: none"> 1) The students of B.Tech course shall get an opportunity to work on live problems of the industry. 2) He/She shall apply learning concepts in the real work situation. 3) He/She shall get an exposure to the industrial environment and thereby enable himself/herself to appreciate the other related aspects of industry viz. human, economic, commercial and regulatory. 4) He/She shall identify career paths taking into account their individual strengths and aptitude. 5) He/She shall contribute for the achievement of economic goals and aspirations of the industry and our country as a whole.
(c)	:	<p>The curriculum for B.Tech students of Final Year Course of Part-II shall consist of;</p> <ul style="list-style-type: none"> • Inplant training for a period of one full term, and the period of the term shall be as prescribed by the university from time to time. • A project on live problems of the industry shall be undertaken by the student/group of students undergoing training in the same establishment. • The term work shall consist of the inplant training record-daily diary, work diary, progress report, a record containing the literature survey in the field of appropriate branch of Engineering, a preliminary report related to project work etc. • Seminars will be arranged after successful completion of period specified in the scheme of semester VIII of B.Tech. The date and times will be decided according to the convenience of guide and student.
(d)	:	<p>General Provisions, Rules and Regulation of Inplant Training</p> <p>1. Definition</p> <ul style="list-style-type: none"> • In-plant training (IPT) means a course of training in any industry or establishment undergone in pursuance of memorandum of understanding between industry and institute and under the prescribed terms and conditions of Dr.Babasaheb Ambedkar Marathwada University, Aurangabad. • Institute means an academic Institution of higher learning associated and admitted under the

	<p>privileges of university, i.e. Maharashtra Institute of Technology, Aurangabad affiliated to Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.</p> <ul style="list-style-type: none"> • Industry means any industry or business in which any trade, occupation or subject field in engineering or technology may be specified as a designated trade. • Establishment includes research organizations (like IITs, NITs, National Laboratories or research center/organization as recognized by Central Govt. / State Govt. / University) or any other organization of repute with the permission of Head of the institute. • University means any of the universities mentioned in the schedule of Maharashtra University Act, 1994 i.e. Dr. Babasaheb Ambedkar Marathwada University, Aurangabad. • Collaboration means collaborative academic activity of the Institute with industry. • Student means a B.Tech. Course student.
:	<p>2. Memorandum of understanding:</p> <p>Maharashtra Institute of Technology, Aurangabad will enter into an agreement with the industry through ‘Memorandum of Understanding’ for creating facilities of inplant training in the appropriate branch of Engineering according to the Course Curriculum and keep this agreement for a period of 10 years to foster a healthy industry- institute interaction for mutual benefits of both.</p>
:	<p>3. Admission to inplant training:</p> <p>No student will be deputed for inplant training unless he/she produces testimonial of having kept one term for the subject under B.Tech. of final year course satisfactorily in Maharashtra Institute of Technology, Aurangabad.</p>
:	<p>4. Period of inplant training:</p> <p>The period of Inplant training will be the period of one term for the subject under B.Tech. course semester-VIII, which will be notified by Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.</p>
:	<p>5. Contract of Inplant Training :</p> <ul style="list-style-type: none"> • The student of Maharashtra Institute of Technology shall enter into a contract of inplant training with the employing industry. • The inplant training shall be deemed to have commenced on the date, on which the contract of inplant training has been entered into. • Every contract of inplant training will contain the Terms and Conditions to be agreed by both the parties. • Every contract of inplant training shall be registered with the Maharashtra Institute of Technology within 15 days from entering into the contract.
:	<p>6. Violation of contract:</p> <p>Where an employer, with whom a contract for inplant training has been entered into, is for any reason, unable to fulfill his obligation under the contract, the contract end with the consent of Maharashtra Institute of Technology. It is agreed between the employer, the student and any other employer that the student shall be engaged as an “inplant trainee” under the other employer till the expiry period of the inplant training. The agreement on registration with Maharashtra Institute of Technology shall be deemed to be the contract of inplant training between the student and other employer, and from the date of such registration, the contract of inplant training with the first employer shall terminate and no obligation under that contract shall be enforceable at the instance of any party to contract against the other party thereto.</p>
:	<p>7. Termination of Contract:</p>

	<p>The contract of inplant training shall terminate on the expiry of the period of inplant training.</p> <p>Either party to the contract of inplant training make an application to Maharashtra Institute of Technology, Aurangabad for the termination of the contract.</p> <p>After considering the content of the application, and objection, Maharashtra Institute of Technology by order in writing, will terminate the contract, if it is satisfied that the parties to the contract have/has failed to carry out the Terms and Conditions of the contract.</p> <p>Provided that where a contract is terminated-</p> <ul style="list-style-type: none"> • For the failure on the part of the Employer, Maharashtra Institute of Technology will depute students to another Employer for providing facilities of inplant training to the remaining period of training. • For the failure on the part of the student, the student will not be allowed to continue his/her inplant training in that term. The student shall be deputed for inplant training in the next coming term.
:	<p>8. Expectation from the Employer / Industry / Establishment:</p> <p>The following expectations are derived for effective inplant training.</p> <ul style="list-style-type: none"> • To provide legitimate facilities for the training and learning of all the processes. • To guide the student for understanding a project of immense importance to industry and to help him/her for his/her career advancement.
:	<p>9. Obligation of Students:</p> <ul style="list-style-type: none"> • Student must maintain a minimum attendance of 90% of total working days for the period of Inplant Training. • To learn his/her subject field in Engineering or Technology consciously and diligently at his place of training. • To carry out all orders of his/her Employer and the Superior in the establishment. • To abide by the Rules and Regulations of the Industry/Establishment in all matters of conduct and discipline. • To carry out the obligation under the contract of inplant training. • The student shall maintain a report of his work during the period of his inplant training in a proforma (form no: 2) made available in Annexure. • Except in case of extreme urgency, the B.Tech. student shall submit an application for all other leaves except the medical leave to the Manager/Gen. Manager (Personnel) of the concerned industry, where he is undergoing an inplant training and obtain sanction before the leave is taken. In case of Medical Leave, he shall submit an application to Maharashtra Institute of Technology, Aurangabad. The shortage in attendance will be subjected to extending the period of inplant training in which case, the student may not be allowed to appear for the test, project seminar and assessment of term work etc. which will be held immediately after successful completion of the inplant training.
:	<p>10. Maintenance of Record:</p> <p>Every student of B.Tech. course shall maintain a daily record of the work done by him/her relating to the inplant training in the proforma (Annexure).</p>
:	<p>11. Industry Sponsored Student Projects:</p> <p>The scheme envisages working out suitable programme for B.Tech. students. They are required to complete their inplant training in a given period. During this period, they shall be familiar with</p>

