

**Dr. Babasaheb Ambedkar Marathwada
University, Aurangabad-431004**



**Syllabus of Final Year Bachelor of Technology
Plastic and Polymer Engineering
(VII& VIII Semester)**

Under Choice Based Credit System (CBCS)

Under Faculty of Science and Technology

(Effective from 2022-23 and onwards)

FACULTY OF SCIENCE AND TECHNOLOGY															
Syllabus Structure w.e.f. 2022-2023 (Choice Based Credit System)															
Final Year B. Tech. (Plastic and Polymer Engineering)															
Semester-VII															
Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks							Credits			
		Theory	Tutorial	Practical	MSE-I	MSE-II	TA	ESE	TW	PR/OR	Total	TH	TUT	TW/PR	Total
PPE 401	Mould and Product design	3	-	-	15	15	10	60	-	-	100	3	-	-	3
PPE 402	Polymer Reaction Engineering	3	-	-	15	15	10	60	-	-	100	3	-	-	3
PPE 403	Polymer Blends and Composites	3	-	-	15	15	10	60	-	-	100	3	-	-	3
PPE 441- PPE 443	Professional Elective Course-IV	3	-	-	15	15	10	60	-	-	100	3	-	-	3
***	Open Elective-III	3	-	-	15	15	10	60	-	-	100	3	-	-	3
PPE 421	Lab 1: Polymer Processing Technology-II	-	-	2	-	-	-	-	-	25	25	-	-	1	1
PPE 422	Lab 2: Polymer Reaction Engineering	-	-	2	-	-	-	-	-	25	25	-	-	1	1
PPE 423	Lab 3: Polymer Blends and Composites	-	-	2	-	-	-	-	50	-	50	-	-	1	1
PPE 426	Major Project-II	-	-	8	-	-	-	-	50	50	100	-	-	4	4
		15	-	14	75	75	50	300	100	100	700	15	-	7	22
Semester-VIII															
Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks							Credits			
		Theory	Tutorial	Practical	MSE-I	MSE-II	TA	ESE	TW	PR/OR	Total	TH	TUT	TW/PR	Total
PPE 471	Internship	-	-	-	-	-	-	-	300	300	600	-	-	20	20
MSE- Mid Semester Exam, ESE- End Semester Examination, TH-Theory, OR- Oral, TA-Teacher Assessment, TW- Term Work, PR- Practical, Tut- Tutorial															

Professional Elective (IV):

Sr. No	Name of the course	Course code
1	Advanced Elastomer Technology	PPE 441
2	Plant Design	PPE 442
3	Advanced Characterization and Analysis	PPE 443

Open Elective-III:

Sr. No	Name of the course	Department	Course code
1	Ecology and Environmental Pollution	Agricultural Engineering	AED431
2	Town Planning	Civil Engineering	CED431
3	Big Data Analytics	Computer Science and Engineering	CSE431
4	Battery Management System	Electrical Engineering	EED431
5	Data Science	Electronics and Telecommunications Engineering	ETC431
6	Modern Management Techniques	Mechanical Engineering	MED431
7	Packaging Technology	Plastic and Polymer Engineering	PPE431

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of Final Year B. Tech. (Plastic and Polymer Engineering) Semester-VII (2022-23 Choice Based Credit System)	
Course Code: PPE401 Course: Mould and Product Design Teaching Scheme: Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 10 Marks End Semester Examination: 60 Marks End Semester Examination (Duration): 3 Hrs
Prerequisite	<ul style="list-style-type: none"> • Knowledge of plastic materials, engineering drawing, tooling and CAD.
Objectives	<ol style="list-style-type: none"> 1. To impart the knowledge about basic concepts of mould and product design. 2. To provide knowledge about detailed drawing of moulds and various products, bill preparation and material selection criteria for end use application
Unit-I	Designing of Compression Moulds Design of flash, positive and semi positive mould with injection, sleeve ejection, stripper plate ejection systems. Design of two-plate and three plate moulds, split moulds. Mould designing for threaded article and inserts. Types of cooling systems and their selection criteria, bill of material. <p style="text-align: right;">(06 Hrs)</p>
Unit-II	Designing of Injection Moulds Design of two – three Plate moulds, core side pin withdrawal, sprue removal and ejection system arrangement. Cavity balancing, types of gates, gate balancing, types of cooling systems, and gas channels for gas assisted IM, Special feature required for thermostat 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, troubleshooting, bill of materials and Specification. <p style="text-align: right;">(06 Hrs)</p>
Unit-III	Design of Transfer, Blow Moulds and Extrusion Dies Pot, Auxiliary ram, separate pot moulds. Details of loading chamber, ejection methods, heating systems. Classification of dies and design fetchers, application and working. Blow mould and their design fetchers. <p style="text-align: right;">(06 Hrs)</p>
Unit-IV	Basic Product Design Considerations Effect of wall thickness, flat surfaces corners, radius, drafts, fillets, shrinkage, warpage, parting line tolerances <p style="text-align: right;">(04 Hrs)</p>
Unit-V	Basic Product Design Features Rim, rib, design, gussets, bosses, radii/fillets, holes and its types. Undercuts, core outs, collapsible core, types of inserts and threads, types of jigs and fits, shapes of male and female inserts. Product costing with reference to number of cavities, cycle time, material for moldings, and overheads. <p style="text-align: right;">(08 Hrs)</p>

