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MAHARASHTRA INSTITUTE OF TECHNOLOGY, CHHATRAPATI SAMBHAJINAGAR

An Autonomous Institute Affiliated to Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra (India)

Third Year B. Tech. Syllabus (Plastic and Polymer Engineering) 2023-24

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T. Y. B. Tech. Syllabus Structure w.e.f. 2023-24

Plastic and Polymer Engineering

Semester-V

Sr. No	Course Category	Course Code	Course Title	L	T	P	Contact Hr /Wk	Credits	MSE-I	MSE-II	CIE	TA	ESE/ Oral	Total
1.1	HSMC	HSM301	Engineering Economics & Financial Management	3	-	-	3	3	15	15	10	10	50	100
1.2	PC	PPE301	Elastomer Technology	3	-	-	3	3	15	15	10	10	50	100
1.3	PC	PPE302	Polymer Rheology	3	-	-	3	3	15	15	10	10	50	100
1.4	PC	PPE303	Polymer Characterimtion	3	-	-	3	3	15	15	10	10	50	100
1.5	PC	PPE304	Polymeric Materials	3	-	-	3	3	15	15	10	10	50	100
1.6	PC	PPE321	Lab-I: Elastomer Technology	-	-	2	2	1	-	-	-	25	-	25
1.7	PC	PPE322	Lab-II: Polymeric Materials	-	-	2	2	1	-	-	-	25	-	25
1.8	PC	PPE323	Lab-III: Polymer Characterization	-	-	2	2	1	-	-	-	-	25	25
1.9	PRO	PPE325	Lab-IV: Seminar	-	-	2	2	1	-	-	-	-	25	25
1.10	PRO	PPE326	Lab-V: Experience-based learning	-	-	2	2	1	-	-	-	25	-	25
1.11	PC	PPE324	Lab-VI: Development of Skills- Design Lab II	-	-	2	2	1	-	-	-	-	25	25
S5				15	0	12	27	21	75	75	50	125	325	650

Semester-VI

Sr. No	Course Category	Course Code	Course Title	L	T	P	Contact Hr /Wk	Credits	MSE-I	MSE-II	CIE	TA	ESE/ Oral	Total
2.1	PC	PPE351	Polymer Processing Technology	3	-	-	3	3	15	15	10	10	50	100
2.2	PC	PPE352	Mould and Product Design	3	-	-	3	3	15	15	10	10	50	100
2.3	PC	PPE353	Additive Manufacturing	3	-	-	3	3	15	15	10	10	50	100
2.4	PC	PPE354	Fluid Mechanics and Heat Transfer	3	-	-	3	3	15	15	10	10	50	100
2.5	OE	PPE391	Open Elective-III Waste Management and Circular Economy	3	-	-	3	3	15	15	10	10	50	100
2.6	PC	PPE371	Lab-I: Polymer Processing Technology	-	-	2	2	1	-	-	-	25	-	25
2.7	PC	PPE372	Lab-II: Fluid Mechanics and Heat Transfer	-	-	2	2	1	-	-	-	25	-	25
2.8	PC	PPE373	Lab-III: 3D Printing Technology	-	-	2	2	1	-	-	-	-	25	25
2.9	PC	PPE374	Lab-IV: Materials Synthesis and Testing	-	-	2	2	1	-	-	-	-	25	25
2.10	PRO	PPE375	Lab-V: Major Project-I	-	-	4	4	2	-	-	-	25	25	50
S6				15	0	12	27	21	75	75	50	125	325	650

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Semester – VI (Open Elective – III)

DEPARTMENT	COURSE CODE	COURSE TITLE
Agricultural Engineering	AED391	Fundamentals of Bioenergy
Civil Engineering	CED391	Solid Waste Management
Computer Science and Engineering	CSE391	RHCSA (RedHat Certified System Administration)
Computer Science and Engineering	CSE392	Digital Marketing
Electronics and Computer Engineering	ECE391	Data Science
Electronics and Computer Engineering	ECE392	Control Systems
Electrical Engineering	EED391	Special Purpose Electric Machines
Emerging Science and Technology	AID391	Business Intelligence
Mechanical Engineering	MED391	Industry 4.0
Mechanical Engineering	MED392	Operations Research
Plastic and Polymer Engineering	PPE391	Waste Management and Circular Economy

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Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester V)

Course Code:HSM301 Course: Engineering Economics & Financial Management Teaching Scheme: Theory:03Hrs/Week	Credits:3-0-0 Mid Semester Examination-I: 15 Marks MidSemesterExamination-II:15 Marks Continuous In-semester Evaluation:10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration):2 Hrs

Prerequisite	• Basic knowledge of concepts of economics.
Objectives	The objectives of the course are: 1. Understanding the principles of economics. 2. Analyzing cost-benefit analysis. 3. Recognizing the role of markets and competition. 4. Understand decision making in uncertainty. 5. Getting introduced to Indian taxing system.
Unit-I	**Introduction to Engineering Economics:** Introduction to Economics, Importance and scope of economics in engineering, economic analysis and its role in project management, Overview of economic principles and concepts relevant to engineering, Micro - and macro- economics, economics of growth and development, Demand and supply analysis. (06 Hrs)
Unit-II	**Cash Flow and Time Value of Money:** Interest rates, compounding, and discounting, Present value and future value analysis, Equivalent annual cost analysis. Cash Flow – Diagrams, Categories & Computation, Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis , Calculating Rate of Return, Incremental Analysis. (06 Hrs)
Unit-III	**Elements of Managerial Economics:** Cost & Cost Control –Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money (present and future worth of cash flows). Business Forecasting – Elementary techniques. (06 Hrs)
Unit-IV	**Rate analysis and Tendering:** Rate analysis - Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment/ productivity. Tendering - Preparation of tender documents, importance of inviting tenders, contract types, relative merits, and prequalification. General and special

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Plastic & Polymer Engineering

	conditions, termination of contracts, penalty and liquidated charges, Settlement of disputes. Bid conditions, alternative specifications, Alternative Bids, Bid process management (06Hrs)
Unit-V	**Decision-making under Risk and Uncertainty** Probability and risk assessment in engineering projects, Sensitivity analysis and scenario analysis, Decision trees and expected value analysis, Real options analysis. **Depreciation** Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation (06Hrs)
Unit-VI	**Personal Financial Management** Insurance, Investment, Insurance Vs investment, Investment types, Equity and debt, Investment options, lumpsum, SIP, STP, Compounding effects of investment, Investment analysis, Introduction to Stock market, fundamental and technical analysis, Derivatives, Types of derivatives, Trading awareness. (03 Hrs) Indian Taxing System, Types of tax: Direct and indirect taxation in India, Excise duty, GST, Income tax introduction, Income Tax calculations, example. (03 Hrs)

Textbooks / Reference Books

Sr. No	Title	Author	Publication	Edition
1.	Economics for Engineers	James L. Riggs, David D. Bedworth, Sabah U. Randhawa	McGraw-Hill	4th
2.	Engineering Economics Analysis	Donald Newnan, Ted Eschembach, Jerome Lavelle	OUP	-
3.	Principle of Engineering Economic Analysis	John A. White, Kenneth E. Case, David B. Pratt	John Wiley	-
4.	Engineering Economics	R. Paneerseelvam	PHI	-
5.	Engineering Economics Analysis	Michael R Lindeburg	Professional Pub	-
6.	Managerial Economics	V. Mote, S. Paul, G. Gupta	Tata McGraw	-

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Plastic & Polymer Engineering

				Hill	
	7.	Principles of Economics	Mankiw Gregory N.	Thompson Asia	3rd

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Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester V)

Course Code: PPE301 Course: Elastomer Technology Teaching Scheme: Theory: 3Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisite	• Fundamentals of Polymer Chemistry • Polymer additives and compounding
Objectives	1. To understand different terminologies associated with elastomer technology. 2. To acquire fundamental knowledge about natural and synthetic rubbers,their structures, basic characteristics, and applications. 3. To gain knowledge about the compounding of elastomer. 4. To acquire knowledge about the vulcanization of rubbers.
Unit-I	**Introduction to Elastomers:** Definitions and terminologies, Gough-Joule effect, molecular structures, classifications (natural and synthetic, general purpose and special purpose, polar and non-polar), basics of thermoplastic elastomer. (3 Hrs)
Unit-II	**Testing of Rubbery Materials:** Brief idea about the principles of tensile strength, tear strength, abrasion resistance, resilience, hardness, compression set, plasticity retention index, heat build-up, flex fatigue, die swell, gas barrier property, and crosslink density measurement. (9 Hrs)
Unit-III	**Natural Rubber and Its Derivatives:** Brief overview of natural rubber latex, composition, tapping and related notations, coagulation, processing of latex, different grades (RSS, SMR, ISNR), properties, and applications. Brief discussion on preparation, properties, and applications of oil extended, epoxidized, cyclized, deproteinized, chlorinated natural rubber, and ebonite. (6 Hrs)
Unit-IV	**Polar and Non-polar Rubber:** Structure, properties, and applications of polar (BR, SBR, IIR, and EPDM) and non-polar (CR, NBR, and silicone) rubbers. (8 Hrs)
Unit-V	**Rubber Compounding Fundamentals:**

