FACULTY OF ENGINEERING AND TECHNOLOGY
Proposed Revised Structure for 2013-14
[Third Year –Plastics and Polymer Engineering]

Sub No.	SEMESTER-V	Contact Hrs / Week				Examination Scheme						
	Subject	L	T	P	Total	CT	TH	TA	P	Total	Credits	Duratio of Theo /practic Exam
PPE301	Polymer Rheology & Marphology	3	1	-	4	20	80	-	-	100	4	3 Hrs
PPE302	Thermosetting Resins	3	1	-	4	20	80	-	-	100	4	3 Hrs
PPE303	Heat Transfer	3	1	-	4	20	80	-	-	100	4	3 Hrs
PPE304	Elastomer Technology	4	-	-	4	20	80	-	-	100	4	3 Hrs
PPE305	Economics & Management	4	-	-	4	20	80	-	-	100	4	3 Hrs
PPE306	Instrumentation & Process Control	2	-	-	2	10	40	-	-	50	2	2 Hrs
PPE321	Lab-I: Polymer Synthesis	-	-	4	4	-	-	50	50	100	2	MAX 50, MIN 25
PPE322	Lab-II: Elastomer Technology	-	-	2	2	-	-	25	25	50	1	25, 13
PPE323	Lab-III: Heat Transfer	-	-	2	2	-	-	25	25	50	1	25, 13
PPE324	Lab-IV: Seminar			2	2			50		50	1	50, 26
	Total of semester-V	19	3	10	32	110	440	150	100	800	27	

Sub No.	SEMESTER-VI	Contact Hrs / Week				Examination Scheme						
	Subject	L	T	P	Total	CT	TH	TA	P	Total	Credits	Duration of Theor /practica Exam
PPE351	Polymer Processing Technology	3	1	-	4	20	80	-	-	100	4	3 Hrs
PPE352	Polymer Reaction Engineering	3	1	-	4	20	80	-	-	100	4	3 Hrs
PPE353	Mass Transfer	3	1	-	4	20	80	-	-	100	4	3 Hrs
PPE354	Polymer Recycling & Waste Management	4	-	-	4	20	80	-	-	100	4	3 Hrs
PPE391 -393	Elective I	4	-	-	4	20	80	-	-	100	4	3 Hrs
PPE355	Specialty Polymers	2	-	-	2	10	40	-	-	50	2	2 Hrs
PPE371	Lab-V: Polymer Processing Technology	-	-	2	2	-	-	25 13	25	50	1	Mo -
PPE372	Lab-VI: Polymer Reaction Engineering	-	-	2	2	-	-	25 13	25	50	1	-
PPE373	Lab-VII: Mass Transfer	-	-	2	2	-	-	25 13	25	50	1	-
PPE374	Lab-VIII: Design Lab II	-	-	2	2	-	-	50 26	-	50	1	-
PPE375	Lab-IX: Project-I	-	-	2	2	-	-	50 26	-	50	1	-
	Total of semester-VI	19	3	10	32	110	440	175	75	800	27	
	Grand Total of V & VI	38	6	20	64	220	880	325	175	1600	54	

Elective I

1. PPE391 Biopolymers
2. PPE392 Plastics Packaging Technology
3. PPE393 Surface coating

L: Lecture hours per week T: Tutorial hours per week P: Practical hours per week CT: Class Test
TH: University Theory Examination TW: Teachers Assessment PR: Practical/Oral Examination

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad

(Faculty of Engineering & Technology)

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

Code No: PPE301	**Title: Polymer Rheology & Morphology**
Teaching Scheme: 04Hrs/week	**Class Test (Marks): 20**
Theory: 03Hrs/week	**Theory Examination (Duration): 03 Hrs**
Tutorial: 01Hr/week	**Theory Examination (Marks): 80**
Credits:04	

Objectives : To study Rheology and Morphology of polymers.

Unit-I **: Introduction to polymer rheology**

Stress & strain ideal, elastic solid, Newtonian and non-Newtonian Fluids, free volume and molecular hole concept and their theories, relation between viscosity and molecular weight distribution, weissenberg effect. **[10Hours]**

Unit-II **: Viscoelastic behavior**

Mechanical models of viscoelastic material, Maxwell model cveep and relaxation, Voigt-Kelvin model, viscoelastic retardation and time, Power law, fracture, die swell. **[10Hours]**

Unit-III **: Factors affecting shear flow**

Introduction, effect temperature, pressure shear history. Viscosity change during extrusion Effect of molecular structure on viscous flow. **[10Hours]**

Unit-IV **: Transition phenomena**

Melting point 1st order transition, Glass transition temperature, measurement of glass transition temperature. Melt fracture and irregular flow, Mechanism of elastic turbulence and pulsing flow. **[7Hours]**

Unit-V **: Measurement of rheological properties classification**

Capillary rheometer, melt flow indexer, cone and plate viscometer, brook field viscometer, torque rheometer, application of torque rheometer to judge the processability of polymer, application of rheology in injection, extrusion, blow moulding, Mooney viscometer, cure meter, rheooptical method, birefvingence. **[12Hours]**

Unit-VI **: Polymer Morphology**

Introduction, Development of crystallinity, Crystalline, Amorphous and oriented states of polymer, Crystallisation of rubber and mechanism of crystallisation, Stress induced crystallisation, Melting of rubber. Polymer single crystal and structure of bulk polymer.

[11Hours]

Reference Books:	Sr. No.	Title	Author	Publication	Edition
	1	Flow properties of polymer melt	Brydson.J.George	George Goodwin Ltd., London	1st Edition, 1981
	2	Polymer melt rheology	Cogswell.F.N	Woodhead Publishing Limited	1st Edition, 1981
	3	The flow of high polymer	Middleman.S	Wiley Interscience, New York	1st Edition, 1968
	4	Rheometry	Walters.K	Chapman and Hall ,London	1st Edition, 1975

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

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

For 80 marks Paper:
1. Minimum ten questions
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

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Syllabus of T. Y. B. Tech. (PPE) Semester-V

Code No: PPE302	**Title: Thermosetting Resins**
Teaching Scheme: 04Hrs/week	**Class Test (Marks): 20**
Theory: 03Hrs/week	**Theory Examination (Duration): 03 Hrs**
Tutorial: 01Hr/week	**Theory Examination (Marks): 80**
Credits:04	

Objectives	**:**	To impart the knowledge of different thermosetting resins considering the structure property relationship for polymer engineers to enable them to select proper material for specific end use.
Unit-I	**:**	**Phenolic Resins** Raw materials, Novolac and Resol, Hardening, Commercial production of phenolics, phenolic molding powders, Processing characteristics, Properties and applications of phenolics. **[8Hours]**
Unit-II	**:**	**Amino Resins** **a) Urea formaldehyde (UF):** Raw materials, resinification, UF molding materials, processing , adhesives, structure, properties & applications. **b) Melamine formaldehyde (MF):** Raw materials, resinification, molding powders, structure, properties & applications. **[12Hours]**
Unit-III	**:**	**Polyesters** **Unsaturated polyester:** Raw materials, resinification, curing system, structure & properties, polyester moulding compositions, Film and fiber forming polyester. Polyethylene terephthalate (PET) and Polybutylene terephthalate (PBT). **[10Hours]**
Unit-IV	**:**	**Epoxide resins** Raw materials, preparation, curing systems, structure-properties and applications, miscellaneous epoxide resins, different, additives for epoxies. **[8Hours]**
Unit-V	**:**	**Polyurethanes** Introduction, raw materials, preparation, properties, processing and applications of PU Rubber and PU foam. **[10Hours]**
Unit-VI	**:**	**a) Silicones** Preparation, properties and applications of Silicon Resin Preparation, properties and applications of Silicon Fluid **b) Furan Resin** Raw materials, Resinification, properties, applications. **[12Hours]**