Unit-VI	Component Design Design of components like: Engine gaskets, pipe, gears, plastic bearing, over head tanks. (06 Hrs)				
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

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of Final Year B. Tech. (Plastic and Polymer Engineering) Semester-VII (2022-23 Choice Based Credit System)	
Course Code: PPE402 Course: Polymer Reaction Engineering Teaching Scheme: Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 10 Marks End Semester Examination: 60 Marks End Semester Examination (Duration): 3 Hrs
Prerequisite	<ul style="list-style-type: none"> • Knowledge of heat transfer, process calculations and mass transfer.
Objective	1. To study kinetics of various reactions.
Unit-I	Introduction to Chemical Kinetics Molecularity and order of chemical reaction, rate constant & its representation, Arrhenius, Bimolecular and transition state temperature dependence theories in terms of rate expression, numericals. <div style="text-align: right;">(07 Hrs)</div>
Unit-II	Introduction to Reactor Design Batch, CSTR, Plug flow reactors, their relative merits & demerits, effect of each type of reactor on polymer properties, applications of each type of reactor, numericals. <div style="text-align: right;">(06 Hrs)</div>
Unit-III	Polymeric Reactions Classification of polymer reactions, effect of mixing on kinetics and molecular weight distribution in batch and continuous reactors, residence time distribution in reactors, heterogenous reacting systems. <div style="text-align: right;">(05 Hrs)</div>
Unit-IV	Types of Reactors Fluidized bed reactors, catalytic reactors, autocatalytic reactors, introduction to non-isothermal reactors, series and parallel reactions, multiple reactors in series and parallel combinations, applications of each type of reactor, numericals. <div style="text-align: right;">(09 Hrs)</div>
Unit-V	Reactor Designing Design considerations solution, suspension and emulsion polymerization reactors. classification and characteristics of catalyst, preparation of a catalyst and its deactivation, poisoning of catalyst and regeneration. <div style="text-align: right;">(04 Hrs)</div>
Unit-VI	Reactor Design for Manufacturing Polymers Reactors for PS, PVC, PET, LDPE, HDPE, LLDPE, PP, Safety aspects for handling various reactors. <div style="text-align: right;">(05 Hrs)</div>

Reference Books:	Sr. No.	Title	Author	Publication	Edition
	1	Introduction to Polymer science & Technology	Dr. Shrikant Dawande	Denett& Co.	-
	2	Chemical reaction Engineering-I	K. A. Gavhane	Nirali Prakashan	-
	3	Chemical Reaction Kinetics	J. M. Smith	Mc Graw Hill	3 rd
	4	Reaction Engineering of Step Growth Polymerization	Gupta S. & Anilkumar	Plenum Press, New York	1 st , 1987
	5	Polymer Reactor Engineering	McGreavy, Blackie Academic & Professional	Chapman & Hall	1 st , 1994
	6	Elements of Chemical Reaction Engineering,	H. Scott Fogler	Prentice Hall International	4 th
	7	Principles of Polymerisation	George Odian	John Wiley& Sons	4 th
	8	Chemical Engineering Volume I & II	Richardson & Coulson	Elsevier Butterworth-Heinemann	3 rd
	9	Encyclopedia of Polymer Science &Engineering	-	-	2 nd

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Course Code: PPE403 Course: Polymer Blends and Composites Teaching Scheme: Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 10 Marks End Semester Examination: 60 Marks End Semester Examination (Duration): 3 Hrs
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	<ol style="list-style-type: none"> 1. To understand the mechanisms and strategies of preparation of polymer blends and composites. 2. Analysis of polymer blends and composites.
Unit-I	Introduction to Polymer 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. <div style="text-align: right;">(04Hrs)</div>
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. <div style="text-align: right;">(07Hrs)</div>
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. <div style="text-align: right;">(07 Hrs)</div>
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 nano-filler. Rules of reinforcement (Guth and Gold equation, critical fiber length, calculation of modulus of fiber reinforced composites). <div style="text-align: right;">(07 Hrs)</div>

Unit-V	<p>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. (06Hrs)</p>				
Unit-VI	<p>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.). (05Hrs)</p>				
Text Book/ Reference Books	Sr. No.	Title	Author	Publication	Editi on
	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