	<p>the understanding of the shop process and activities. The students can be asked to solve the mini-shop problem, which will make them think and try out short experiments as an improvement in the process, tools and equipment.</p> <p>The students in a group alone can undertake a project of immense importance for the benefit of the industry and also useful for the students for their advancement of career. Industry staff and Maharashtra Institute of Technology faculty can plan in advance to effectively complete the practical training with the project for preliminary studies on the floor.</p> <p>The projects should aim mainly-</p> <ul style="list-style-type: none"> • Cost reduction • Enhancing productivity • Development/ Improvement/ Effective use of Softwares/ Systems • Energy conservation measures • Process Improvement technique • Application Development • Plastic and Polymer working • Hardware/ Software • Agroengineering and so on.
:	<p>12. What will form a good project?</p> <p>Through the project, it is hoped to provide the students an exciting experience in solving line problems under practical constraints. Hence it is desired that the project should be a well-defined problem, which can be completed and implemented within the project period. It may be a problem, evolving analysis, design, fabrication and / or testing.</p>
:	<p>13. Time Schedule for the Project:</p> <p>The following time schedule should be planned by each student or groups of students, who undertake the project.</p> <ul style="list-style-type: none"> • Proposal to be received before specified date. • Project acceptance before. • Commencement of the project. • Completion of the project.
:	<p>14. Commitment on the part of the Institute:</p> <ul style="list-style-type: none"> • Providing a faculty member to supervise the project. • Providing the Institute facilities to complete the project. • Coordinator from industry will be invited to participate in the stage wise assessment of the students performance.
:	<p>15. Assistance for completion of the Project:</p> <p>All the projects undertaken by the students are time bound. Although, every attempt results may not be achieved within the period available for the student. In such cases, the services of the associated faculty members can be sought for the completion of the same on mutually agreed terms.</p>
:	<p>16. Monitoring of Inplant Training:</p>

	<p>The B.Tech. students are expected to follow all the rules and discipline of the industry. However, because of other academic requirements and the nature of the project, the student may have to work in other places outside the industry. The faculty and Industry supervisor will work out a suitable arrangement to review the progress of the work from time to time. Maharashtra Institute of Technology, Aurangabad will monitor the progress of inplant training in association with industry authority.</p>
	<p>: 17. Conduct and Discipline:</p> <p>In all matters of the conduct and discipline, B.Tech. student shall be governed by the rules and regulations (applicable to employees of the corresponding category) in the Establishment, where he/she is undergoing a training.</p>
	<p>: 18. B.Tech. Students are Trainees and not Workers:</p> <ul style="list-style-type: none"> • Every B.Tech. student undergoing an inplant training in the respective branch of Engineering & Technology in any Establishment shall be treated as a trainee and not a worker and- • The provision of any law with respect to labour will not apply to such a trainee.
	<p>: 19. Settlement of Disputes:</p> <p>Any disagreement or dispute between an industry and a B.Tech. student trainee arising out of the contract of inplant training shall be resolved both by Maharashtra Institute of Technology and the industry with mutual cooperation. The decision of both Maharashtra Institute of Technology and the industry shall be final.</p>
	<p>: 20. Holding of Test and Grant of Certificate:</p> <p>The progress in inplant training of every student shall be assessed by the industry and Maharashtra Institute of Technology faculty from time to time.</p> <p>Every B.Tech. student undergoing an inplant training shall be issued a certificate of Proficiency on completion of his/her training to the satisfaction of the industry.</p>
	<p>: 21. Offer of Stipend / Other Welfare Activities and Employment:</p> <p>It shall not be obligatory on the part of the Employer / Industry to offer any stipend and other welfare amenities available, if any, to the students of B.Tech. courses undergoing an inplant training. However, if the industry desirous to do so will be a privilege for the students and also for Maharashtra Institute of Technology in view of the bonding of better understanding and cooperation forever.</p>
(e)	<p>: PRACTICAL EXAMINATION</p> <p>The Practical examination will be conducted after successful completion of the inplant training for which guide will be internal examiner and external examiner will be appointed by the university. The date of practical examination will be same for the students of a branch and will be notified by the university. The assessment of the practical examination shall consist of</p> <ol style="list-style-type: none"> 1. Seminar Performance 2. An oral on the project work done. 3. Assessment of the term work / report.