Reference Books	:	Sr. No.	Title	Author	Publication	Edition
		1	Handbook of Plastics Materials and Technology	I. Rubin	Wiley-Interscience	First Edition, 1990
		2	Plastics Materials	J.A.Brydson	Butterworth Heinemann	Seventh Edition, 1999
		3	Plastics Materials Handbook	A. S. Athalye	Multi Tech Publishing	First Edition, 1995
		4	Textbook of Polymer Science	Fred Bilmeyer	John Wiley & Sons	Third Edition, 1984

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

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

For 80 marks Paper:
1. Minimum ten questions
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

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

Code No: PPE303	**Title: Heat Transfer**
Teaching Scheme: 04Hrs/week	**Class Test (Marks): 20**
Theory: 03Hrs/week	**Theory Examination (Duration): 03 Hrs**
Tutorial: 01Hr/week	**Theory Examination (Marks): 80**
Credits:04	

Objectives	:	This course is designed to provide a basic overall understanding of heat transfer, laws of heat transfer; their applications and the equipments used for heat transfer.
Unit-I	:	Introduction, modes of heat transfer, Conduction, Steady state conduction in one dimension, Fourier's law, heat transfer through plane, cylindrical and spherical walls, compound resistances in series, thermal insulation, critical and economic thickness **[10Hours]**
Unit-II	:	Convection,Film concept individual and overall coefficients and factors affecting them. Natural and forced convection. Dimensional analysis applied to heat transfer, Seidar Tate equation and Dittus- Boelter equation. **[10Hours]**
Unit-III	:	Heat exchange equipments, Heat transfer by parallel and counter current flow, log mean temperature difference, rate of heat ,double pipe heat exchanger, shell and tube heat exchanger, fouling factors, concept of transfer units in heat exchanger, NTU concept. **[10Hours]**
Unit-IV	:	Boiling and condensation, Theory of boiling, classification, heat transfer by drop wise and film wise condensation in horizontal and vertical tube. **[10Hours]**
Unit-V	:	Evaporation, Types of evaporator, Capacity, Economy of evaporator, Single and multiple effect evaporators **[10Hours]**
Unit-VI	:	Radiation, Concept of black body& grey body, laws of radiation, black and gray body radiation, Heat exchange by radiation between two black surface elements, radiation shape factor, Radiation shields. **[10Hours]**

Reference Books:

Sr. No.	**Title**	**Author**	**Publication**	**Edition**
1	Heat Transfer	D.Q.Kern	McGraw Hill Co.	1St Edition, 2000
2	Heat Transfer	J.P.Holman	McGraw Hill Co	8th Edition, 2006
3	Heat Transfer: A Practical Approach	Yunus A.Cengel	McGraw Hill Co	3rd Edition, 2007

		4	Chemical Engineering Volume I & II	Richardson & Coulson	Butterworth-Heinemann	3rd Edition, 2005
		5	Unit Operations of Chemical Engineering	McCabe & Smith	McGraw Hill Co	6th Edition, 2007
		6	Heat Transfer	S.P.Sukhatme	Universities Press	4th Edition, 2006
		7	Heat & Mass Transfer	R.K.Rajput	S.Channd	4th Edition, 2001

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

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

For 80 marks Paper:
1. Minimum ten questions
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

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

Code No: PPE304	**Title: Elastomer Technology**
Teaching Scheme: 04Hrs/week	**Class Test (Marks): 20**
Theory: 04Hrs/week	**Theory Examination (Duration): 03 Hrs**
Tutorial: ----	**Theory Examination (Marks): 80**
Credits:04	

Objectives	:	This course is designed to provide a basic overall understanding of natural rubber and synthetic rubbers, rubber compounding, rubber processing technology and vulcanization technology.
Unit-I	:	**Natural Rubber** Introduction to Rubbery materials, Type of rubbers- Diene and non-Diene rubber. Natural Rubber(NR)—Importance as Raw Material,uniqueness of NR, Plantation, Taping of NR latex, Factors affecting Tapping Efficiency, Stabilization and Coagulation of latex, Chemical nature of natural rubber hydrocarbon, Ageing of NR, Derivatives of NR, Possibilities of Blending of NR with Synthetic Rubbers(SR), Study the processing of NR latex into dry marketable forms (RSS, Grading of Rubber) **[10Hours]**
Unit-II	:	**General characteristics of Elastomers-I** Brief history of NR& SR, Classify SR with reference to their applications. Structure, production, properties (raw and vulcanisate), curing systems, compounding, processing, grades, trade names and application of general purpose synthetic rubbers like Styrene butadiene rubbers (SBR),Poly butadiene rubber (BR), Isoprene rubber(IR),Butyl (IIR),EPDM **[10Hours]**
Unit-III	:	**General characteristics of Elastomers-II** Structure, production, properties (raw and vulcanisate), curing systems, compounding, processing, grades, trade names and application of general purpose synthetic rubbers like NBR, CR, CSM, Polysulphide Rubber **[10Hours]**
Unit-IV	:	**Compounding and Vulcanisation** Compounding and its objective, General recipe for product manufacturing,Different types of compounding ingredients & role of them in rubber compounding, Base polymer and its function in a, Mastication, Mixing techniques - internal mixer, two roll mill. Vulcanization by Sulphur(conventional, efficient & semi-efficient System), Peroxide, metaloxide and other special curing methods, Chemical reactions, factors affecting vulcanization rate, Numericals on sulphur vulcanization **[10Hours]**

Unit-V	**:**	**Processibility & vulcanization test -** Processibility test - Plasticity test (compression plastometer,Mooney viscometer), Extrusion test(Rheometrics-Online-Rheometer,die swell tester, Monsanto processibility tester), Relaxation testing(Dynamic stress relaxometer, stress relaxation processibility tester), Scroth test, Mixing test. Vulcanization test -Step-cure method, Continuous method **[10Hours]**
Unit-VI	**:**	**Thermoplastic Elastomers** - Structure, Manufacture, Morphology, Effects of molecular weight on properties, Compounding, commercial grades and Applications of - Polystyrene/elastomer, Polyester, Polyurethane, Polyamide block copolymers, PP/EP copolymer blend **Rubber Elasticity** Physics of raw and vulcanized rubber, kinetic theory of rubber elasticity, Strain relationship. **[10Hours]**
Reference Books:		

Sr. No.	Title	Author	Publication	Edition
1.	Handbook of elastomers	Anil K Bhowmick Marcel Dekker and Howard L Inc Stephens		1st Edition, 2000
2.	An Introduction to Rubber Technology	Ciesielski, A	Rapra Techonology Limited, UK	1st Edition, 1999
3.	The Science and Technology of Rubber	James E. Mark, Burak Erman	Academic Press	3rd Edition, 2011
4.	Rubber Curing Systems	R.N. Datta, B.V. Rapra Flexsys	Techonology Limited, UK	1st Edition, 2001
5.	The Physicas of Rubber Elasticity	L.G.Treolar	Oxford University Press	1st Edition, 2005
6.	Physical Testing of Rubber	Roger Brown	Springer-Verlag New York Inc	1st Edition, 2000
7.	Handbook of Specialty Elastomers	Robert C. Klingender	CRC Press Inc	1st Edition, 2008
8.	The Mixing of Rubber	R.F. Grossman	Chapman and Hall	1st Edition, 1997
9	Rubber Technology and Manufacture	Blow C.M	Butterworth, London	2nd Edition, 1982