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Plastic & Polymer Engineering

	Vulcanization, curing agents, accelerators, fillers (carbon black and silica), vulcanization methods, vulcanization systems (conventional, EV, and semi-EV), roles of different additives, and compounding formulation. (5 Hrs)
Unit-VI	**Rubber Compounding Calculations:** Analysis of rheo-curve, calculation of induction time, scorch time, optimum cure time, rate of cure, and cure index. Calculation of density of compound and amounts of components required for a compounding formulation. (5 Hrs)

Textbooks / Reference Books

Sr. No.	Title	Author	Publication	Edition
1	Rubber Technology	Maurice Morton	Van Nostrand Reinhold	3rd
2	Rubber Technology and Manufacture	C. M. Blow	Butterworths for the Institution of the Rubber Industry	2nd
3	Handbook of Elastomers	Anil K. Bhowmick, Howard Stephens	CRC Press	2nd
4	Rubber Engineering	Indian Rubber Institute	McGraw Hill, India	1st
5	Physical Testing of Rubber	Roger Brown	Springer	4th

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Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester V)

Course Code: PPE302 Course: Polymer Rheology Teaching Scheme: Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisite	• Introduction to Polymer Engineering. • Physical Chemistry of Polymers. • Polymer Testing
Objectives	1. To understand the flow behaviour of polymeric materials 2. To understand the rheological characteristics of the polymeric materials
Unit-I	**Introduction to Rheology:** Overview and importance of rheology, power law, Newtonian and non-Newtonian fluids, pseudoplastic and dilatant fluids, thixotropy and rheopexy, viscoelasticity, thermal dependence of viscous flow (free volume), Deborah number, Weissenberg effect, die swell. (6 Hrs)
Unit-II	**Factors Affecting Shear Flow:** Effect of temperature, pressure, and frequency on rheological behavior; effect of molecular weight and concentration on viscous flow, melt fracture, and irregular flow (6 Hrs)
Unit-III	**Viscoelastic Models:** Creep and stress relaxation in Maxwell, Voigt-Kelvin and four parameter model, viscoelastic relaxation and retardation, creep compliance, correlations of rheological parameters. (6 Hrs)
Unit-IV	**Transition Phenomena:** Identification of phase transition temperatures, WLF equation, time-temperature equivalence, and superposition. (5 Hrs)
Unit-V	**Measurement of Rheological Characteristics:** Brief working principle and application of various rheometers: Capillary rheometer, Mooney rheometer, cone and plate rheometer, parallel plate rheometer, Brookfield viscometer, extensional rheometer, moving die rheometer, oscillating die rheometer. (8 Hrs)

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Plastic & Polymer Engineering

Unit-VI	**Interpretation of Rheological Characteristics of Polymeric Materials:** Analysis of storage modulus, loss modulus, tan δ, glass transition, curing, gelation, interfacial interaction (5Hrs)

Textbooks / Reference Books

Sr. No.	Title	Author	Publication	Edition
1.	Polymer melt rheology	F. N. Cogswell	Woodhead Publishing Ltd.	1st
2.	Rheometry	K. Walters	Chapman and Hall	1st
3.	Flow properties of polymer melt	Brydson. J.	George George Goodwin Ltd.	1st
4.	Viscoelastic properties of polymers	John D. Ferry	John Willey & Sons	3rd
5.	A practical approach to Rheology and Rheometry	Gebhard Schramm	Gebrueder Haake GmbH	2nd
6.	Applied Rheology in Polymer Processing	B. R. Gupta	Asian Books Pvt Ltd.	1st

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Faculty of Science & Technology Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester V)	
Course Code: PPE303 Course: Polymer Characterization Teaching Scheme: Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisite	• Chemical structure and formulae, crystal lattice types.
Objectives	1. To understand the mechanisms of different instrumental analysis methods. 2. To acquire fundamental knowledge about the structural characteristics of polymers and their correlation to the analysis methods.
Unit-I	**Introduction to Characterization Techniques:** Classifications of various characterization techniques. Significance and applications of different characterization techniques. (2 Hrs)
Unit-II	**Spectroscopy:** Introduction, basic working principle, strategy of analysis with examples and applications of FTIR (including ATR mode), UV-VIS. (8 Hrs)
Unit-III	**Morphology:** Introduction, basic working principle of SEM (including EDS analysis and mapping), TEM (including brief introductory idea about SAED. (8 Hrs)
Unit-IV	**X-ray analysis:** Introduction, basic working principle, strategy of analysis with examples and applications of XRD (including determination of crystallinity, crystallite size, lattice strain and indexing) and SAXS. (8 Hrs)
Unit-V	**Thermal and thermomechanical analysis:** Introduction, basic working principle, strategy of analysis with examples and applications of DSC, TGA (including reverse engineering techniques, isothermal and non-isothermal degradation, isothermal DSC in correlation to crystallization characteristics) and DMA (insight to loss modulus, storage modulus and tan delta). (8 Hrs)
Unit-VI	**Gel Permeation Chromatography:** Introduction, basic working principle, strategy of analysis with examples and

	applications of GPC (with reference to different types of detectors used). (2 Hrs)				
Textbooks / 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	7th
	2.	Modern Instrumental Analysis	S. Ahuja, N. Jesperson	Elsevier	1st
	3.	Polymer characterization - laboratory techniques and analysis	Nicholas P. Cheremisinoff	Noyes Publications	1st
	4.	Analytical Methods for Polymer Characterization	Rui Yang	CRC Press	1st
	5.	Characterization of Solid Polymers: New techniques and developments	S.J. Spells	Chapman & Hall	1st
	6.	Spectroscopy of Polymers	Jack L. Koenig	Elsevier	2nd
	7.	Polymer Characterization by Liquid Chromatography	Gottfried Glockner	Elsevier	1st
	8.	Thermal Analysis Fundamentals and Applications to Polymer Science	Joseph D. Menczel, R. Bruce Prime	John Wiley & Sons	1st
	9.	Polymer Microscopy	Linda C. Sawyer, David T. Grubb, Gregory F. Meyers	Springer	3rd

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Plastic & Polymer Engineering
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Faculty of Science & Technology
Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester V)

Course Code: PPE304 Course: Polymeric Materials Teaching Scheme: Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisite	• Introduction to Polymer Engineering. • Physical Chemistry of Polymers. • Polymer Synthesis and Manufacturing. • Polymer Testing. • Polymer Additives and Compounding.
Objectives	To provide a general overview of 1. Different polymeric materials, their types. 2. General properties, processing behaviour and applications of different class of polymeric materials. 3. Structure-property relationship of different classes of polymer.
Unit-I	**Natural Polymers:** Properties and applications of natural polymers – cellulose – Regenerated cellulose, cellulose nitrate, cellulose esters, cellulose ethers. (5 Hrs)
Unit-II	**Commodity Plastics:** Properties and applications of polyethylene – LDPE, LLDPE, HDPE, UHMWHDPE, crosslinked polyethylene, chlorinated polyethylene, polypropylene – homo- and co-polymer, polyvinyl chloride. (6 Hrs)
Unit-III	**Phenolic and Amino Resins:** Properties and application of phenol formaldehyde (PF) resins (Novolac, Resol), melamine formaldehyde (MF) and urea formaldehyde (UF) resins. (7 Hrs)
Unit-IV	**Polyester Resins:** Types of unsaturated polyester resins, PET, PBT properties and applications. Alkyd Resins Structure-properties relationship and application of alkyd resins. (6 Hrs)
Unit-V	**Engineering Plastics and its Applications-I:** Properties and applications of high impact polystyrene (HIPS), acrylonitrile butadiene styrene (ABS), styrene acrylonitrile (SAN), polymethyl methacrylate,

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Plastic & Polymer Engineering
MIT Aurangabad

	polyacrylonitrile, ethylene vinyl alcohol (EVA). (6 Hrs)				
Unit-VI	**Engineering Plastics and its Applications-II:** Properties and applications of Nylons 6, (6, 6), (6, 10), polycarbonate, polyacetals, PTFE. **Epoxies:** Structure-properties relationships and application of epoxies. (6 Hrs)				
Textbooks / Reference Books	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1.	Polymer Science and Technology: Plastics, Rubber, Blends and Composites	Premamoy Ghosh	Tata McGraw Hill	2nd
	2.	Plastics Materials	J. Brydson	Butterworth Hienemann	7th
	3.	Introduction to Polymer Science and Chemistry: A Problem-Solving Approach	Manas Chanda	CRC Press	2nd
	4.	Principles of Polymerization	George Odian	Wiley Interscience	4th
	5.	Handbook of Industrial Polyethylene and Technology Definitive Guide to Manufacturing, Properties, Processing, Applications and Markets	Mark A. Spalding and Ananda M. Chatterjee	Scrivener Publishing	2nd
	6.	Polyurethane and Related Foams	KaneyoshiAshida	Taylor and Francis	1st

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Plastic & Polymer Engineering

Faculty of Science & Technology
Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester V)

Course Code: PPE 321 Course: Lab-I: Elastomer Technology Teaching Scheme: Practical: 02 Hrs/week	Credits: 0-0-1 Teacher's Assessment: 25 marks
Objective	To acquire practical exposure of elastomer technology in laboratory
List of practicals	**Any 8 practicals to be conducted** 1. To determine total solid content (TSC) of rubber latex. 2. To determine dry rubber content (DRC) of rubber latex. 3. To determine total alkalinity of rubber latex. 4. To masticate rubber in two-roll mill. 5. To formulate rubber compounds for different vulcanization systems. 6. To mix a rubber compound using different ingredients. 7. To determine minimum torque, maximum torque, induction time (t_s2), scorch time (t_s5), optimum cure time (t_c90) and cure rate index from rheometer curve. 8. To analyze rheocurve of rubber compounds with different vulcanizing systems. 9. To analyze the comparative rheocurves of different types of accelerators.