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of Final Year B. Tech. (Plastic and Polymer Engineering) Semester-VII (2022-23 Choice Based Credit System)	
Course Code: PPE441 Course: Professional Elective-IV (Advanced Elastomer Technology) Teaching Scheme: Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 10 Marks End Semester Examination: 60 Marks End Semester Examination (Duration): 3 Hrs
Prerequisite	<ul style="list-style-type: none"> Knowledge on properties and processing of elastomers.
Objective	1. To acquire knowledge about the fundamentals about miscellaneous rubber products.
Unit-I	Fundamentals of Tyre Technology Construction, nomenclature and the characteristics of different components of tyre. Radial and bias tyre. Different types of tread designs. Bead nomenclature. (06Hrs)
Unit-II	Tyre Manufacturing Selection of rubbers for different components of tyre. Compounding formulation of different components. Tyre manufacturing process. (06Hrs)
Unit-III	Tyre Testing and Analysis Tyre magic triangle. Quality control of tyre-specific testing methods (e.g. load/speed, plunger energy, noise, endurance, rolling resistance, traction). Significance of Payne effect. (06Hrs)
Unit-IV	Rubber Seals Classification and working principle of seals. Properties for functional seal requirements, Formulation and compounding of O-rings and seals, performances of different rubbers for use in seal including formulation. (06Hrs)
Unit-V	Miscellaneous Rubber Products Fundamental characteristics, preparation, properties and applications of miscellaneous rubber products: rubber-coated fabrics, damper, vibration isolator, cable, v-belt, hose, mattress (Dunlop and Talalay process). (10 Hrs)
Unit-VI	REACH Guidelines Registration, evaluation, authorization and restriction of chemicals (REACH) – working mechanism, effects on companies, and guidelines for recovered polymers. (02 Hrs)

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, BurakErman, 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

<p style="text-align: center;">Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of Final Year B. Tech. (Plastic and Polymer Engineering) Semester-VII (2022-23 Choice Based Credit System)</p>					
Course Code: PPE442 Course: Professional Elective-IV (Plant Design) Teaching Scheme: Theory: 3 Hrs/week			Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 10 Marks End Semester Examination: 60 Marks End Semester Examination (Duration): 3 Hrs		
Prerequisite	<ul style="list-style-type: none"> Basic knowledge of Heat and Mass Transfer. 				
Objective	1. To get a basic understanding of chemical equipment design and managerial techniques for designing of polymer plant.				
Unit-I	Process Development Process selection, literature survey, study of alternate process, development of project from laboratory and pilot plant data Preliminary Process Design Batch versus continuous processes				(06 Hrs)
Unit-II	Equipment Design Heat Exchangers, plant design of Polyvinyl chloride				(06 Hrs)
Unit-III	Material Specifications Types and selection of material and their mechanical properties.				(06 Hrs)
Unit-IV	Plant Location and Layout Selection of location and plant layout.				(04 Hrs)
Unit-V	Piping Auxillaries Piping standards and color codes, P&I diagrams, selection of piping, supports.				(07 Hrs)
Unit-VI	Engineering Economics Elements of project cost, total capital investment and total capital cost, project financing.				(07 Hrs)
Reference Books:	Sr. No.	Title	Author	Publication	Edition
	1.	Plant Design and Economics for Chemical Engineers	Peters, Max S., K.D. Timmerhaus	McGraw-Hill International Editions	5 th

	2.	Chemical Engineering: Vol.6,	Coulson J.M. and Richardson J.F	Pergamon Press	-
	3.	Process Design of Equipments	Dawande S. D	Central Techno Publications	-

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Course Code: PPE443 Course: Professional Elective-IV (Advanced Characterization and Analysis) Teaching Scheme: Theory: 3Hrs/week	Credits: 3-0-1 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 10 Marks End Semester Examination: 60 Marks End Semester Examination (Duration): 3 Hrs
Prerequisite	<ul style="list-style-type: none"> • Fundamental knowledge on properties of polymers and characterization methods.
Objectives	<ol style="list-style-type: none"> 1. To understand about the mechanisms of different advanced characterization methods. 2. To acquire knowledge about analysis of materials from different characterization results.
Unit-I	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). <div style="text-align: right;">(06Hrs)</div>
Unit-II	Electrochemical Characterization Introduction, basic working principle, strategy of analysis with examples and applications of cyclic voltammetry, potentiostatic and galvanostatic methods, EIS (Nyquist analysis). <div style="text-align: right;">(06 Hrs)</div>
Unit-III	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. <div style="text-align: right;">(06 Hrs)</div>
Unit-IV	Elemental Analysis Introduction, basic working principle, strategy of analysis with examples and applications of MS, AAS, ICP, XRF, EELS, stripping voltammetry. <div style="text-align: right;">(10 Hrs)</div>
Unit-V	Miscellaneous Characterization Methods Introduction, basic working principle, strategy of analysis with examples and applications of BET (determination of surface area and pore size), EPR. <div style="text-align: right;">(04Hrs)</div>

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;">(04Hrs)</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. Jesperson	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