		10.	Rubber Technology Handbook	Dr. Warner Hoffmen	Hanser Publication, NY	1st Edition, 1996
		11.	Rubber Technology	Morton,M	N.Y. Vannostrand Reinhold Company	2nd Edition, 1973
		12.	Polymer Physics	Rubinstein,M,Colby R.H.	Oxford University press	1st Edition, 2003

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

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

For 80 marks Paper:
1. Minimum ten questions
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

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(Faculty of Engineering & Technology)

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

Code No: PPE305	**Title: Economics & Management**
Teaching Scheme: 04Hrs/week	**Class Test (Marks): 20**
Theory: 04Hrs/week	**Theory Examination (Duration): 03 Hrs**
Tutorial: ----	**Theory Examination (Marks): 80**
Credits:04	

Objectives	:	To study various aspects of economics and management needed for engineers..
Unit-I	:	Nature and Scope of Economics: Definition and scope of study of the subject, Significance of economic analysis in business decisions, Definition of management, function of management, different forms of organization, different organization structure, Demand and Supply analysis, Determinants of demand, Law of demand, Elasticity of demand, demand forecasting, Law of supply, Elasticity of supply, Market price. **[10Hours]**
Unit-II	:	Cost Analysis: - Fixed cost, Variable cost, Marginal cost, Cost output relationship in the short run and the long run , Equilibrium of the firm, Pricing decisions , Situation demand ,pricing in practice , full cost pricing , marginal cost pricing , bid pricing , pricing for a rate of return, statutory price fixation in India. **[10Hours]**
Unit-III	:	Break-even analysis: Breakeven point , basic assumptions , breakeven chart ,Managerial uses of break even analysis, Capital Budgeting, Need of capital budgeting , Method of appraising project profitability ,Rate of return , Payback period , Present value comparison , Cost benefit analysis. **[10Hours]**
Unit-IV	:	Preparing of feasibility report, appraisal process, Economic and commercial feasibility, Financial feasibility, Technical feasibility, Ownership of Industries Proprietorship, partnership, joint stock companies, public and private undertakings, co-operative organizations. **[10Hours]**
Unit-V	:	Work Study, Production,Productivity,Factors affecting productivity ,Role of work study , Method study,SIMO chart, Work measurement, Stop watch, time study, Rating concept and systems,Allowances,Worksampling, The Meaning of Quality and Quality Improvement; Brief History of Quality Methodology; Statistical Methods for Quality Control and Improvement; Total Quality Management. **[12Hours]**
Unit-VI	:	Risk Analysis & Management ,Risk analysis of single project, Sensitivity/Simulation/Decision Tree Analysis),Fault tree analysis, Reliability Engineering, Process Management Standardization ISO 9000, 14000 **[8Hours]**

Reference Books:

Sr. No.	Title	Author	Publication	Edition
1	Industrial Engineering & Management	O. P. Khanna	Dhanpatrai Publications	15th Edition, 2010
2	Managerial Economics	R.L.Varhney & K.L.Maheswari	S.Chand & Co.	20th Edition, 2012
3	Economics	Samuelson P.A.& Nordhaus	McGraw-Hill	16th Edition, 1992
4	Introduction to Work study	ILO	ILO	4th Edition, 1992
5	Production and Operation Management	P.Ramamurthy	New Age International	2nd Edition, 2005
6	Statistical Quality Control	E.L.Grant & R.S. Leavenworth	McGraw Hill	7th Edition, 2000
7	Management of Organizational	Hersey Paul & Kenneth H	Prentice Hall of India Pvt. Ltd.	9th Edition, 2001

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

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

For 80 marks Paper:
1. Minimum ten questions
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

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(Faculty of Engineering & Technology)

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

Code No: PPE306 | **Title: Instrumentation and Process control**

Teaching Scheme: 02Hrs/week | **Class Test (Marks): 10**

Theory: 02Hrs/week | **Theory Examination (Duration): 02 Hrs**

Tutorial: ---- | **Theory Examination (Marks): 40**

Credits:02

Objectives : To study the instrumentation in process industries and control of processes.

Unit-I : Elements of instruments, temperature scales, industrial thermocouples, bimetallic thermometer temperature probe and sensors, thermisters, resistance thermometer, response of thermometer. **[5Hours]**

Unit-II : Measurement of Head and Level

Head, density and specific gravity, Measurement of liquid level in continous ultrasonic sensors, level measurement in pressure vessels. **[5Hours]**

Unit-III : Pressure measurement

Manometers, Measurement of absolute pressure, McLeod vacuum gauge. **[5Hours]**

Unit-IV : Control Systems:

Laplace transform,Dynamic behavior and Response of first order systems,forcing functions, Dynamic behavior of Second order systems and multicapacity control systems. **[6Hours]**

Unit-V : Control system, block diagram representation, control system components. **[4Hours]**

Unit-VI : Types of Controllers and transfer functions, closed loop systems, stability. **[5Hours]**

Reference Books:

Sr. No.	Title	Author	Publication	Edition
1	Process Systems Analysis and Control	Donald Coughanowr	McGraw-Hill Higher	3rd Edition, 2009
2	Process Control & Instrumentation	R P Vyas	Central Techno Publications,Nagpur	4th Edition, 2010
3	Instrumentation	Donald Eckman	John Wiley	1st Edition, 1950

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

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

For 40 marks Paper:
1. Minimum ten questions
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for six marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 7 marks each from remaining questions from each section A and B be asked to solve.

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

Code No: PPE321 **Title: Lab I-Polymer Synthesis**
Teaching Scheme: 04 Hrs/week **Teachers Assessment: 50 Marks**
Practical: 50 Marks **Credit: 2**

Objectives : To provide the practical exposure of polymer synthesis in the laboratory.

List of Practicals :

1. Synthesis of Resol.
2. Synthesis of Novolac.
3. Synthesis of Urea Formaldehyde.
4. Synthesis of Melamine Formaldehyde.
5. Synthesis of alkyd resin.
6. Synthesis of saturated polyester.
7. Synthesis of epoxy resin. Analysis of
8. epoxy resin.

Any other experiments related to above topics can be performed.

Reference Books :

Sr. No.	Title	Author	Publication	Edition
1	Handbook of Plastics Materials and Technology	I. Rubin	Wiley-Interscience	First Edition, 1990
2	Plastics Materials	J.A.Brydson	Butterworth Heinemann	Seventh, 1999
3	Plastics Materials Handbook	A. S. Athalye	Multi Tech Publishing	First Edition, 1995
4	Textbook of Polymer Science	Fred Bilmeyer	John Wiley & Sons	Third Edition, 1984

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.

Practical Examination
The practical examination shall consist of performing an experiment based on the practical work done during the course, the record of the experiment performed by the candidate and viva-voce based on the syllabus. The assessment will be based on
1. Performing the experiment.
2. Record of experiment performed by the candidate.
3. Viva-voce on the syllabus.

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

Code No: PPE322 **Title: Lab II- Elastomer Technology**

Teaching Scheme: 02 Hrs/week **Teachers Assessment: 25 Marks**

Practical: 25 Marks **Credit: 1**

Objectives : To provide the practical exposure of elastomer technology in the laboratory.