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.

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Faculty of Science & Technology
Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester V)

Course Code: PPE 322 Course: Lab-II: Polymeric Materials Teaching Scheme: Practical: 02 Hrs/week	Credits: 0-0-1 Teacher's Assessment: 25 marks

Objective	• Different polymeric materials, their types. • General properties, processing behaviour and applications of different class of polymeric materials. • Structure-property relationship of different classes of polymer.
List of practicals	**Any 8 practicals to be conducted** 1. To synthesize Polystyrene by suspension polymerization technique. 2. To synthesize Polyacrylonitrile by precipitation polymerization technique. 3. To synthesize Polymethyl methacrylate by solution polymerization technique. 4. To synthesize Polyaniline by interfacial polymerization. 5. To synthesize Polyvinyl alcohol from Polyvinyl acetate. 6. To synthesize Polymethyl methacrylate / Polystyrenecopolymer by emulsion polymerisation. 7. To determine the molecular weight of polyester bytitration method. 8. To determine the chlorine content of given polymeric sample by Mohr's method. 9. To synthesize Aniline-Formaldehyde by polycondensation method.

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.

Chairman Board of Studies
Plastic & Polymer Engineering
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Maharashtra Institute of Technology, Aurangabad
(An Autonomous Institute)

Faculty of Science & Technology
Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester V)

Course Code: PPE 323 Course: Lab-III: Polymer Characterization Teaching Scheme: Practical: 02 Hrs/week	Credits: 0-0-1 ESE/Oral: 25 marks

Objective	• To apply characterization techniques on polymeric materials. • To analyze polymer characterization results
List of practicals	**Any 8 practicals to be conducted** 1. To characterize a known polymer through FTIR and interpret the spectrum. 2. To predict the structure of unknown polymeric material from analysis of FTIR spectrum. 3. To characterize a solution through UV-VIS and analyze the spectrum. 4. To determine Tg and Tm of a polymer through DSC analysis. 5. To study the thermal degradation of a polymer through TGA and DTG analysis. 6. To determine percent crystallinity of a polymer from an X-ray diffractogram. 7. To determine a polymer's crystallite size and lattice strain from an X-ray diffractogram. 8. To index the peaks of an X-ray diffractogram of a polymer. 9. To analyze the shape and size of nanomaterials from scanning electron micrographs. 10. To analyze the shape and size of nanomaterials from transmission electron micrographs.

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.

Chairman Board of Studies
Plastic & Polymer Engineering

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester V)	
Course Code: PPE325 Course: Lab-IV: Seminar Teaching Scheme: Practical: 02 Hrs/week	Credits: 0-0-1 ESE/Oral: 25 Marks
Objectives	• To encourage the students to study advanced engineering developments. • To develop skills in doing literature survey, technical presentation and report preparation. • To prepare and present technical reports. • To encourage the students to use various teaching aids such as power point presentation and demonstrative models.
Guidelines	Each student shall identify a topic of current relevance in his/her branch of engineering, get approval of faculty concerned. To encourage and motivate the students to read and collect recent and reliable information about their area of interest confined to the relevant discipline, from technical publications including peer reviewed journals, conferences, books, project reports etc., prepare a report based on a central theme and present it before a peer audience. Each student shall present the seminar for about 20 minutes duration on the selected topic. The report and the presentation shall be evaluated by a team of faculty members comprising Academic coordinator for that program, seminar coordinator and seminar guide based on style of presentation, technical content, adequacy of references, depth of knowledge and overall quality of the report. A Faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.
Evaluation	Distribution of marks for the seminar is as follows: i. Topic Selection and Technical Contents: 30 % ii. Presentation: 20%, iii. Ability to answer questions: 20% & iv. Report: 30%). Evaluation is based on rubrics prepared based on above guidelines.

Chairman Board of Studies
Plastic & Polymer Engineering
MIT Aurangabad

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(An Autonomous Institute)

Faculty of Science & Technology
Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester V)

Course Code: PPE326 Course: Lab-V: Experienced based learning Teaching Scheme: Practical: 02 Hrs/week	Credits: 0-0-1 Teacher's Assessment: 25 Marks

Objectives	1. To promote professional skills and knowledge through hands on experience. 2. To inculcate independent learning by problem solving with social context.
Attributes	The following attributes are necessary in some combination, • The goal of experience-based learning involves something personally significant or meaningful to the students. • Students should be personally engaged. • Reflective thought and opportunities for students to write or discuss their experiences should be ongoing throughout the process. • The whole person is involved, meaning not just their intellect but also their senses, their feelings and their personalities. • Students should be recognised for prior learning they bring into the process.
Guidelines	**4 Stages of Experiential Learning Cycle** **1. Concrete Experience:** It describes the hands-on experiences that it is learn from. It's here that to try new things, face problems and step out of our comfort zone. **2. Reflective Observation** Next, it is needed to reflect to learn from the experiences. The 'reflective observation' phase of the experiential learning cycle is all about reflection on the experiences which include both action and feelings. It is a stage get to reflect on what went right and what could be improved? It's also a chance to observe how it could have been done differently and to learn from each other. **3. Abstract Conceptualization** Once it has been identified and understood the defining characteristics of an experience, it can decide on what can be done differently next time. This is a time for planning and brainstorming steps for success. **4. Active Experimentation** The active experimentation phase of the learning cycle is where the experimentation with the ideas is done. It's time to put the plan of action to the test in the real world. The active experimentation phase of the learning cycle is where there is need to experiment with the ideas. It's time to put plan of action to the test in the real world. Following activities may be performed under experience-based learning.

Chairman Board of Studies
Plastic & Polymer Engineering

	• Role Play • Case Studies • Field Visits • Undergraduate Research • Question generating activity • Fishbowl • Make a Mnemonic • Peer Group Learning • Group 'Change' Projects • Creative Problem-Solving **Assessment:** Assessment will be done through following ways. • Creating a reflective journal or a portfolio • Essay, report, or presentation (could be arts-based, multimedia or oral) on what has been learnt • Short answers to questions of a 'why' or 'explain' nature • One-on-one oral assessments with the instructor • A project that develops ideas further (individually or in small groups) • Self-evaluation and/or group evaluation of a task performed Rubrics shall be prepared for the activities in which the performance is to be evaluated. During process of monitoring and continuous assessment and evaluation the individual and team performance is to be measured. EBL is monitored and continuous assessment is done by mentor and authorities.

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Plastic & Polymer Engineering
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(An Autonomous Institute)

Faculty of Science & Technology
Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester V)

Course Code: PPE 324 Course: Lab-VI: Design Lab-II Teaching Scheme: Practical: 02 Hrs/week	Credits: 0-0-1 ESE/Oral: 25 marks

Objective	• To understand CAD - solid modeling, Surface modeling, assembly modeling and drafting of different engineering parts. • To enable students to design and model the objects as per defined dimensions & features. • To enable students to simulate the models of different assemblies.
List of practicals	**Any 8 practicals to be conducted** 1. To practice basic 3D modelling features: Introduction to 3D modeling software package, basic 3D modeling concept, basics of sketching constraints, extrude, revolve, sweep, Boolean operations etc. 2. To practice 3D Model Editing tools: Edit, edge blend, shell, array, pattern, mirror etc. 3. To practice 3D surface modeling tools: freeform modeling ruled, through curves, through curve mesh, swept and N-sided, Trim sheet, 4. To practice Advances Swift Commands: face blend, surface through points, X form, curve on surface. 5. To practice 3D Assembly Modelling: Basic assembly concepts, Bottom-up approach, top-down approach, creating assemblies. 6. To practice 3D Assembly constraints, components, assembly explosion. 7. To practice 3D Drafting tools: Introduction to drafting, drawings & views, linear dimensions, radial dimensions, notes & labels, section views, half section, detailed view, stepped section views, broken view, revolved section views. 8. To practice 3D Designing symbols: additional drafting symbols like thread, weld, surface finish, annotation edit. 9. To design Injection Mould: Cavity Core Extraction, Assembly of Mold, GD & T.

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Plastic & Polymer Engineering
MIT Aurangabad

	Sr. No.	Title	Author	Publication	Edition
Textbooks / Reference Books	1.	Injection Mould Design,	R.G.W.Pye	East West Press Pvt. Ltd. NewDelhi.	4th
	2.	Plastic Product Design	Tycoon industries ltd. Japan	Tycoonindustriesltd. Japan	1st
	3.	Design Analysis methods and Techniques	F. Rouessac, A. Rouessac	John Wiley and Sons Ltd.	4th
	4.	Principles of Polymer Processing	A. Tadmor and C. G. Gagos	John Wiley & Sons, New York	2nd

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.