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

Course Code: AED431 Course: Open Elective-III Ecology and Environmental Pollution Teaching Scheme: Theory: 03 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 10 Marks End Semester Examination: 60 Marks End Semester Examination (Duration): 3 Hrs
Prerequisite	Concept of ecology and types of pollution
Objectives	1. To impart knowledge of ecological applications 2. To impart knowledge of environment and different types of pollution 3. To impart knowledge of pollution analysis and instrumentation
Unit-I	Principles of Ecology: Definition Principles and Scope of Ecology – Energy Flows, Ecological Pyramids, Types and Diversity, Food Chains and Food Webs. Homeostasis – Theories of Limiting Factors Ecological Succession – Population and Communities- Reproductive Strategies- r and k Factors. Community Ecology- Structure, Species Diversity and Species Interaction. <p style="text-align: right;">(4 Hrs)</p>
Unit-II	Ecosystem Ecology: Ecosystem- Structure- Components (Abiotic and biotic) and Functions of an Ecosystem. Ecosystem Types and Diversity- Terrestrial and Aquatic (Fresh water and Marine) Ecosystems. Ecotones - Concept of Edge Effect, Ecological Niche- Classification Biomes - General Relationships Landscapes and Biomes – Climatic factors - Bio-geographical Regions of the World and Modern Biogeography. <p style="text-align: right;">(6 Hrs)</p>
Unit-III	Ecological Applications: Sustainable Development- Ecological Sustainability- Organic Farming, Bio fertilizers and Bio pesticides - Integrated Pest Management (IPM) - Biological Monitoring of the Environment- Indicator species - Ecosystem Development- Theory of Human Ecology, Ecology of Space Travel- Types of Life Supporting Systems- Exobiology. <p style="text-align: right;">(6 Hrs)</p>
Unit-IV	Atmosphere Structure of Atmosphere: Temperature Profile – Influence of Meteorological factors on Air Pollution – Air Pollutants: Oxides of Sulphur – Oxides of Nitrogen – Carbon monoxide – Particulate matter, Dispersion and impacts – Photochemical smog – Green house effect – Ozone depletion – Acid Rains – Sources of noise pollution, measurement of noise and standards – impacts of Air Pollution on human health and

	structures. <p style="text-align: right;">(6 Hrs)</p>				
Unit-V	Hydrosphere and Lithosphere Classification of water and Water bodies – Abnormal properties of water – Water cycle Water Quality Parameters – Water Pollution – Sources – Classification, nature and Toxicology of water pollutants: Trace metals – Lead – Mercury – Zinc – Cadmium – Organic substances - Pesticides – Oil surfactants – Nutrients – Phosphates – Nitrates – Eutrophication – Ground water pollution – Ocean Pollution by toxic wastes – Ecological and Economic impacts of water pollution. Soil: Texture – Composition and distribution – Land use Classification and Patterns – Impacts of land use on soil ecology – Ecological and Economic impacts of soil erosion and soil pollution. <p style="text-align: right;">(8 Hrs)</p>				
Unit-VI	Pollution Analysis and Instrumentation: Principles of Sampling of Air, Water and Soil: Samplers and Sampling Techniques – Analysis of Pollutants: Titrimetry – Gravimetry – Spectrophotometry – Chromatography and Flame techniques. Instrumentation: Instruments for specific parameters – Principles and Applications of UV – VIS Spectrophotometer – Flame Photometer – Atomic Absorption Spectrophotometer – Gas Chromatography – GLC – HPLC – Instrumentation for Weather monitoring <p style="text-align: right;">(6 Hrs)</p>				
Reference Books:	Sr. No.	Title	Author	Publication	Edition
	1	Environmental Sciences	Turk J and Turk A.	Saunders College Pub	1984 3rd
	2	Fundamentals of Ecology	Odum E. P.	W. B. Saunders Company London	1971 3rd
	3	Environmental Pollution	Laurent Hodges	Holt McDougal	1977 2nd Revised
	4	Environmental Pollution Control Engineering	C.S. Rao	John Wiley & Sons	1992

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

Course Code: CED431 Course: Open Elective –III Town Planning Teaching Scheme: Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 10 Marks End Semester Examination: 60 Marks End Semester Examination (Duration): 3 Hrs
Prerequisite	Basic of Urban Planning and Development
Objectives	<ol style="list-style-type: none">1. The course is intended to provide the students an overview and understanding of Town Planning.2. To study history & ancient planning in India.3. To study origin and growth of towns.
Unit-I	Introduction: Necessity and scope of Town planning, Brief History Greek and Roman Town, Planning in Ancient India, Indus valley Civilization Vedic and Harappan period. Principles of Town Planning, Development of Towns, Elements of towns. <p style="text-align: right;">(06 Hrs)</p>
Unit-II	Levels of planning process: Town planning survey, Data collection and analysis, Growth Pattern, Development plan, Master Plan, Regional Plan, Zoning. <p style="text-align: right;">(06 Hrs)</p>
Unit-III	Housing: Importance of housing, Demand for houses, Requirements, Rural Housing, Village Planning, Low-cost Housing, Agencies for Housing, Functions of CIDCO, HUDCO, MHADA, HDFC, Housing problems in India. <p style="text-align: right;">(06 Hrs)</p>
Unit-IV	Town Planning Scheme: Concept, Preparation of town planning scheme, Relation with Development plan, Original Plot, Final plot, Semi Final Plot, Local Area Plan-Concept, objective, methods of Preparation, Case studies in India, Re-planning of Existing Towns. <p style="text-align: right;">(06 Hrs)</p>