List of Practicals :

1. Qualitative tests on Synthetic rubbers. Identify the manufactures of Synthetic rubbers in India and overseas. List the applications of these rubbers as charts. Identify and collect rubber products made out of these rubbers.
2. Qualitative tests for the Special purpose synthetic rubbers and prepare a chart illustrating the manufacturers and the properties of the Rubbers. Identify and collect rubber products made out of these rubbers.
3. Mix full rubber compounds containing all the necessary ingredients.(Accelerators, Curing Agents and Special compounding Ingredients - Blowing Agents, Factice, Colours etc).
4. Testing of Rubber Latex for
    a. Total Solid Content
    b. Total Alkalinity
    c. Magnesium Content
5. Mastication of Natural rubber to various extent on a two roll mixing mill (2 minutes, 5 min, 10 min, 20 min, 40 min), Observe the changes and find out the plasticity of these samples.
6. Determine the cure time of different rubber compounds containing different cure systems on a Rheometer. Try to predict the cure behavior of the compound from the Rheograph
7. Preparation of Blends of rubbers like NR/SBR, NR/PB etc.
8. Determination of Carbon Black content in a given Rubber sample.

Any other experiments related to above topics can be performed.

Reference Books :

Sr. No.	Title	Author	Publication	Edition
1.	Handbook of Elastomers	Anil K Bhowmick and Howard L Stephens	Marcel Dekker Inc	1st Edition, 2000
2.	An Introduction to Rubber Technology	Ciesielski, A	Rapra Techonology Limited, UK	1st Edition, 1999
3.	The Science and Technology of Rubber	James E. Mark, Burak Erman	Academic Press	3rd Edition, 2011

		4.	Rubber Curing Systems	R.N. Datta, B.V. Flexsys	Rapra Techonology Limited, UK	1st Edition, 2001
		5.	The Physicas of Rubber Elasticity	L.G.Treolar	Oxford University Press	1st Edition, 2005
		6.	Physical Testing of Rubber	Roger Brown	Springer-Verlag New York Inc	1st Edition, 2000
		7.	The Mixing of Rubber	R.F. Grossman	Chapman and Hall	1st Edition, 1997
		8.	Rubber Technology and Manufacture	Blow C.M	Butterworth, London	2nd Edition, 1982
		9.	Rubber Technology Handbook	Dr. Warner Hoffmen	Hanser Publication, NY	1st Edition, 1996
		10.	Rubber Technology	Morton,M	N.Y. Vannostrand Reinhold Company	2nd Edition, 1973
		11.	Polymer Physics	Rubinstein,M,Colby R.H.	Oxford University press	1st Edition, 2003

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.

Practical Examination
The practical examination shall consist of performing an experiment based on the practical work done during the course, the record of the experiment performed by the candidate and viva-voce based on the syllabus. The assessment will be based on
1. Performing the experiment.
2. Record of experiment performed by the candidate.
3. Viva-voce on the syllabus

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad

(Faculty of Engineering & Technology)

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

Code No: PPE323 **Title: Lab III-Heat Transfer**

Teaching Scheme: 02 Hrs/week **Teachers Assessment: 25 Marks**

Practical: 25 Marks **Credit: 1**

Objectives : To study and understand practically the concepts, principles, laws, observations, and modes of Heat Transfer.

Unit-I :

1. Determination of thermal conductivity of insulating powder.
2. Determination of thermal resistances of a composite wall. 3. Determination of heat transfer coefficient by forced convection.
4. Determination of heat transfer coefficient by natural convection.
5. Determination of heat transfer coefficient by drop and film wise condensation.
6. Determination of overall heat transfer coefficient in a shell and tube heat exchanger.
7. Determination of heat transfer coefficient in double pipe heat exchanger.
8. Determination of Stefan Boltzmann constant in Radiation.
9. Determination of critical heat flux in boiling.

Any other experiments related to above topics can be performed.

Reference Books:

Sr. No.	Title	Author	Publication	Edition
1	Heat Transfer	D.Q.Kern	McGraw Hill Co.	1St Edition, 2000
2	Heat Transfer	J.P.Holman	McGraw Hill Co	8th Edition, 2006
3	Heat Transfer: A Practical Approach	Yunus A.Cengel	McGraw Hill Co	3rd Edition, 2007
4	Chemical Engineering Volume I & II	Richardson & Coulson	Butterworth-Heinemann	3rd Edition, 2005
5	Unit Operations of Chemical Engineering	McCabe & Smith	McGraw Hill Co	6th Edition, 2007
6	Heat Transfer	S.P.Sukhatme	Universities Press	4th Edition, 2006

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.

Practical Examination

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

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

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of T. Y.B. Tech. (Plastics and Polymer Engineering) Semester- V

Code No: PPE324 **Title: Lab-IV (Seminar)**
Teaching Scheme: 02 Hrs/week **Teachers Assessment: 50 Marks**
Practical: ---- **Credit: 1**

Course Objectives	**:**	1. To create awareness amongst pre final year students for latest technological Aspects. 2. To improve presentation and communication skills. 3. To inculcate qualities of team work and team spirit. 4. To motivate for research work in the respective areas. 5. To have common platform where interaction between various groups of students will take place on the various advanced and emerging topics of technology. 6. To improve skills related to search on the internet. 7. To realize importance of basic technological aspects.

Guidelines for students and faculty

1. Seminar topics may be chosen by the students with advice from the guide/Industry persons, which shall be finalized by guide and approved by concerned head of the department. Students are to be exposed to the following aspects of the seminar presentation.
    a. Literature Survey / Review
    b. Organization of the material
    c. Preparing for presentation
    d. Technical writing

2. Each student is required to-
    a. Submit one page synopsis before the seminar talk for display on the notice board and
    b. Give a 20 minutes presentation through OHP, PC, and Slide projector followed by a 10 minute question answer session.

3. For award of Sessional marks:
    a. 25 marks - based on the assessment done by internal guide during semester and the involvement of student in the work assigned related to the seminar topic
    b. Remaining 25 marks based on the examination at final presentation. Student is to be examined on the basis of an oral and written presentation by at least two examiners, one of them shall be guide and other as an external examiner appointed by the principal of the institute.

Seminar Report Format

1. The Seminar Report shall be typed on A-4 size white bond paper.
2. Typing shall be with spacing of 1.5 using one side of the paper.
3. Margins :- (i) Left 37.5 mm.
   (ii) Right, top and bottom 25 mm.
4. Binding: - Hard with golden embossing on the front cover of brown colour
5. Front cover of hard bound report:- It should be identical to first title page.
6. Default font size TNR-12
7. Format for title page (First Page) (Centre justified)

Report of Seminar (TNR-14, Bold)

In (TNR-12)

{Title}(TNR-18, Bold)

By (TNR-12)

{Name of student}(TNR-16, Bold)

(Roll No:) (TNR-12)

Submitted in partial fulfillment of the requirement for (TNR-12)

Degree of Bachelor of Technology (Branch Name) (TNR-14, Bold)

of (TNR-12)

Dr. Babasaheb Ambedkar Marathwada University,

Aurangabad. (TNR-14, Bold)

Department of _____Engineering, (TNR-14, Bold)

Maharashtra Institute of Technology, (TNR-16, Bold)

Aurangabad. (TNR-14, Bold)

200- 200 (Academic Year) (TNR 14)

Format for Certification page (Second page)

CERTIFICATE (TNR-16, Bold)

This is to certify that the Seminar Report (TNR-12)

Submitted by (TNR-12)

(Name of Student) (TNR-14, Bold)

(Roll No: __) (TNR-12)

Is completed as per the requirement of the Dr. Babasaheb Ambedkar Marathwada University, Aurangabad in partial fulfillment of (TNR-12)

Degree of Bachelor of Technology (Branch Name) (TNR-14, Bold)

For the academic Year 20__ - 20__(TNR-12)

(Name)	(Name)	(Name)
Guide	Head of Department	Principal (TNR -12, Bold)

8. The third page will be certificate issued by the industry regarding the completion of Seminar if applicable.
9. The fourth page would be for acknowledgement, which would be followed by index page (Fifth page).
10. Sketches should be drawn on separate sheet (minimum A4 size) and be inserted at proper places. The sketches should be drawn in black ink and be numbered. 11. Tables should preferably type in the text only.
12. The mathematical symbol should be typed or neatly written so as to match darkness of the text.
13. The last item on the index should be references.
14. Page number must appear on the right hand top corner of each page starting after index page. 15. The contents of the seminar can be decided by the internal guide / department and student.
16. Minimum number of copies = 5 Copies (Central Library + Department + Internal Guide + External Examiner + Student). The copy of External Examiner will be submitted by the student after completion of Seminar.