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester-VI)	
Course Code: PPE351 Course: Polymer Processing Technology Teaching Scheme: Theory: 3Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs
Prerequisite	• Knowledge of Polymer materials, additives and compounding, rheology, heat transfer.
Objectives	1. To impart the understanding of various polymer processing techniques considering the equipment, material, processing parameters etc.
Unit-I	**Injection Moulding:** Introduction, basic components and process, moulding materials, moulding cycle, co-injection moulding, gas/water assisted injection moulding, foam injection moulding, advantages and limitations of the process, troubleshooting and safety measures, process parameters and their effects on product quality. (10 Hrs)
Unit-II	**Compression Moulding:** Introduction, basic process, moulding cycle, moulding materials, process parameters, types of molds, advantages and limitation of process, troubleshooting. (4 Hrs)
Unit-III	**Rotational Moulding:** Introduction, moulding material, cycle time, types of machines, process parameters & their effects on product quality, advantages & disadvantages, troubleshooting. (4 Hrs)
Unit-IV	**Extrusion:** Introduction, extrusion process and extruder screw, moulding materials, extruder output, extrusion blown and cast film, sheet extrusion, pipe extrusion, process parameters & their effects on product quality, co-extrusion, twin screw extruder, troubleshooting. (10 Hrs)

Chairman Board of Studies
Plastic & Polymer Engineering
MIT Aurangabad

Unit-V	**Blow Moulding:** Introduction, moulding materials, Extrusion blow moulding, Injection blow moulding, stretch blow moulding, process parameters and their effects on quality of product, advantages & disadvantages, troubleshooting. (4 Hrs)
Unit-VI	**Transfer Moulding:** Introduction, basic process, moulding cycle, types of transfer moulding machines, process parameters and their effect on product quality. **Calendering** Introduction, moulding material, process, types of calendar roll, process parameters, Advantages, disadvantages, troubleshooting. (4 Hrs)

Textbooks / Reference Books

Sr. No.	Title	Author	Publication	Edition
1	Plastics Engineering Handbook	J. Frados	Van Nostrand Reinhold Company	4th
2	Plastics Processing Handbook	A. S. Athalye	Colour Publications (Pvt.) Ltd.	1st
3	SPI Plastics Engineering Handbook	Michael Berins	Springer	5th
4	Principles of Polymer Processing	A. Tadmor and C. G. Gagos	John Wiley & Sons, New York	2nd

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Plastic & Polymer Engineering
MIT Aurangabad
(An Autonomous Institute)

Faculty of Science & Technology Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester VI)	
Course Code: PPE352 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 Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisite	• Polymer Processing Technology • Polymer Rheology • 2 D and 3 D designing • Polymeric Materials
Objectives	1. To impart the knowledge about basic concepts of mould& 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 pin ejection, sleeve ejection, stripper plate ejection systems. Design of two-plate and three plate moulds, split moulds. Mould designing for threaded articles and inserts. Types of cooling systems and their selection criteria. Bill of material. (6 Hrs)
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 injection moulds. Special features required for thermoset moulds. Selection of suitable machine for suitable mould, types of heating systems available for moulds. Mould designing for threaded articles and inserts, multi-daylight mould, troubleshooting. Bill of materials and specification. (8 Hrs)
Unit-III	**Basic Product Design Considerations:** Effect of wall thickness, flat surfaces, corners, radius, drafts, fillets, shrinkage, warpage, partingline tolerances. (4 Hrs)
Unit-IV	**Basic Product Design Features:** Rim, rib design, gussets, bosses, radii/fillets holes and its types, under cuts, core outs, collapsible core, types of inserts and threads, types jigs and fits, shapes of male and female inserts, product costing with reference to number

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	of cavity, cycle time, material for moldings, and over heads. (10 Hrs)
Unit-V	**Basics of Geometric Dimensioning and Tolerances in mold:** Importance of geometric dimensioning &tolerances, tolerance symbols, tolerance specification and interpretation (4 Hrs)
Unit-VI	**Component Design:** Design of components like: Engine gaskets, chair, plastic gears, plastic bearing, overhead tanks. (4 Hrs)

Textbooks / Reference Books

Sr. No.	Title	Author	Publication	Edition
1	Plastic product design	Ronold D. Beck,	Van Nostrand Reinhold company.	2nd
2	Plastics product design handbook	Edward Miller	Marceldekker	1st
3	Plastics Design handbook	Dominic & Donald V. Rosato	Kauwer Academic publisher	4th
4	Injection Mould Design	R. G. W. Pye	East-West Press Pvt. Ltd. New Delhi.	4th

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Plastic & Polymer Engineering
MIT Aurangabad
(An Autonomous Institute)

Faculty of Science & Technology
Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester VI)

Course Code: PPE353 Course: Additive Manufacturing Teaching Scheme: Theory: 3Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisite	• Basic Knowledge of plastic materials, engineering drawing and CAD.
Objectives	1. Students will be able to understand Basic concept of 3D printing. 2. Students will be able to understand various types of 3D printing. 3. To acquire knowledge related to 3D printing technologies. 4. To apply 3D printing techniques into various applications.
Unit-I	**Introduction:** Introduction to 3D Printing technologies, short history, classification of 3D printing processes, selection criteria for 3D technology. Applications, advantages and limitations of 3D printing technology. Introduction to CAD/CAM for 3D printing, myths and reality in 3D printing. (6 Hrs)
Unit-II	**Fused deposition modeling (FDM):** Extrusion-based systems: Fused Deposition Modelling (FDM), principles, plotting & path control, materials used for FDM, pre and post processing operation in FDM, defects in FDM 3D printed parts, applications, advantages and limitations in FDM. (6 Hrs)
Unit-III	**Streolithography (SLA):** Principle, photo polymerization, photocurable materials used for SLA, top down and bottom-up approach in SLA, pre and post processing operation in SLA, micro-streolithography, defects in SLA 3D printed parts, applications, advantages and limitations in SLA. (6 Hrs)
Unit-IV	**Selective Laser Sintering (SLS):** Introduction to selective laser sintering (SLS), principle, powder materials used in SLS,classification of SLS printing, advantages, limitations and applications of SLS. (6 Hrs)
Unit-V	**3D Printing Process optimization:** Building orientation effects over aspects: support structure position & volume, surface quality, resolution, layer thickness, time & cost, mechanical

	properties, filament deposition, materials and processing issues, reverse engineering. (6 Hrs)				
Unit-VI	**Advanced Applications and Costing of 3D Printing:** 3D printing applications in medical devices, custom made prosthetics, dental applications, prosthetic jaws and implants, defense application. Estimating costing for 3D printing. (6 Hrs.)				
Textbooks / Reference Books	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1	The 3D Printing Handbook: Technologies, design and applications	Ben Redwood, Filemon Schoffer, Brian Garret	3D Hubs	1st
	2	Make: Getting Started with 3D Printing	Liza Wallach Kloski, Nick Kloski	Maker Media, Inc.	1st
	3	3D Printing for Dummies	Richard Horne, Kalani Kirk Hausman	John Wiley & Sons	2nd

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Faculty of Science & Technology
Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester VI)

Course Code: PPE354 Course: Fluid Mechanics and Heat Transfer Teaching Scheme: Theory: 3Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisite	• Basic calculations in Chemical Engineering
Objectives	1. To understand basic concepts of fluid flow and its applications in upstream anddownstream process industry. 2. To understand the dynamics of fluid flow and non-dimensional parameters. 3. To understand the fundamental concepts, modes and laws related to heat transfer. 4. To identify the mechanisms of heat transfer that occurs in practice.
Unit-I	**Introduction to Fluid Mechanics:** Fluid, properties of fluid, classification of fluids, Newton's law of viscosity, rheological classification of fluids, types of flow. (4 Hrs)
Unit-II	**Fluid flow and pressure measurement:** Pascal's law, hydrostatic law, the concept of atmospheric, gauge, vacuum, and absolute pressure and pressure measuring devices. Continuity equation,Bernoulli's equation. Flow measurement devices like pitot tube, venturimeter, orifice meter, and rotameter. (8 Hrs)
Unit-III	**Fluid Transporting Machines:** Fluid flow machineries: Fans, blowers, and compressors. Types of pumps, their operating characteristics, performance curves, NPSH. (6 Hrs)
Unit-IV	**Heat Transfer by Conduction:** Modes of heat transfer,Fourier's law, steady state heat conduction: one plane wall of uniform thickness, composite wall in series, heat flow through cylinder and sphere, thermal insulation, critical radius of insulation. (6 Hrs)
Unit-V	**Heat transfer by Convection :** Free and forced convection, individual and overall heat transfer coefficient, fouling factor, log mean temperature difference, dimensional analysis, Sieder-Tate equation, Dietus-Boelter equation.