Unit-V	<p>History of Architecture: Principle, Types of Architecture (Greek Egyptian Roman styles),</p> <p>Building Byelaws: Objective, Principles, Aspect, Prospect, Importance.</p> <p style="text-align: right;">(06 Hrs)</p>				
Unit-VI	<p>Acts: Land Acquisition Act, Necessity, and procedure of Acquisition, MRTP Act, RTI and RTS Act, URDPFI.</p> <p>Urban Road Development: Objectives Requirements, Classification, Types.</p> <p style="text-align: right;">(06 Hrs)</p>				
Reference Books:	Sr. No.	Title	Author	Publication	Edition
	1	Town Planning	S. C. Rangwala	Charotar	21 st
	2	Fundamentals of Town Planning	G. K.. Hirasakar	Dhanpat Rai Publication	2 nd .
	3	Textbook of Town Planning	G.K. Bandopadhyaya	Charotar	2 nd

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

Course Code: CSE431		Credits: 3-0-0
Course: Open Elective -III- Big Data Analytics		Mid Semester Examination-I: 15 Marks
Teaching Scheme:		Mid Semester Examination-II: 15 Marks
Theory: 03Hrs/week		Teacher Assessment: 10 Marks
		End Semester Examination: 60 Marks
		End Semester Examination (Duration): 3 Hrs
Prerequisite	Knowledge of Programming Language (Java preferably), SQL	
Objectives	<ol style="list-style-type: none">1. To understand the Big Data Platform and its Use cases2. To understand the basics of Apache Hadoop and HDFS3. To apply analytics on Structured, Unstructured Data	
Unit-I	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. (6 Hrs)	
Unit-II	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. (6 Hrs)	
Unit-III	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. (6 Hrs)	
Unit-IV	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 MapReduce Paradigm: Map and Reduce tasks , Job Scheduling, Shuffle and Sort, Task	

	Execution, Map Reduce Types and Formats. (6 Hrs)				
Unit-V	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. (6 Hrs)				
Unit-VI	HADOOP ECHO SYATEM 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. (6 Hrs)				
Reference Books:	Sr. No.	Title	Author	Publication	Edition
	1.	Big Data Analytics	Seema Acharya, Subhasini Chellappan	Wiley	2 nd
	2.	Hadoop: The Definitive Guide	Tom White	O'reily Media	3 rd
	3.	Analytics in a Big Data World: The Essential Guide to Data Science and its Applications	Bart Baesens	Wiley	2014

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

(Faculty of Science & Technology)

Syllabus of final year B.Tech (All) Semester-VII

Course Code: EED431		Credits: 3-0-0	
Course: Open Elective III – Battery Management System		Mid Semester Examination-I: 15 Marks	
Teaching Scheme:		Mid Semester Examination-II: 15 Marks	
Theory: 03Hrs/week		Teacher Assessment: 10 Marks	
		End Semester Examination: 60 Marks	
		End Semester Examination (Duration):03 Hrs	
Prerequisite			
Objectives	The objective of this course is to introduce learner to batteries, its parameters, modelling and charging requirements. The course will help learner to develop battery management algorithms for batteries.		
Unit-I	Introduction: Introduction to Battery Management System, Cells & Batteries, Nominal voltage and capacity, C rate, Energy and power, Cells connected in series, Cells connected in parallel. <p style="text-align: right;">(5 Hrs)</p>		
Unit-II	Battery cell: Electrochemical and lithium-ion cells, Rechargeable cell, Charging and Discharging Process, Overcharge and Undercharge, Modes of Charging. <p style="text-align: right;">(6 Hrs)</p>		
Unit-III	Battery Management System Requirement: Introduction and BMS functionality, Battery pack topology, BMS Functionality, Voltage Sensing, Temperature Sensing, Current Sensing, BMS Functionality, High-voltage contactor control, Isolation sensing, Thermal control, Protection, Communication Interface, Range estimation, State of charge estimation, Cell total energy and cell total power. <p style="text-align: right;">(7 Hrs)</p>		
Unit-IV	Battery State Parameters: State of Charge (SoC), estimation of SOC, voltage-based methods to estimate SOC, Model-based state estimation, Battery Health Estimation, State of Health Definition (SoH),State of function definition (SoF),Charge acceptance (CA).Classification of Soc, SoH Estimation Methods. <p style="text-align: right;">(6 Hrs)</p>		

Unit-V	<p>Cell Balancing and aging: Cell Balancing. Causes of Imbalance in Battery Cells. Classification Systems for Balancing Methods-Static Methods, Dynamic methods. Lithium-ion aging: Negative electrode, Lithium-ion aging: Positive electrode, Cell Balancing, Causes of imbalance, Circuits for balancing.</p> <p style="text-align: right;">(7 Hrs)</p>				
Unit-VI	<p>Design of battery BMS: Design principles of battery BMS, Effect of distance, load, and force on battery life and BMS, energy balancing with multi-battery system.</p> <p style="text-align: right;">(5 Hrs)</p>				
Reference Books:	Sr. No.	Title	Author	Publication	Edition
	1.	Battery management systems	Plett, Gregory L	Volume I: Battery modeling. Artech House	2015
	2.	Battery management systems	Plett, Gregory L	Volume II: Battery modeling. Artech House	2015
	3.	Battery Management Systems -Design by Modelling	Bergveld, H.J., Kruijt, W.S., Notten, P.H.L	Philips Research Book Series	2002
	4.	Battery Management Systems for Large Lithium-ion Battery Packs	Davide Andrea	Artech House	2010
	5.	Battery management systems: Accurate state-of-charge indication for battery-powered applications	Pop, Valer, et al.	Vol. 9. Springer Science & Business Media,	2008