Report of Seminar

on

Impact of Biodegradable Polymers on Society

by

Mr. Amit Gawde

(Roll No: T3703)

Submitted in partial fulfillment of the requirement for

Degree of Bachelor of Technology (Plastics & Polymer Engineering)

of

Dr. Babasaheb Ambedkar Marathwada University

Aurangabad

Department of Plastics & Polymer Engineering,

Maharashtra Institute of Technology,

Aurangabad.

201_ - 201_

SAMPLE COPY

CERTIFICATE

This is to certify that the Seminar Report

Submitted by

Mr. Amit Gawde

(Roll No: T3703)

is completed as per the requirement of the Dr. Babasaheb Ambedkar Marathwada University, Aurangabad in partial fulfillment of

Degree of Bachelor of Technology

(Plastics & Polymer Engineering)

For the academic Year 201_ - 201_

(Name)	**(Name)**	**(Name)**
Guide	**Head of Department**	**Principal**

General Attributes

- Chapter heading -All Capital—TNR 14 Font (Bold)
- Heading -All Capital- TNR 12 Font (Bold)
- Subheading-Title case- TNR12 Font (Bold)
- Text - TNR11 Font
- Title of the Report should not be more than two lines
- Page numbers are at right hand corner at ½ inch from right and top side.
- Page number should be allotted only from Chapter no. 1 onwards.

References

Last chapter of the report is references including the addresses of websites.

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad

(Faculty of Engineering & Technology)

Syllabus of T. Y. B. Tech. (Plastics and Polymer Engineering) Semester-VI

Code No: PPE351	**Title: Polymer Processing Technology**
Teaching Scheme: 04Hrs/week	**Class Test (Marks): 20**
Theory: 03Hrs/week	**Theory Examination (Duration): 03 Hrs**
Tutorial: 01Hr/week	**Theory Examination (Marks): 80**
Credits:04	

Objectives	:	To impart the understanding of various polymer processing techniques considering the equipment, material behavior, processing parameters etc.
Unit-I	:	**Injection Moulding** Introduction, basic components and processes, types of machines, materials, moulding crycub,lesahdovotnnageasndansd felimitmteiasnureo,f prhoeceprocesrs,mMearcshianed stpeciificafteions and pratduct to le at ig a ty aos s t ss pa a et n he r ef ct on o r ing, quality, Injection molding of thermosets. **[10Hours]**
Unit-II	:	**a) Compression Moulding** Introduction, basic process, moulding cycle, moulding materials, bulk factor, flow properties, temperature and pressure on moulding cycle, types of molds, advantages and limitation of process, troubleshooting. **[6Hours]** **b) Transfer Moulding** Introduction, basic process, moulding cycle, moulding materials, types of machines, process parameters and their effect on product quality, troubleshooting. **[7Hours]**
Unit-III	:	**Rotational Moulding** Introduction, basic process, material, process parameters, cycle time, types of machines, process parameters & their effects on product quality, melt flow, advantages & disadvantages, troubleshooting. **[7Hours]**
Unit-IV	:	**Extrusion** Introduction, components of extrusion and extruder screw, materials, extruder output, blown film plant, sheet extrusion, pipe extrusion, process parameters & their effects on product quality, Mixing sections, troubleshooting, twin screw extruder. **[10Hours]**
Unit-V	:	**a)Thermoforming** Introduction, principle, materials, process parameters and their effects, types of thermoforming, troubleshooting. **[6Hours]** **b) Calendering** Introduction, material, products, types of calendar roll, constructions and configuration, process parameters, film and sheet lines, Advantages, disadvantages, troubleshooting. **[4Hours]**

Unit-VI	:	**a) Blow Moulding:** Introduction, basic process, materials, parison, wall thickness control, Extrusion blow moulding, Injection blow moulding, Stretch blow moulding, process parameters and their effects on quality of product, advantages & disadvantages, defects, causes and remedies. **[6Hours]** **b) Post Moulding Operations:** Machining operations, Special guidelines for machining of polymers with respect to tool geometry and other machining parameters, Joining of plastics, welding techniques. **[4Hours]**

Reference Books: :

Sr.no	Title	Author	Publication	Edition
01	Plastics Engineering Handbook	J.Frados	Van Nostrand Reinhold Company	Fourth Edition, 2007
02	Plastics Processing Handbook	A S Athalye	Colour Publications (Pvt.) Ltd.	First Edition - 2002
03	SPI Plastics Engineering Handbook	Michael Berins	Springer	Fifth Edition - 1991
04	Principles of Polymer Processing	Tadmor A. and Gagos C.G.	John Wiley & Sons, New York,	2006 Second Edition

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

Pattern of Question Paper:

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

For 80 marks Paper:

1. Minimum ten questions
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

Dr.BabasahebAmbedkarMarathwada University, Aurangabad

(Faculty of Engineering & Technology)

Syllabus of T. Y. B. Tech. (Plastics and Polymer Engineering) Semester-VI

Code No: PPE352
Teaching Scheme:04hrs/week
Theory: 3hrs/week
Tutorial: 1hrs/week
Credits: 4

Title: Polymer Reaction Engineering
Class Test (Marks): 20
Theory Examination (Duration): 3 Hrs
Theory Examination (Marks): 80

Objectives	**:**	To study kinetics of various reactions.
Unit-I	**:**	Introduction to Chemical Kinetics: Molecularity and order of chemical reaction, Rate constant & its representation, temperature dependence of terms in rate expression. **[10Hours]**
Unit-II	**:**	Types of Polymerisation Reactors: Batch, CSTR, Plug flow reactors, their relative merits & demerits, effect of each type of reactor on polymer properties. **[10Hours]**
Unit-III	**:**	Fluidized bed reactors, Catalytic reactors, Autocatalytic reactors,series and parallel reactions. **[10Hours]**
Unit-IV	**:**	Classification of polymer reactions, molecular weight distribution in batch and continuous reactors, residence time distribution, heterogenous reacting systems. **[10Hours]**
Unit-V	**:**	Design considerations of batch polymerisation reactor, solution, suspension and emulsion polymerization reactors. Agitation in polymerization reactors. **[10Hours]**
Unit-VI	**:**	Reactors for PS, PVC, PET,PE, HDPE,LLDPE,safety in polymerization reactors. **[10Hours]**

Reference Books: :

Sr. No.	**Title**	**Author**	**Publication**	**Edition**
1	Chemical reaction Engineering	Levenspiel	John Wiley& Sons	3rd Edition, 1999
2	Chemical Engineering Volume I & II	Richardson & Coulson	Butterworth-Heinemann	3rd Edition, 2002
3	Reaction Engineering of Step Growth	Gupta S. & Anilkumar	Plenum Press, New York	1st Edition, 1987.