					(7 Hrs)
Unit-VI	**Heat transfer by Radiation:** Concept of a black body and grey body, laws of black body radiation (Kirchhoff's law, Stefan – Boltzmann law, Planck's Law, Wiens displacement law), concept of radiation shieldand its application. (5 Hrs)				
Textbooks / Reference Books	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1	Unit Operations of Chemical Engineering	McCabe, W. L, J. Smith and P. Harriot	McGraw-Hill International Edition	7th
	2	Fluid Mechanics: fundamentals and Applications	Yunus A Cengel , John M. Cimbala	McGraw-Hill	3rd
	3	A Textbook of Fluid Mechanics	R.K. Bansal	Laxmi Publications Pvt. Ltd	1st
	4	Heat Transfer	D. Q. Kern	McGraw Hill Co	1st
	5	Chemical Engineering Vol. I & II	Richardson & Coulson	McGraw Hill Co	6th
	6	Heat & Mass Transfer	R. K. Rajput	S. Chand	4th

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Faculty of Science & Technology
Syllabus of T. Y. B.Tech. Agricultural Engineering (Semester VI)

Course Code: AED391 Course: Open Elective-III- Fundamentals of Bioenergy Teaching Scheme: Theory: 3 Hrs./week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisite	Basic knowledge of bioenergy sources and biomass utilization
Objectives	1. Understand bioenergy technologies, processes, reactions and energy conversion rates for Anaerobic Digestion, gasification, pyrolysis (fast, intermediate and slow) and combustion 2. 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, basic biomass technology (resources and production) biomass production: wastelands, classification and their use through energy plantation, selection of species, methods of field preparation and transplanting. (6 Hrs)
Unit-II	**Bioethanol:** Biofuels: Introduction, ethanol production process, biodiesel production process, environmental benefits, bio-oil: pyrolysis or destructive distillation. (6 Hrs)
Unit-III	**Biogas:** Biogas: Introduction, process description, constituents of biogas, main features of biogas plant, classification & popular designs, applications, factors considered for selection of biogas plant, advantages, disadvantages. (6 Hrs)
Unit-IV	**Biodiesel:** Biodiesel production processes, biodiesel characterization, biodiesel feedstocks, environmental permitting and safety considerations for biodiesel production. (6 Hrs)
Unit-V	**Thermo Chemical Processes:** Basic concepts in gasification and pyrolysis, chemistry of gasification, gasification types – updraft gasifier, downdraft, cross draft, applications, and difference. (6 Hrs)

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Unit-VI	**Biomass utilization:** Biomass densification technique (briquetting, pelletization, and cubing), environmental aspect of bio-energy, waste to energy conversion. (6 Hrs)				
Textbooks / Reference Books	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1	Introduction to Bioenergy (Energy and the Environment)	Vaughn C. Nelson, Kenneth L. Starcher	CRC Press	1st
	2	Bioenergy: Biomass to Biofuels	Anju Dahiya	Elsevier Science	2nd
	3	Bioenergy: Principles and Applications	Yebo Li and Samir Kumar Khanal	Wiley	2nd

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Syllabus of T. Y. B. Tech. Civil Engineering (Semester VI)

Course Code:CED391 Course: Open Elective III – Solid Waste Management Teaching Scheme: Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisite	• Environmental Science
Objectives	To get introduced to the generation, collection and management of the various types of solid waste and different waste management techniques.
Unit-I	**Introduction to Solid Waste Management (SWM):** Need and Objectives, Waste ManagementHierarchy, Functional elements, Environmental impact of mismanagement. Solid waste: Sources, types, Composition, Quantities, Physical, chemical and biological properties. (06 Hrs)
Unit-II	**Generation of solid waste:** Factors affecting. Storage and collection:General considerations for waste storage at source, Types of collection Systems, Transfer station: Meaning, Necessity, transportation of solid waste: Means and Methods, Routing of vehicles. (06 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. (06 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. (06 Hrs)
Unit-V	**Disposal:** Landfills and its introduction, Definition, Essential components, Site selection, Land filling methods, Leachate analysis and landfill gas management, treatment & disposal, Determination of capacity of landfill disposal site.

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	(06 Hrs)				
Unit-VI	**Hazardous waste management (HWM):** Types of hazardous waste (such as nuclear, biomedical and industrial waste), problems and issues related to HWM, Need for HWM, 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 & stabilization of hazardous waste. (06 Hrs)				
Textbooks / Reference Books	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1	Integrated Solid Waste Management	Hilary Theisen and Samuel A, Vigil	McGraw-Hill, New York	1993
	2	CPHEEO, Manual on Municipal Solid waste management,	Central Public Health and Environmental Engineering Organization	Government of India	2000
	3	Environmental Resources Management, Hazardous waste Management	Michael D. LaGrega, Philip L Buckingham Jeffrey C. E vans	Mc-Graw Hill International edition	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	2nd

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FacultyofScience& Technology SyllabusofT.Y.B.Tech. ComputerScienceandEngineering(SemesterVI)	
Course Code: CSE391 Course: Open Elective-III – RHCSA (RedHat Certified System Administration) Teaching Scheme: Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs
Prerequisites	This course has prerequisites like previous system administration experience on other operating systems is beneficial. Fundamental knowledge of Operating System..
Objectives	1. Develop a strong understanding of the command-line interface (CLI) and become proficient in using essential command-line tools and utilities for system administration tasks. 2. Understanding fundamental system administration tasks, such as managing file systems, users, and groups. 3. Ability to Install, update, and remove software packages using package management tools and service management. 4. Ability to identify and resolve common system issues, perform system analysis, and troubleshoot problems related to hardware, software. 5. Ability to configure and troubleshoot network interfaces and handling system security. 6. Ability to manage storage devices and file systems and utilize containerization tools like Podman.
Unit-I	**Introduction to Red Hat Enterprise Linux (RHEL, File system and File Permissions** Overview of RHEL and its features. Installation and deployment of RHEL, File system hierarchy standard (FHS), Managing files and directories. (6 Hrs)
Unit-II	**User and Group Administration** Permissions and ownership User and group management, Password policies and authentication methods, User and group quotas user and group level security measures, such as password policies and file permissions, to maintain system integrity. (6 Hrs)

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Plastic & Polymer Engineering
MIT Aurangabad

Unit-III	**Package Management, System Initialization** Package installation, removal, and verification Managing software repositories, Dependency resolution and package querying, Boot process and run levels Managing services and daemons, Systemd and SysVinit. (7Hrs)
Unit-IV	**System Maintenance, Troubleshooting and System Recovery** System updates and patching, Kernel management, Managing log files and system monitoring, System troubleshooting methodologies, Rescue and recovery techniques, Boot loader configuration and troubleshooting. (7Hrs)
Unit-V	**Network Configuration** User and Group Administration Permissions and ownership User and group management, Password policies and authentication methods, User and group quotas user and group level security measures, such as password policies and file permissions, to maintain system integrity. (7Hrs)
Unit-VI	**Storage Administration & Run containers** Disk partitioning and formatting, Logical Volume Manager (LVM), File system creation and mounting, Deploy Container, Manage Container Storage and Network Resources, Manage Containers as System Services (7Hrs)

Textbooks / Reference Books

Sr. No.	Title	Author	Publication	Edition
1	LinuxSystem Programming	RobertLove	O'Reilly, SPD	10th
2	UNIXNetwork Programming	W.R.Stevens	McGraw-Hill	5th
3	LinuxCommand LineandShell ScriptingBible	Richard Blumand ChristineBres nahan	McGrawHill	6th
4	UNIXand LinuxSystem AdministrationHandb ook	Evi Nemeth, Garh Snyder, Trent R. Hein	Ben Whaley	3rd
5	RHCSA/RHCE RedHatLinuxCertific ationStudy Guide	RedHat StudentGuide	RedHat	9th

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Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester VI)

Course Code: CSE392 Course: Open Elective-III - Digital Marketing Teaching Scheme: Theory:3Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisites	• Basic Understanding of Digital Marketing
Objectives	1. To understand the basic concept of digital marketing 2. To understand the concept of search engine optimization. 3. Implement Social Media Optimization 4. Discuss the concept of google advertising
Unit-I	**Digital Marketing Introduction** Concept of Digital Marketing, Use of Digital Marketing, Digital Marketing Platform, Digital Marketing Strategy, Types of Digital Marketing – Organic & Paid, Digital Marketing VS Traditional Marketing. How is it different from traditional marketing, ROI between Digital and traditional Marketing. (7Hrs)
Unit-II	**Search Engine Optimization (SEO)** Introduction of SEO, Search Engine working, SEO Tools w eb position Analysis, Competition Analysis, Google Algorithms and Updates. (6 Hrs)
Unit-III	**Social Media Optimization (SMO)** Facebook - Profile Creations, Creating groups and pages, Tips and Guides, Posts And promotions, Events Creations, Video Marketing, Promotional Techniques, Integration Techniques. Twitter -Set-up and usage Tips, Promoted Tweets, Video Marketing, Promotional Techniques, Integration Techniques, Analytics. LinkedIn-Profile Creations, Company Page Creations, Tips and Guides, LinkedIn posts LinkedIn promotions LinkedIn Groups, Video Marketing, Promotional Techniques, Integration Techniques, Instagram -Integration Techniques, Promotional Techniques. (5Hrs)
Unit-IV	**Introduction to SEM** Google AdWords, Search Advertising, Display Advertising, Mobile Advertising, Video Advertising, Shopping Advertising, Report generation, Google AdWords Express, Setup, Google Mapping Ads. (6 Hrs)