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

(Faculty of Science & Technology)

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

Course Code: ETC431		Credits: 3-0-0
Course: Open Elective-III Data Science		Mid Semester Examination-I: 15 Marks
Teaching Scheme:		Mid Semester Examination-II: 15 Marks
Theory: 3 Hrs/week		Teacher Assessment: 10 Marks
		End Semester Examination: 60 Marks
		End Semester Examination (Duration): 3 Hrs
Prerequisite	Programming Concepts, Data Structure, Basic Linear Algebra, Basic Probability and Statistics.	
Objectives	<ol style="list-style-type: none">1. Give an introduction to data science and its applications.2. Understand use of statistics in data science3. Use data science to analyze large and unstructured data with different tools.	
Unit-I	Introduction: Introduction, Terminologies in data science, Applications of Data science, Data science and Development , datafication, current landscape of perspective. Role of Data science in AI and ML. (6 Hrs)	
Unit-II	Statistical Inference and Exploratory data analysis: Statistical modelling, probability distributions, fitting a model, Populations and samples, Basic Tools (Plots, Graphs and summary statistics) of EDA, philosophy of EDA, the data science process, Case Study. Introduction to R. (6 Hrs)	
Unit-III	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. (6 Hrs)	
Unit-IV	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. (6 Hrs)	

Unit-V	Mining Social Network: Social Networks as graphs, clustering of graphs, direct discoveries of communities in graphs, portioning of graphs, neighbourhood properties of graphs. Illustration with an example. (6 Hrs)				
Unit-VI	Data visualization and ethical issues: Basic principles, ideas and tools for data visualization, creation of visualization for complex data set. Aesthetics in data visualization, software's used for data visualization, Case study. Privacy, security and ethics of data science. (6 Hrs)				
Reference Books:	Sr. No.	Title	Author	Publication	Edition
	1.	Doing Data Science: Straight Talk from The Frontline	Cathy O'Neil and Rachel Schutt	O'Reilly Media, Inc	3 rd
	2.	Mining of Massive Datasets. v2.1	Jure Leskovek, Anand Rajaraman and Jeffrey Ullman	Cambridge University Press	1 st
	3.	Learning: A Probabilistic Perspective	Kevin P. Murphy	MIT Press	2 nd
	4.	Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking.	Foster Provost and Tom Fawcett	O'Reilly Media, Inc	1 st

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

(Faculty of Science & Technology)

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

Course Code: AED431		Credits: 3-0-0
Course: Open Elective-III		Mid Semester Examination-I: 15 Marks
Modern Management Techniques		Mid Semester Examination-II: 15 Marks
Teaching Scheme:		Teacher Assessment: 10 Marks
Theory: 03 Hrs/week		End Semester Examination: 60 Marks
		End Semester Examination (Duration): 3 Hrs
Prerequisites	:	1.Knowledge of basic concepts of manufacturing processes
Objectives	:	1)To understand the concepts of modern management to enhance creativity 2)To understand the significance of TPM & SCM
Unit-I	:	Value Engineering: Value-types, Value analysis, Value Engineering, Value Control, FAST analysis DARSARI method <p style="text-align: right;">(06 Hrs)</p>
Unit-II	:	Supply Chain Management: Introduction, Decision Phases in Supply Chain, Process view of a supply chain importance of supply Chain Flows. New Customer –Supplier relationship–Supplier selection, purchasing, JIT in Supply Chain, E-Business and the Supplier Chain. <p style="text-align: right;">(06Hrs)</p>
Unit-III	:	Methods Engineering: Continuous method improvement, waste, type of waste elimination. KAIZEN Improvement versus Innovation, Finding & Implementing improvements-PDCA cycle, Five- Why Process. Process Reengineering. Ensuring Correct method of working POKAYOKE. Workplace layout & work station design, single minute exchange of dies, material handling system. <p style="text-align: right;">(06 Hrs)</p>
Unit-IV	:	Lean Manufacturing: Introduction Definition, distinctive features, mall-Lot Production, setup- time Reduction, Maintaining and Improving Equipment. Pull production system. Focused factories and group technology, work cells and Cellular Manufacturing

		Standard Operation. (06 Hrs)			
Unit-V	:	Total Productive Maintenance: Introduction, Definition, Distinctive features, Four developments striving for overall equipment effectiveness, the five TPM development activities the twelve steps of TPM, stages of TPM development. (06 Hrs)			
Unit-VI	:	Management Information System Data, Information, Needs of computer based introduction system Definition & concept of MIS and Data processing, need of database, Role of MIS in organization Impact of MIS on function of organization. (06 Hrs)			
Reference Books:	Sr. No.	Title	Author	Publication	Edition
	1	Industrial Engineering & Production Management	Maratand Telsang	S. Chand	3 rd
	2	Techniques of Value Analysis & Engineering	I.D. Miles	McGraw-Hill	3 rd
	3	Kaizen	Masaaki Imai	McGraw-Hill Education	1986
	4	Pokayoke	Hiroyuki Hirmao	Productivity Press, Cambridge	1994
	5	Management Information System	W.S. Jawadekar	TMH	4 th
	6	Supply Chain Management	Sunil Chopra, Peter Meindl	Pearson Education	6 th
	7	Competitive Manufacturing Management	John M. Nicholas	TMH	1997
8	Management Information System, Conceptual foundation, Structure & Development	Gordon Davis, Margrethe Olson	McGraw Hill Education	2017	