			Polymerization			
		4	Encyclopedia of Polymer Science & Engg.	H. F. Mark, N. M. Bikales, C. G. Overberger and G. Menges	Wiley-Interscience, New York	2nd Edition, 1985
		5	Polymer Reactor Engineering	McGreavy, Blackie Academic & Professional,	Chapman & Hall	1st Edition, 1994
		6	Elements of Chemical Reaction Engineering,	H.Scott Fogler	Prentice Hall International	4th Edition, 2005
		7	Principles of Polymerisation	George Odian	John Wiley& Sons	4th Edition, 2004
		8	Introduction to Polymer science & Technology	Dr.Shrikant Dawande	Denett & Co	1st Edition, 2006

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V and VI.

Pattern of Question Paper:

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

For 80 marks Paper:

1. Minimum ten questions
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad

(Faculty of Engineering & Technology)

Syllabus of T. Y. B. Tech. (Plastics and Polymer Engineering) Semester-VI

Code No: PPE353	**Title: Mass Transfer**
Teaching Scheme: 04Hrs/week	**Class Test (Marks): 20**
Theory: 03Hrs/week	**Theory Examination (Duration): 03 Hrs**
Tutorial: 01Hr/week	**Theory Examination (Marks): 80**
Credits:04	

Objectives :	To study various unit operations of chemical engineering
Unit-I	**: Diffusion** Introduction and various mass transfer operations, fundamentals of mass transfer, Ficks law, Eddy diffusion, Equimolar countercurrent diffusion, Diffusion through polymers, factors affecting gas permeability of polymers. **[12Hours]**
Unit-II	**: Mass transfer coefficients** Introduction, Theories of mass transfer (film theory, penetration theory, surface stretch theory,surface renewal theory) mass transfer coefficients **[8Hours]**
Unit-III	**: Absorption** Introduction, Ideal liquid solutions, material balance for one component transferred in countercurrent and cocurrent flow, counter current multistage operation, Absorption operation equipments like plate tower, packed tower **[10Hours]**
Unit-IV	**: Distillation** Introduction, Vapor liquid equilibria, differential condensation, continuous rectification, calculation of number of equilibrium stages by Mccabe Thiele method, reflux ratio, multicomponent mixtures, azeotropic, extractive and steam distillation, vacuum distillation, distillation equipments, plate and packed towers**.** **[15Hours]**
Unit-V	**: Liquid liquid Extraction** Introduction, Ternary liquid liquid equilibrium, equilateral triangular coordinates, single stage extraction, calculation of number of equilibrium stages for cocurrent and countercurrent multistage contacting**.** **[10Hours]**
Unit-VI	**: Drying** Definitions, Batch drying, rate of batch drying,drying rate curve, mechanisms of batch drying, continuous drying**.** **[5Hours]**

References:	Sr.no	Title	Author	Publication	Edition
	01	Mass Transfer Operation	R.E.Trybel	Mcgraw Hill Company	3rd edition, 1980
	02.	Chemical Engineering Vol I & II	Richardson & Coulson	Mcgraw Hill Company	6th Edition, 2002
	03.	Unit Operations of Chemical Engineering	McCabe & Smith	Mcgraw Hill Company	7th Edition, 2004
	04.	Chemical Engineering Handbook	Robert Perrys	Mcgraw Hill Company	8th Edition, 2007

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

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

For 80 marks Paper:
1. Minimum ten questions
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad

(Faculty of Engineering & Technology)

Syllabus of T. Y. B. Tech. (Plastics and Polymer Engineering) Semester-VI

Code No: PPE354	**Title: Polymer Recycling and Waste Management**
Teaching Scheme: 04Hrs/week	**Class Test (Marks): 20**
Theory: 04Hrs/week	**Theory Examination (Duration): 03 Hrs**
Tutorial: ----	**Theory Examination (Marks): 80**
Credits:04	

Objectives :		To learn the various methods employed for recycling of polymers. Tforleecayrclineedefor poolymeraredcyhceling, pilaasttiiocnsnodf rrubberawaste management, various methods o n ng t chnol gies n t appl c a ecycl tes.
Unit-I	**:**	**Need for recycling :** Sorting and segregation of waste, Plastics identification, Plastics production and composition, Plastics waste: Composition, quantities and disposal, alternative types of recycle methods. **[7Hours]**
Unit-II	**:**	**Recycling :** Equipments for primary recycling, Secondary recycling, Tertiary recycling-Reactors used, Specific recycling technique for PE films, PP battery cases, Crushing and separation of PET films and bottles. **[8Hours]**
Unit-III	**:**	**a)**Recycling of plastics from urban waste ,rheology, density ,mechanical behavior of recycled plastics, Plastics waste containing paper- hydrolytic treatment, processing of mixed plastics waste, household waste, industrial sector, TPO based materials **[8Hours]** **b)**Use of recyclable plastics in motor vehicles: Recoverable materials, disposal of residuals, recyclable plastic components, virgin and recycled HDPE, Flourinated and unflourinated HDPE fuel tanks, use of recyclable plastics in automobiles. **[7Hours]**
Unit-IV	**:**	**Types of rubber products:** Grounrdprrubberst.yre, recycling of rubber tyres, polymer rubber composites, use of recouled yc rubbe oduct **[8 H rs]**
Unit-V	**:**	**Use of Plastics in Conservation of Natural Resources:** Mulching, waste water recovery by membrane separation, use of plastics in rain water harvesting, plastic pipes for transportation of potable water (as compared to iron pipes) and canal lining. **[10Hours]**
Unit-VI	**:**	**Waste Management:** Medical plastic waste generation, handling methods, Waste management of plastics packaging, effective management of plastics woven sacks, Solid waste generation, municipal solid waste management, infectious waste management, emerging processing technologies

for waste reusage. **[12Hours]**

Reference Books: :

Sr. No.	Title	Author	Publication	Edition
1	Plastics Product Design	R.D Beck	Van Nostrand Reinhold Co	2nd Edition, 1980
2	Plastics Engineering	R.J.Crawford, Pergamon Press	Pergamon Press	3rd Edition, 1998
3	Injection mould Design	R.G.W.Pye	Longman Scientific and Technical	4th Edition, 1989
4	Blow Molding Handbook	Rosato	Hanser Pub., Munich Vienna NY,	2nd Edition, 2004
5	Designing with Plastics & Composites	Rosato & Rosato	Springer	1st Edition, 1991
6	Plastics Products Design Hand Book	Edward Miller	Marcel Dekker	1st Edition, 1981
7	Plastic Part Design for Injection Moulding	Robert A. Malloy	Hanser Pub., Munich Vienna NY	4th Edition, 1994
8	Plastics Product Design and Process Engineering	H. Belofsky	SPE, Hanser Publication, Munich Vienna NY	1st Edition, 1995
9	Plastic Product Design Engineering Hand Book	S.Levy & J.H.Dubois	Chapman and Hall	2nd Edition, 1984

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

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

For 40 marks Paper:
1. Minimum ten questions
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for six marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 7 marks each from remaining questions from each section A and B be asked to solve.