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Unit-V	**E-Commerce Management** Maintenance of an online product-listing website through product keyword research, product pricing, positive reviews, and customer retention. (6 Hrs)
Unit-VI	**Email Marketing** How to create and send product-based emails in bulk, and ensure that all of the emails have a good open rate and conversion rate. (6 Hrs)

Textbooks/ Reference Books

Sr. No.	Title	Author	Publication	Edition
1.	Digital Marketing For Dummies	Ryan Deiss & Russ Henneberry	Tata McGraw Hill	6th
2.	Social Media Marketing All-in-one Dummies	Jan Immerman, DeborahNg	Prentice Hall	3rd
3.	Digital Marketing	Seema Gupta	Tata McGraw Hill	1st

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Syllabusof Third Year B. Tech Electronics and Computer Engineering(Semester-VI)

CourseCode: ECE391 Course: Open Elective-III - Data Science Teaching Scheme: Theory:3Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisites	• Programming Concepts, Data Structure, Basic Linear Algebra, Basic Probability and Statistics.
Objectives	1. Give an introduction to data science and its applications. 2. Understand use of statistics in data science 3. Use data science to analyze large and unstructured data with different tools
Unit-I	**Introduction to Data Science:** Overview of Data science and its terminologies, Applications of Data Science, Role of Data science in emerging technologies. Data types and Data sources, Data preprocessing techniques, Statistical concepts for Data Science. (6 Hrs)
Unit-II	**Machine Learning for Data Science:** Introduction to machine learning algorithms, Supervised learning: linear regression, logistic regression, decision trees, and random forests, Unsupervised learning: clustering algorithms, dimensionality reduction, Feature generation and selection using Machine learning. (6 Hrs)
Unit-III	**Data Visualization and Communication:** Principles of data visualization, Exploratory data analysis using visual techniques Tools and libraries for data visualization. Mining Social Networks: Social Networks graphs, clustering of graphs, direct discoveries of communities in graphs, analyze the portioning of graphs, the neighborhood properties of graphs. (6 Hrs)
Unit-IV	**Big Data Analytics and cloud computing for Data Science:** Introduction to big data and its challenges, Distributed computing frameworks: Hadoop and Spark, Big data processing and analysis. Cloud concept and computing for data science. (6 Hrs)

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Unit-V	**Programming Languages and libraries for Data Science:** Python for Data Science, Python libraries for data science. R programming language for Data science. Implementation examples in Python and R language. (6 Hrs)
Unit-VI	**Ethical Considerations in Data Science**: Privacy, security, and ethical considerations in data science, Bias, fairness, and interpretability in machine learning algorithms, Legal and regulatory aspects of data science. (6 Hrs)

Textbooks/ Reference Books

Sr.No.	Title	Author	Publication	Edition
1.	Python for Data Analysis	Wes McKinney	O'Reilly Media	2nd
2.	The Elements of Statistical Learning	Trevor Hastie, Robert Tibshirani, Jerome Friedman	Springer	2nd
3.	Data Science for Business	Foster Provost, Tom Fawcett	O'Reilly Media	1st
4.	Hands-On Machine Learning with Scikit-Learn and TensorFlow	Aurélien Géron	O'Reilly Media	2nd
5.	Doing Data Science:Straight Talk from The Frontline	Cathy O 'Neiland Rachel Schut	O'Reilly Media, Inc	3rd

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Syllabusof Third Year B. Tech Electronics and Computer Engineering(Semester-VI)

Course Code: ECE392 Course: Open Elective-III - Control Systems Teaching Scheme: Theory:3Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisites	• Linear algebra and calculus
Objectives	1. The objective of this course is to introduce students to the fundamental concepts and principles of control systems. 2. Students will develop an understanding of the analysis and design of control systems, including time-domain and frequency-domain techniques.
Unit-I	**Introduction to Control Systems** Definition and classification of control systems, Feedback and feedforward control, Open-loop System, closed-loop control and their examples. Distinguish between open and close system. Laplace transforms. (6 Hrs)
Unit-II	**Mathematical Modeling of Dynamic Systems** Differential equations and transfer functions, Advantages, Disadvantages and Properties of Transfer function, transfer function representation, Block diagrams and signal flow graphs, State-space representation. (6 Hrs)
Unit-III	**Time-Domain Analysis** Time response analysis, Step response analysis.Time constant and system behavior.Transient and steady-state response, Second-order system characteristics:Step response analysis. Natural frequency and damping ratio.Undamped, underdamped, critically damped, and overdamped systemsPerformance specifications: Rise time, settling time, peak time, and peak overshoot.Steady-state error and error constants.Introduction to error analysis. (6 Hrs)
Unit-IV	**Stability Analysis:** Definition of stability, Stability conditions based on the Routh array, Application of the Routh-Hurwitz criterion to analyze system stability.Nyquist stability criterion, Application of stability criteria to determine system stability. (6 Hrs)

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Unit-V	**Frequency-Domain Analysis:** Frequency response analysis, Relationship between time-domain and frequency-domain representations, Bode plots, Nyquist stability criterion, Stability margins, gain margin and phase margin. (6 Hrs)
Unit-VI	**Controller Design:** Sensors and actuators, Sampling and discrete-time control systems, Proportional-Integral-Derivative (PID) controllers, Frequency response design (lead, lag, and lead-lag compensation), Digital controllers and hardware implementation (6 Hrs)

Textbooks/ Reference Books

Sr.No.	Title	Author	Publication	Edition
1.	Modern Control Engineering	Katsuhiko Ogata	--	--
2.	Control Systems Engineering	Norman S. Nise	--	--
3.	Feedback Control of Dynamic Systems	Gene F. Franklin, J. David Powell, and Abbas Emami-Naeini	--	--
4.	Automatic Control Systems	Benjamin C. Kuo and Farid Golnaraghi	--	--

Chairman Board of Studies
Plastic & Polymer Engineering
MIT Aurangabad
(An Autonomous Institute)

Faculty of Science & Technology Syllabus of S. Y. B.Tech. (Electrical Engineering) (Semester VI)	
Course Code: EED391 Course Title:Open Elective-III: Special Purpose Electric Machines Teaching Scheme: Theory: 03 Hrs /week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs
Prerequisite	• Basic electrical Engineering, magnetic circuit, conventional electrical machines
Objectives	1. To understand different types of motors for particular application 2. To examine behaviour of machines for specific applications 3. To compare different machines 4. To develop knowledge in regards of control and use of machines
Unit-I	**Induction Generators** Construction, operating principle, types, operating characteristics, applications. (06 Hrs)
Unit-II	**Doubly fed induction Machines** Construction, operating principle, types, operating characteristics, Applications to grid connected wind and mini/micro hydel systems. (06 Hrs)
Unit-III	**Switched Reluctance Motor:** Construction, operating performance, control and applications. **Variable reluctance stepper motor:** Construction, operating performance, control and applications. (06 Hrs)
Unit-IV	**Linear Machines:** Linear Induction Machines and Linear Synchronous Machines: Construction, operation, performance, control and applications. (06 Hrs)
Unit-V	**BLDC Machine:** Construction, magnetic materials used, types of motors,control and applications. Recent developments in BLDC motors. (06 Hrs)
Unit-VI	**Permanent Magnet Machines:** Construction, magnetic materials used, types of motors e.g. PMDC and PM Synchronous Machine, control and applications. Recent developments in electrical machines. (06 Hrs)

Chairman Board of Studies
Plastic & Polymer Engineering

	Sr. No.	Title	Author	Publication	Edition
Textbooks/ Reference Books	1	Switched Reluctance motor drives'	R.Krishnan,	CRC press, 2001	1st
	2	Permanent magnet and Brushless DC motors'	T. Kenjo and S. Nagamori	Clarendon press. London, 1988	1st
	3	Special Electrical Machines	Simmi P Burman	S.K. Kataria& Sons	2nd
	4	Permanent Magnet Synchronous and Brushless DC Motor Drives	R. Krishnan.	New Delhi, Prentice, Hall of India, 2009	2nd
	5	Special Electrical Machines	Venkataratnam	Taylor and Francis, 2009	1st

Chairman Board of Studies
Plastic & Polymer Engineering
MIT Aurangabad
(An Autonomous Institute)