	9	Industrial Engineering & Production & Operations Management	Sanjay S. Patil Nanadkumar Hukkeri	Electrotech Publications	3 rd
Additional References:	:	<ol style="list-style-type: none"> 1. https://onlinecourses.nptel.ac.in/noc21_ge20/preview 2. https://onlinecourses.nptel.ac.in/noc22_cs97/preview 3. https://onlinecourses.nptel.ac.in/noc22_cs89/preview 4. https://onlinecourses.nptel.ac.in/noc22_cs73/preview 			

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

(Faculty of Science & Technology)

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

Course Code: PPE431		Credits: 3-0-0
Course: Open Elective-III: Packaging Technology		Mid Semester Examination-I: 15 Marks
Teaching Scheme:		Mid Semester Examination-II: 15 Marks
Theory: 3 Hrs/week		Teacher Assessment: 10 Marks
		End Semester Examination: 60 Marks
		End Semester Examination (Duration): 3 Hrs
Prerequisite	Basic knowledge of Polymeric Materials, Processing and Testing.	
Objectives	1. To impart knowledge and skills related to packaging system for various products. 2. To understand the concepts of materials, machinery used and testing of packaging material.	
Unit-I	Introduction: Packaging: History, Need & Evolution, Elements, Approach, Functions of packaging, Applications. Elements of Package Design, Importance of a good design, Packaging Hazards and their control. <p style="text-align: right;">(6Hr)</p>	
Unit-II	Packaging Materials: Selection criteria, Properties and Applications of plastic, paper, metal, wood and glass packaging materials, Bio degradable material. <p style="text-align: right;">(6Hr)</p>	
Unit-III	Packaging forms: Bottle, Skin, Blister, Shrink Carton, Vacuum, Gas, CAP, MAP, Tubes, Corrugated containers etc. <p style="text-align: right;">(6Hr)</p>	
Unit-IV	Specialty packages: Aseptic, Tetra, Types of pouches/sack; Stand up pouch, Retort pouch, gusseted pouch, Flexible Packaging. <p style="text-align: right;">(6Hr)</p>	
Unit-V	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 style="text-align: right;">(6 Hr)</p>	
Unit-VI	Printing: Surface treatment, Printing processes, Printing inks. Packaging quality control: Criteria, Physical, Chemical, and Mechanical test Procedure for packaging materials & packaged products.	

					(6 Hr)
Reference Books:	Sr. No.	Title	Author	Publication	Edition
	1.	Understanding Plastic Packaging Technology	Susan E. M. Seleke	Hanser publications - Munich	1 st
	2.	Plastics in Packaging	A.S. Althalye	Tata Mc Graw Hill publishing Co. Ltd., New Delhi.	1 st
	3.	Food Packaging Technology Handbook	NIIR	Asia-Pacific publication.	1 st
	4.	Package Engineering	Honlon J. F.	Mc Graw Hill	1 st
	5.	Plastics Packaging	Turtle Ivor	Pira International	1 st
	6.	Handbook of Packaging-Plastics	A. S. Althalye	Multi-tech Plastics publishing Co. Mumbai.	1 st
	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

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of Final Year B. Tech. (Plastic and Polymer Engineering) Semester-VII (2022-23 Choice Based Credit System)	
Course Code: PPE421 Course: Lab 1: Polymer Processing Technology-II Teaching Scheme: Practical: 2Hrs/week	Credits: 0-0-1 Practical Examination: 25 Marks
Objective	1. Practical exposure of working of polymer processing machines.
List of practicals	<ol style="list-style-type: none"> 1. To perform rotational molding for producing a single-layer product. 2. To perform rotational molding for producing a multi-layer product. 3. To perform blow molding of a bottle. 4. To perform compression molding of a polymer. 5. To perform hand layup process for producing FRP laminate. 6. To study the construction and working of transfer molding process. 7. To study the construction and working of thermoforming process. 8. To study the construction and working of calendaring process.

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

- Continuous assessment
- Performing the experiments in the laboratory
- 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 (2022-23 Choice Based Credit System)	
Course Code: PPE422 Course: Lab 2: Polymer Reaction Engineering Teaching Scheme: Practical: 2 Hrs/week	Credits: 0-0-1 Practical Examination: 25 Marks
Objective	1. To study the order and kinetics of various chemical reactions
List of practicals	Any 8 practical to be conducted <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. Residence time distribution of PFR and CSTR in series. 8. To study effect of monomer concentration on rate of polymerization. 9. To study effect of change in initiator concentration on rate of polymerization.