Dr.BabasahebAmbedkarMarathwada University, Aurangabad

(Faculty of Engineering & Technology)

Syllabus of T. Y. B. Tech. (Plastics and Polymer Engineering) Semester-VI

Code No: PPE391	**Title: Elective- I (Biopolymers)**
Teaching Scheme: 04Hrs/week	**Class Test (Marks): 20**
Theory: 04Hrs/week	**Theory Examination (Duration): 03 Hrs**
Tutorial: ----	**Theory Examination (Marks): 80**
Credits:04	

Objectives	**:**	To have indepth knowledge of various biopolymers including their various other aspects like testing, toxic effects.
Unit-I	**:**	**a) Biopolymers** Introduction, definition, classification, applications, advantages and disadvantages, Biopolymers vs polymers, Biopolymers vs Biodegradable polymers, introduction of different types of biopolymers like polypeptides, nucleic acid, sugar based, poly lactic acid, PHBV etc. **[6Hours]** **b) Chemistry And Biochemistry of Polymer Degradation** Introduction of enzyme, nomenclature, enzyme specificity, physical factors affecting the activity of enzymes, enzyme mechanism, biodegradation and its classification. **[6Hours]**
Unit-II	**:**	**Biopolyesters** Introduction, History, biosynthesis, Isolation - solvent extraction , sodium hypo chloride digestion, enzymatic digestion, Properties - crystal structure , nascent morphology, degradation - Intracellular biodegradation , extra cellular biodegradation , thermal degradation , hydrolytic degradation ,environmental degradation , effects of recycling, applications, economics, future prospects. **[6Hours]**
Unit-III	**:**	**a)Test Methods & Standards For Biodegradable Plastics** Introduction, defining biodegradability, criteria used in the evaluation of biodegradable polymers, tiered systems for evaluating biodegradability, choice of environment, choosing the most appropriate methodology, description of current test methods - screening test for ready biodegradability, tests for inherent biodegradability, tests for simulation studies, other methods for assessing biodegradability - petri dish screen - environmental chamber method - soil burial tests, Test method developments for the future. **[6Hours]** **b) Biocompatibility & Toxicological screening of biomaterials** Definition of Biocompatibility, blood compatibility and tissue compatibility. Toxicity tests: acute and Chronic toxicity studies (in situimplantation, tissue culture, haemolysis, thrombogenic Potential test, systemic toxicity, intracutaneous irritation test), sensitization, Carcinogenicity, mutagenicity and special tests. **[6Hours]**

Unit-IV	**:**	**Polymeric implant materials** Polyolefins, polyamides, acrylic polymers, fluorocarbon polymers, silicon rubbers, acetals. (Classification according to thermosets, thermoplastics and elastomers),Viscoelastic behavior-creep-recovery, stress-relaxation, strain rate sensitivity,Importance of molecular structure, hydrophilic and hydrophobic surface properties, migration of additives (processing aids), aging and environmental stress cracking. Physiochemical characteristics of biopolymers, Biodegradable polymers for medical purposes, Biopolymers in controlled release systems, Synthetic polymeric membranes and their biological applications. **[10Hours]**
Unit-V	**:**	**a)** Biopolymers in 1) Drug delivery system, 2) Disposable in Health care, 3) Packaging, 4) Medication. **[6Hours]** **b)** Biopolymers: Preparation of nanobiomaterials - Polymeric scaffolds ,collagen, Elastins, Mucopolysaccharides, Proteoglycans, Cellulose and derivates, Dextrans, Alginates, Pectins,Chitin. Biomaterials for Ophthalmology: Contact lenses; Optical implants for glaucoma, Adhesives, Artificial tears, Protection gears. **[8Hours]**
Unit-VI	**:**	Technology, Production and Application of Biopolymers based on PVOH, Lactic Acid. **[6Hours]**

Reference Books: **:**

Sr. No.	Title	Author	Publication	Edition
1	Chemistry & Technology of Biodegradable Polymers	G.J.L.Griffin Blackie(ed.)	Academic & Professional London	1st Edition,1994
2	Biodegradable Plastics & Polymers	Yoshiharu Doi , Kazuhiko Fukuda(ed.)	Elsevier	1st Edition, 1994
3	Handbook of Biodegradable Polymers	Abraham J.Donb & others(ed.)	Harwood Academic Publishers	1st Edition, 1998
4	Polymeric Biomaterials	Piskin and A S Hoffmann	Martinus Nijhoff Publishers. (Dordrecht.)	2nd Edition, 1986
5	Biomaterials - An introduction	J.B. Park	Plenum Press	2nd Edition, 1979

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V and VI.

Pattern of Question Paper:

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

For 80 marks Paper:

1. Minimum ten questions
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad

(Faculty of Engineering & Technology)

Syllabus of T. Y. B. Tech. (Plastics and Polymer Engineering) Semester-VI

Code No: PPE392
Teaching Scheme: 04Hrs/week
Theory: 04Hrs/week
Tutorial: ----
Credits:04

Title: Elective- I (Plastic Packaging Technology)
Class Test (Marks): 20
Theory Examination (Duration): 03 Hrs
Theory Examination (Marks): 80

Objectives :	The main objective of this subject is to impart knowledge and skills related to packaging syastem frorinvariokagiproducts,esttongundersctandingemcoenrciepts of materials used in packaging,
	m chine y pac us ng and t i of pa kag th at al.
Unit-I	**Introduction** Packaging - A total Concept, Packaging as a system: Elements, Approach, Package design, **:** Funecctions ocfrptacikagiOrigAdvaTnyages oPfrplpeticepackadgvinntaAppli&ationm.iPacokagingf Matcekaalisng ng, t as g, c s ri - Sel ion i er a, in, pes, o rti s, A a ges Li tati ns o pa g materials, Bio degradable material. **(10Hrs)**
Unit-II	**Conversion Process** Injection molding, Blow molding,Extrusion,Sealing methods,Metalising, Thermoforming in **:** Packaging, Types of Thermoforming, Thermoforming Fill- Seal, Aseptic Thermoforming. Transit Hazards - Road, Rail, Sea & Air, Transport and Storage Hazards. **(10Hrs)**
Unit-III	**Packaging Industry: a forecast** **:** Econom ticas, ofhpiack, Viang,Sm, cGaalslitCAac,kageP- ,Bostetlpt,iSt,rip,Ski,n,Blvistners,aSchrienk,.Stand up**(10Hr**h**)**, Box, Te r S r n kag cuu pe i , yp s e c Tubes Wo e k tc pouc P MA A **s**
Unit-IV	**Food Packaging** Requirements and their selection for raw and processed foods, Meat, Fish, Poultry, Eggs, Milk **:** anddu cDsa,iByverproducns,cksFRuiatdy tandat fveoge.tSapeesa,liseCerpaaclkaggrnginsor faonodds, Beackend trefodsd. r t rs bl e a o pro t e ages,S a , e oe o d ci d if r et n Prevention of Food Adulteration Act (PFA). **(10Hrs)**
Unit-V	**Flexible Packaging** Extrusion, Cast film & sheet, Blown film, Multi layer film & sheet coatings, materials used, **:** laminations & co extrusions, stretch and shrink wrapping, advantages of flexible packaging, limitations. Forms of flexible packaging. **(10Hrs)**

Printing

Surface treatment, Techniques: Gravure, Flexography, Ink jet printing for coding, Printing

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epahakacal, BeasrtriProceduraetioor,

Unit-VI nks. gi g te als i ge r ria sc m c ni t er, Migr fn , C p bil ty o c ge

Printing. Recycling and Disposal of packaging waste. **(10Hrs)**

Reference Books:	:	Sr. No.	Title	Author	Publication	Edition
		1	Understanding Plastic Packaging Technology	Susan E.M. Seleke,	Hanser publications - Munich	1st Edition, 1997.
		2	Plastics in Packaging	A.S. Althalye	Tata McGraw-Hill publishing Co. Ltd., New Delhi	1st Edition, 1992
		3	Food Packaging Technology Hand Book	NIIR,	Asia-Pacific publication	1st Edition, 2012
		4	Package Engineering	Honlon J F	McGraw Hill	1st Edition, 1984
		5	Plastics Packaging	Turtle Ivor,	Pira International	1st Edition, 1990.
		6	Handbook of Packaging-Plastics	A.S. Altalye	multi-tech publishing co.Mumbai.	1st Edition, 2013

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

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

For 40 marks Paper:
1. Minimum ten questions
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for six marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 7 marks each from remaining questions from each section A and B be asked to solve.