Faculty of Science & Technology Syllabus of T. Y. B. Tech. Artificial Intelligence and Data Science (Semester VI)	
Course Code: AID391 Course: Business Intelligence Teaching Scheme: Theory: 03 Hrs/week	Credits: 3-0-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15 Marks Continuous In-semester Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Prerequisites	None
Objectives	1. Student should learn fundamental concepts of Business Intelligence. 2. To learn analytics framework to support decision making in business intelligence.
Unit-I	**Understanding Business Intelligence** The Challenge of Decision Making, What Is Business Intelligence?, The Business Intelligence Value Proposition, The Combination of Business and Technology (6 Hrs)
Unit-II	**Business Intelligence Technology Counterparts** Data Warehousing: What Is a Data Warehouse?, Data Marts and Analytical Data, Organization of the Data Warehouse Enterprise Resource Planning: Distributing the Enterprise, First ERP, then Business Intelligence, The Current State of Affairs Customer Relationship Management: CRM, ERP, and Business Intelligence Customer Decisions, Decisions About Customers, Business Intelligence and Financial Information (6 Hrs)
Unit-III	**The Spectrum of Business Intelligence** Enterprise and Departmental Business Intelligence, Strategic and Tactical Business Intelligence, Power and Usability in Business Intelligence, Finding the Right Spot on the Continuum, Business Intelligence: Art or Science? (6 Hrs)

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Plastic & Polymer Engineering
MIT Aurangabad
(An Autonomous Institute)

Unit-IV	**Business Intelligence User Interfaces** Querying and Reporting, Reporting and Querying Toolkits, Basic Approaches: Building Ad-Hoc Queries, Building On-Demand Self-Service Reports, Enhancing and Modifying, Data Access: Pull-Oriented Data Access, Push-Oriented Data Access, Dashboards: EIS Is the Engine, Metric System and KPIs, Business Intelligence Dashboards (6 Hrs)
Unit-V	**On-Line Analytical Processing (OLAP)** OLAP: OLAP and OLTP, Operational Data Stores, Variations in Data and Approach, OLAP Applications and Functionality, Multi-Dimensions: Thinking in More Than Two Dimensions, What Are the Possibilities?, Drilling and Pivoting, OLAP Architecture: Cubism, Tools, ROLAP, MOLAP, HOLAP, Data Mining (6 Hrs)
Unit-VI	**Visualization, Guided Analysis and** Visualization: The Basics, Unconstrained Views, Guided Analysis: The Business Intelligence Two-Step, How to Guide the Guides, Handling Unstructured Data (6 Hrs)

Textbooks / Reference Books

Sr. No.	Title	Author	Publication	Edition
1	Decision Support and Business Intelligence Systems	Efraim Turban, Ramesh Sharda, Jay Aronson, David King	Pearson Education, 2009.	9th
2	The Savy Manager's Guide Getting Onboard with Emerging IT,	David Loshin, Business Intelligence	Morgan Kaufmann Publishers.	2009

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Plastic & Polymer Engineering
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Faculty of Science & Technology
Syllabus of T. Y. B. Tech. Mechanical Engineering (SemesterVI)

Course Code: MED391 Course: Open Elective III: Industry 4.0 Teaching Scheme: Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Objectives	1. To make students aware of the structure and role of Industry 4.0, in current evolving industrial environment. 2. To give learners overview of Industry 4.0 technologies and their integration.
Unit I	**Introduction** Four industrial revolutions, Digital transformation of Industry and the fourth industrial revolution, Scope of Industry 4.0, Automation pyramid and Industry 4.0, Principles of Industry 4.0. (6 Hrs)
Unit II	**Internet of Things (IoT)** Concept of IoT, IoT Architecture – Sensing layer, Network layer, Data processing layer, Application layer, Applications of IoT – for automobiles, homes, etc. Internet of Service (IoS), Internet of Energy (IoE). (6 Hrs)
Unit III	**Technologies in Industry 4.0 (1)** Augmented reality and Virtual Reality, 3D Printing, Collaborative robots, Smart material handling, Smart sensors, Concept of smart products. (6 Hrs)
Unit IV	**Technologies in Industry 4.0 (2)** Machine learning, Introduction to Cyber Physical Systems (CPS), Components of Cyber Physical Systems, Digital twins, Machine vision, Smart factory, Artificial intelligence. (6 Hrs)
Unit V	**Data in Industry 4.0** Big Data, Data Mining, Data Analytics, Cloud computing, Data – anew resource of organization, Data analysis for optimal decision making, Digitalization of the entire value chain. (6 Hrs)
Unit VI	**Applications of Industry 4.0** Industry 4.0 in Manufacturing – Predictive maintenance, Real-time supply-chain optimization, Digital performance management, Smart energy consumption, Challenges in implementing Industry 4.0.

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					(6 Hrs)
Textbook/ Reference Books	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1	Industry 4.0 - the Industrial Internet of Things	Industry 4.0_ the Industrial Internet of Things	Industry 4.0_ the Industrial Internet of Things	-
	2	Industry 4.0- Managing The Digital Transformation	Alp Ustundag, Emre Cevikcan	Springer	1st
	3	Automated Manufacturing System	Hugh Jack	Lulu.com	7th
	4	Industry 4.0- Opportunities Behind The Challenge	Dr. Mirjana Stankovic, Ravi Gupta and Dr. Juan E. Figueroa	UNIDO General Conference 2017	-
	5	Handbook of Ind. Automation	Richard L. Shell Ernest L. Hall	CRC Press	1st

Chairman Board of Studies
Plastic & Polymer Engineering
MIT Aurangabad
(An Autonomous Institute)

Faculty of Science & Technology Syllabus of T. Y. B. Tech. Mechanical Engineering (SemesterVI)	
Course Code: MED392 Course: OE-III: Operations Research Teaching Scheme: Theory: 03 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continues Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration):2 Hrs
Prerequisites	• None
Objectives	1. To familiarize the students with formal quantitative approach to problem solving 2. To formulate real life engineering problems 3. To solve engineering problems using various operations research techniques
Unit-I	**Introduction to Operations Research :** Basics definition, scope, objectives, phases, models, applicationsand 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. (08 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. (08 Hrs)
Unit-IV	**Assignment Problem:** Hungarian method to solve assignment problem, travelling salesman as an extension of assignment problem. (04 Hrs)
Unit-V	**Queuing modeland Sequencing model :** Queuing systems and structures, notation parameters, single server and multi server models, poisson input, exponential service, constant rate service, infinite populationsequencing model: introduction, n jobs through two machines, n jobs through three machines, two jobs through m machines

	and n jobs through m machines. (06 Hrs)
Unit-VI	**Network Models:** Fulkerson's rule, concept and types of floats, float calculations, CPM and PERT, crashing cost and crashing network. (08 Hrs)

Text Book/ Reference Books

Sr. No.	Title	Author	Publication	Edition
1.	Operations Research	Taha H.A.	Prentice Hall of India.	9th
2	Introduction to Operations Research	Frederick S. Hillier and Gerald J. Lieberman	Tata McGraw-Hill	7th
3	Operations Research	P.K. Gupta, D.S Hira	S. Chand & Co.	4th
4	Operations Research	Man Mohan, P. K. Gupta, Kanti Swarup	S. Chand & Co.	12th
5	Operations Research Principles and Practice	Ravindran, Phillips and Solberg	Mc. WSE Willey	2nd
6	Operations Research: Applications and Algorithms	Wayne L. Winston, Jeffrey B. Goldberg	Thomson Brooks	4th
7	Operations Research: Theory, Methods and Applications	S. D. Sharma, Himanshu Sharma	Kedar Nath Ram Nath	4th
8	PERT and CPM: Principles and Applications	L. S. Srinath	East-West Press Private Limited,	3rd
9	Project Planning and Control with PERT & CPM	Dr. B.C. Punmia & K. K. Khandelwal	Firewall Media	4th

Chairman Board of Studies
Plastic & Polymer Engineering

Faculty of Science & Technology
Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester VI)

Course Code: PPE391 Course: Open Elective III: Waste Management and Circular Economy Teaching Scheme: Theory: 03hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisite	• Plastic materials, processing, rheology, basics of polymer technology and designing
Objectives	1. It aims to provide students with a comprehensive understanding of sustainable practices and the principles of the circular economy within the context of polymer engineering. 2. Students will explore various strategies, technologies, and policies for achieving sustainability, reducing environmental impact, and promoting circularity in the polymer industry. 3. The course will emphasize the importance of integrating sustainable principles in the design, production, and disposal of polymer materials.
Unit-I	**Introduction to Waste Management and Circular Economy** Definition and significance of sustainability in polymers, basics of waste management, principles and goals of the circular economy, environmental, social, and economic dimensions of waste management, life cycle thinking and assessment in plastics (04 Hrs)
Unit-II	**Waste generation, composition, and management** Sources and types of plastic and polymer waste, composition analysis and characterization of waste, quantification and assessment of waste generation, waste management and treatment methods: MSWM processing and plastics waste management comprising of waste hierarchy i.e., prevention, minimization, reuse, recycling, energy recovery, and disposal. (08 Hrs)
Unit-III	**Sustainable Polymer Processing** Energy-efficient processing techniques, clean and green manufacturing practices, waste reduction and recycling in polymer processing, sustainable additives and processing aids (06 Hrs)
Unit-IV	**Sustainable Waste Management and Disposal** Waste characterization and classification in polymers, mechanical recycling, waste-to-energy conversion technologies, biological treatment methods for

	polymer waste, hazardous waste management and regulations, sustainable landfilling and waste disposal practices (06 Hrs)
Unit-V	**Circular Economy Strategies** Design for recycling and upcycling principles, closed-loop supply chains and reverse logistics, extended producer responsibility and product stewardship, circular economy business models and initiatives, case studies on successful implementation of circular economy strategies (06 Hrs)
Unit-VI	**Policy and Regulatory Framework for Sustainability** International and national policies promoting sustainability in polymers, Environmental regulations and standards for the polymer industry, corporate social responsibility and sustainability reporting, challenges, and opportunities in implementing sustainable practices, future trends and emerging technologies in sustainable polymer engineering (06 Hrs)