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

- Continuous assessment
- Performing the experiments in the laboratory
- 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 (2022-23 Choice Based Credit System)	
Course Code: PPE423 Course: Lab 3: Polymer Blends and Composites Teaching Scheme: Practical: 2 Hrs/week	Credits: 0-0-1 Term Work: 50 Marks
Objectives	1. To prepare polymer blends and composites by using different materials. 2. To analyze polymer blends and composites
List of practicals	Any 8 practical to be conducted 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 nano-filler based composite. 6. Prepare 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.

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

- Continuous assessment
- Performing the experiments in the laboratory
- 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
(2022-23 Choice Based Credit System)

Course Code: PPE426

Course: Major Project-II

Teaching Scheme:

Practical: 8Hrs/week

Credits: 0-0-4

Term Work: 50 Marks

Practical Examination: 50 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.

	<p>The format and other guidelines for the purpose of the Project Submission in hard bound copies should be as follows:</p> <p>REPORT STRUCTURE</p> <p>Index/Contents/Intent List of Figures List of Tables List of Symbols / Abbreviations</p> <ol style="list-style-type: none"> 1. Introduction 2. Literature survey 3. System development 4. Performance analysis 5. Conclusions <p>References Appendices Acknowledgement</p>
	<ol style="list-style-type: none"> 1. INTRODUCTION <ol style="list-style-type: none"> 1.1. Introduction 1.2. Necessity 1.3. Objectives 1.4. Theme 1.5. Organization 2. LITERATURE SURVEY <ul style="list-style-type: none"> • Literature Survey <p>Related information available in standard Books, Journals, Transactions, Internet Websites etc. till date (More emphasis on last three to five years)</p> 3. SYSTEM DEVELOPMENT <ul style="list-style-type: none"> • Model Development • Mechanical / Fabricated • Analytical • Computational • Experimental • Mathematical • Software 4. PERFORMANCE ANALYSIS <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.

	<ul style="list-style-type: none"> • Results at various stages may be compared with various inputs. <p>Output at various stages with same waveforms or signals or related information/parameters.</p> <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. Paper size- A4, 75 to 85 gsm paper Left Margin-1.5” Right Margin-3/4” Top Margin-1” Bottom Margin-1”</p>

	<ul style="list-style-type: none"> • Pagination <ul style="list-style-type: none"> ▪ 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 (2022-23 Choice Based Credit System)	
Course Code: PPE471 Course: Internship	Credits: 0-0-20 Term Work: 300 Marks Practical Examination: 300 Marks
(a)	Rationale: 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 visa 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.
(b)	Objectives: 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)	The curriculum for B. Tech students of Final Year Course of Part-II shall consist of: <ul style="list-style-type: none"> • In-plant 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 in-plant 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 In-plant 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 privileges of university, i.e. Maharashtra Institute of Technology, Aurangabad affiliated to Dr. Babasaheb Ambedkar Marathwada University, Aurangabad. • 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 in-plant 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 in-plant training:</p> <p>No student will be deputed for in-plant 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 in-plant training:</p> <p>The period of In-plant 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 In-plant Training :</p> <ul style="list-style-type: none"> • The student of Maharashtra Institute of Technology shall enter into a contract of in-plant training with the employing industry. • The in-plant training shall be deemed to have commenced on the date, on which the contract of in-plant training has been entered into. • Every contract of in-plant training will contain the Terms and Conditions to be agreed by both the parties. • Every contract of in-plant training shall be registered with the Maharashtra Institute of Technology within 15 days from entering into the contract.

	<p>6. Violation of contract: Where an employer, with whom a contract for in-plant 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 “in-plant trainee” under the other employer till the expiry period of the in-plant training. The agreement on registration with Maharashtra Institute of Technology shall be deemed to be the contract of in-plant training between the student and other employer, and from the date of such registration, the contract of in-plant 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: The contract of in-plant training shall terminate on the expiry of the period of in-plant training.</p> <p>Either party to the contract of in-plant 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 in-plant 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 in-plant training in that term. The student shall be deputed for in-plant training in the next coming term.
	<p>8. Expectation from the Employer / Industry / Establishment: The following expectations are derived for effective in-plant 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 in-plant 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 In-plant training.

	<ul style="list-style-type: none"> • The student shall maintain a report of his work during the period of his In-plant 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 in-plant 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 In-plant 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 In-plant training.
	<p>10. Maintenance of Record: Every student of B. Tech. course shall maintain a daily record of the work done by him/her relating to the in-plant training in the proforma (Annexure).</p>
	<p>11. Industry Sponsored Student Projects: The scheme envisages working out suitable programme for B.Tech. students. They are required to complete their in-plant training in a given period. During this period, they shall be familiar with 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 • Agro-engineering and so on.
	<p>12. What will form a good project? 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: The following time schedule should be planned by each student or groups of students, who</p>

	<p>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 student's 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 term</p>
	<p>16. Monitoring of In-plant 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 in-plant 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 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 in-plant 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 in-plant 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 in-plant 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 in-plant 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: 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 in-plant 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 The Practical examination will be conducted after successful completion of the in-plant 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.