Textbooks / Reference Books

Sr. No.	Title	Author	Publication	Edition
1.	Waste Management and the Circular Economy in Selected OECD Countries	OECD	OECD Publishing	1st
2.	Plastics and Sustainability: Towards a Peaceful Coexistence between Bio-based and Fossil Fuel-based Plastics	Michael Tolinski	Wiley	1st
3.	Plastics and Sustainability: Towards a Deeper Understanding of the Environmental Role of Plastics in Today's World	Conor P Carlin	Wiley-Scrivener	1st
4.	Strategic Management for the Plastics Industry: Dealing with Globalization and Sustainability	Jones, Roger F.	CRC Press	1st

Chairman Board of Studies

	5.	Plastics in the Circular Economy	Vincent Voet, Jager, Rudy and Folkersma	De Gruyter	1st
	6.	A Practical Guide to Plastics Sustainability: Concept, Solutions, and Implementation	Michel Biron	William Andrew Publishers	1st
	7.	Circular Economy and Waste Valorisation: Theory and Practice from an International Perspective	Jingzheng Ren, Long Zhang	Springer	1st

Chairman Board of Studies
Plastic & Polymer Engineering
MIT Aurangabad
(An Autonomous Institute)

Maharashtra Institute of Technology, Aurangabad
(An Autonomous Institute)

Faculty of Science & Technology
Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester VI)

Course Code: PPE 371 Course: Lab-I:Polymer Processing Technology Teaching Scheme: Practical: 02 Hrs/week	Credits: 0-0-1 Teacher's Assessment: 25 marks
Objective	• Practical exposure of working of polymer processing machines.
List of practicals	**Any 8 practicals to be conducted** 1. To set up the reciprocating screw type injection moulding machine for processing. 2. To produce an article from reciprocating screw type injection moulding machine. 3. To troubleshoot an injection molding product defect along with estimation of the product cost. 4. To perform extrusion compounding and/or extrusion recycling of a thermoplastic material. 5. To perform compression molding of thermoplastic/thermoset material. 6. To perform rotational molding for thermoplastic material. 7. To perform blow molding of a bottle. 8. To study the construction and working of thermoforming process. 9. To study the construction and working of calendaring process. 10. To study the construction and working of hand injection molding machine.

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.

Chairman Board of Studies
Plastic & Polymer Engineering

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(An Autonomous Institute)

Faculty of Science & Technology Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester VI)	
Course Code: PPE 372 Course: Lab-II: Fluid Mechanics and Heat Transfer Teaching Scheme: Practical: 02 Hrs/week	Credits: 0-0-1 Teacher's Assessment: 25 marks
Objective	• To study/demonstrate conceptual understanding of Fluid Mechanics and Heat transfer practically.
List of practicals	**Any 8 practicals to be conducted** 1. To determine the nature of flow (laminar or turbulent) by using Reynold's experiment. 2. To verify Bernoulli's Equation. 3. To determine the coefficient of discharge of the Orifice meter. 4. To determine the coefficient of discharge of the Venturi Meter. 5. Study of different types of valves and pipe fittings. 6. To determine thermal conductivity of insulating powder. 7. To determine thermal resistances of a composite wall. 8. To determine heat transfer coefficient by natural convection. 9. To determine heat transfer coefficient by forced convection. 10. To determine Stefan Boltzmann constant in Radiation.

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.

Chairman Board of Studies
Plastic & Polymer Engineering
MIT Aurangabad
(An Autonomous Institute)

Faculty of Science & Technology
Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester VI)

Course Code: PPE 373 Course: Lab-III: 3D Printing Technology Teaching Scheme: Practical: 02 Hrs/week	Credits: 0-0-1 ESE/Oral: 25 marks
Objective	• Students will be able to understand Basic concept of 3D printing. • Students will be able to understand Basics knowledge of 3D modelling.
List of practicals	**Any 8 practicals to be conducted** 1. 3D Modelling of a single component and creating.stl file from 3D File. 2. To design a Basic Hex Nut and perform slicing operation. 3. To study basic parts of Fused Deposition Modeling 3D Printer. 4. To study different materials available for Fused Deposition Modelling. 5. To practice on position of articles on printer bed (bed leveling) using moving trial. 6. To study effect of variation of printing speed, temperature, and layer thickness on 3D printed product. 7. Post processing inspection analysis of 3D printed product. 8. Identification of defects and errors during 3D printing process. 9. Compare the 3D printed products with conventionally manufactured product. 10. To study the costing of 3D printed product.

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.

Chairman Board of Studies
Plastic & Polymer Engineering
MIT Aurangabad
(An Autonomous Institute)

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Maharashtra Institute of Technology, Aurangabad
(An Autonomous Institute)

Faculty of Science & Technology
Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester VI)

Course Code: PPE 374 Course: Lab-IV: Materials Synthesis and Testing Teaching Scheme: Practical: 02 Hrs/week	Credits: 0-0-1 ESE/Oral: 25 marks
Objective	• To understand synthesis, processing, characterization and properties of materials. • To enable students to design and conduct materials synthesis experiments, analyze and interpret the data. • Understand the structure-property relationship in materials.
List of practicals	**Any 8 practicals to be conducted** 1. Synthesis of Polyurethane Foams. 2. Synthesis of nanomaterial using Ultrasonicator. 3. Synthesis of Polysulfide rubber. 4. To synthesize a copolymer using Autoclave Reactor. 5. To determine the molecular weight of polymer by end group analysis. 6. Determination of K-value of PVC. 7. Determination of the Particle size of the given material by DLS. 8. Determination of the Zeta potential of the given material by Nano-ZS Zetasizer. 9. To determine the kinematic viscosity of a polymer by Brookfield Viscometer.

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.

Chairman Board of Studies
Plastic & Polymer Engineering
MIT Aurangabad
(An Autonomous Institute)

Faculty of Science & Technology Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester VI)	
Course Code: PPE375 Course: Lab-V: Major Project-I Teaching Scheme: Practical: 04 Hrs/week	Credits: 0-0-2 Teacher's Assessment: 25 marks ESE/Oral: 25 marks
Objectives	• Solve a real-life societal problem through research based approaches.
Course Outcome	Upon the completion of this course the students will be expected to: 1. Formulate an analytical model for an engineering problem and obtain its solution with necessary tools. 2. Perform and manage as an individual or as a member of a team with ethical values. 3. Examine the concepts of environment and sustainability 4. Write effective reports and communicate effectively on civil engineering problems. 5. Present the conclusions in a way to benefit the society.
Instructions to Students	Solving a real-life problem should be the focus of under graduate projects. Faculty members should prepare project briefs (giving scope and references) well in advance which should be made available to the students at the departmental level. The project may be classified as hardware / software / modelling / simulation. It may comprise any elements such as analysis, design, synthesis, validation etc. Interdisciplinary/Multidisciplinary projects are encouraged.
Guidelines	The department will appoint a project coordinator who will coordinate the following. 1. Grouping of students (a maximum of 3/4 in a group) 2. Allotment of projects and project guides 3. Project monitoring at regular intervals . All project allotments are to be completed as given in the Academic Calendar. All projects will be monitored at least twice in a semester through students' presentation and will be conducted as per Academic Calendar. Distribution of marks for TA shall be as follows: • Problem Statement 10; • Literature Review 10; • Group formation and identification of individual responsibility 10; • Objective of Project activity 10; • Knowledge of domain, technology and tools being used 10 **For TA 50 Marks to be converted to 25 Marks.**

Chairman Board of Studies
Plastic & Polymer Engineering

Distribution of marks for ESE/Oral shall be as follows:

- Realization of project as per problem statement 10;
- Design & Testing 30;
- Documentation and Report Writing 20;
- Quality of Work 15;
- Performance in Question & Answers Session 15;
- Timely Completion of Project work 10

For ESE/Oral – 100 Marks to be converted to 25 Marks.

- Efforts be made to carry out industry based/ Societal Projects. Problems can also be invited from the industries/Society to be worked out through undergraduate projects.
- In case of Interdisciplinary/Multidisciplinary Projects, as per the requirements, a greater number of Guides may be appointed. A Joint committee of involved departments shall conduct the review of the students.
- The students shall aim to promote their project work in project exhibitions/competitions, paper presentation/publication in reputed journals and conferences.
- The relevance of project and implementation including details of attainment of POs and PSOs addressed through the projects with justification must be clearly stated.

Phases of Major Project - I:

- Phase I: Need Statement, Literature Review, data collection, Problem Statement, Objectives,Scope, Analysis/Framework/ Algorithm
- Phase II: Details of Hardware & Software, Methodology, and Implementation plan for next semester.
- Phase III: Submission of report of project work.

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Plastic & Polymer Engineering
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