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad

(Faculty of Engineering & Technology)

Syllabus of T. Y. B. Tech. (X)Semester-VI

Code No: PPE393	**Title: Elective I - Surface Coating Technology**
Teaching Scheme: 04Hrs/week	**Class Test (Marks): 20**
Theory: 4Hrs/week	**Theory Examination (Duration): 03 Hrs**
Tutorial: ---	**Theory Examination (Marks): 80**
Credits:04	

Objectives :	To ensure effective training in practical and academic skills at an advanced level in various aspects of Polymer and Surface Coatings Science and Technology
Unit-I	**: Introduction to surface coatings** Components of paints, Importance of coating, Pigments, pigment properties, different types, factors affecting pigment dispersion, preparation of pigment dispersion, extenders, solvents. **[8Hours]**
Unit-II	**:** Oils, driers, diluents, lacquers, varnishes, paint preparation methods Additives: Wetting and dispersing agents, Anti-skin, Flow and leveling agents, Mar resistance, Anti-foam, Anti-settling, Anti-rust, Biocide, Adhesion promoter, UV-Stabilizers. **[10Hours]**
Unit-III	**: Surface preparation** Surface Preparation methods such as Chemical, Electrochemical, Mechanical- Sand Blasting, Shot peening, Shot blasting, Hydroblasting, Vapor Phase Degreasing etc. Coating Application Technique: Brushing, extrusion, roller coating, blade, kiss, dip coating, flow coating, curtain coating, spray painting, electro deposition, chemiphoretic deposition, chemical vapour deposition, physical vapour deposition. **[12Hours]**
Unit-IV	**: Classification of coating** Industrial Coating (appliance finishes, automotive finishes, coil coatings, can coatings, marine coatings, aircraft finishes, paper coatings),Decorative/Architectural coating (Interior, Exterior, Floor, Building, wood coating), Automotive Coating (Primer, Base coat, Top coat etc), Water borne coating, curable coating, powder coating, high solid liquid coating. **[12Hours]**
Unit-V	**: Resin** Alkyd, Polyester, Epoxy, Acrylic coating, Phenolic, UF and MF, Polyurethane, Different Polymerisation Techniques, Different Film Formation Mechanism **Characterization** Mechanical, Rheological, Optical, Morphological, Thermal, barrier, Corrosion, Chemical and whether resistance properties **[14Hours]**
Unit-VI	**: Advanced Application** Nanoscale protective coating, Self Healing Coating, Thermal barrier coating, Teflon Coating, Tablet Coating, Oleophobic coating, PTFE Coating, PVDF Coating. **[4Hours]**

Reference Books:	:	Sr. No.	Title	Author	Publication	Edition
		1	Surface Coating Science & Technology	Swaraj Paul	John Wiley & Sons	2nd Edition, 1995
		2	Basics of Paint Technology Vol I	V.C. Malshe		1st Edition, 2000
		3	Basics of Paint Technology Vol II	V.C. Malshe	Antar Prakash Centre for Yoga	1stEdition, 2008
		4	Organic Coating Technology Vol I	Henry Fleming Payne	John Wiley & Sons	1st Edition, 1954
		5	Outlines of Paint Technology	By W.M.Morgans, Edward Arnold	John Wiley & Sons	3rd Edition, 1996
		6	Paints and surface coating theory and practice	R. L. Lambourna	Woodhead Publishing Ltd	2nd Edition, 1999
		7	Resins for surface coating	P.K.T. Oldering	Wiley interscience	2nd Edition, 2002
		8	Coating technology handbook	D. Satas	CRC Press, Taylor & Francis Group	2nd Edition, 2001

Section A: Includes Unit I, II and III; Section **B**: Includes Unit IV, V and VI.

Pattern of Question Paper:

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

For 80 marks Paper:

1. Minimum ten questions
2. Five questions in each section
3. Question no 1 from section A and Question no 4 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 4 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of T. Y. B. Tech. (PPE) Semester-VI

Code No: PPE355 | **Title: Specialty Polymers**
Teaching Scheme: 02Hrs/week | **Class Test (Marks): 10**
Theory: 02Hrs/week | **Theory Examination (Duration): 02 Hrs**
Tutorial: ---- | **Theory Examination (Marks): 40**
Credits:02

Objectives	**:**	To promote basic knowledge of various special purpose polymer.
Unit-I		**Heat Resistant Polymer**
	:	Introduction, Preparations, Structure-Property Relationships, Properties and Application of folloowyings,nylene Sulphide b) Polyphenylene Oxide & its blends, a) P l phe c) Polybenziimidazole d) Polysulphone e) Polyetherether Ketone **[7Hours]**
Unit-II		**Inorganic Polymers**
	:	IntSrolducneonb,)PPepapatoion,hpropertie)sBaordaappliPatliy msrof ti rr n c on a) i ico s oly h sp azenes c zine o e **[4Hours]**
Unit-III		**Smart Polymers as Biomaterials**
	:	Introduction, Physical form of Smart Polymer Chain, pH-sensitive smart polymers: General considerations,Thermo-sensitive smart polymers: General considerations, Polymers with LCST, Polymers with amphiphilic balance, Polymers with dual stimuli-responsiveness. Application of smart polymers in Drug Delivery, Gene Carriers & Glucose sensors. **[4Hours]**
Unit-IV		**Liquid Crystalline Polymer**
	:	Introduction, Classification, Description of mesophase, Lyotropic and Thermo tropic System, Liquid crystal main chain polymer, Liquid crystal side chain polymer, Synthesis, Structure-Property Relationship, Blends of LCPs, Applications of LCPs. **[6Hours]**
Unit-V		**Polymer Membrane**
	:	Introduction, Classification, Membrane configuration: Plate and frame module, Tubular Module, Hollow Fibre, Spiral Wound module, Membrane Preparation: Membranes with Symmetric: Track etching, Precipitation from the vapor phase; Membranes with AspamamietnricmSttrucd,ure:omry-weet Mease ainve:rsiDnp teccohniique, IThermaallly polymedizphiasn; y t D ph o induc e se r t o e ho C posit mbr nes i at ng, n erfaci er at o Membrane Surface Modiication, Membranes for Separation Processes: Reverse Osmosis

Membranes, Nanofiltration Membranes, Ultrafiltration Membranes, Microfiltration Membranes . **[4Hours]**

Unit-VI	**:**	**Conducting Polymers** Introduction, Conduction, Mechanism, Factors affecting conductivity, Methods of Enhancement of Conduction. Preparation, Properties and Applications of Polyacetylene, Polyparaphenylene, Polypyrrole. **[5Hours]**

Reference Books: :

Sr. No.	Title	Author	Publication	Edition
1	Liquid Crystalline Polymers	Xin-Jiu Wang. Qi Feng Zhou	World Scientific Publishing Co. Pte. Ltd.	1st Edition, 2004
2	Specialty Polymers	R.W.Dyson	Chapman & Hall, New York	2nd Edition, 1998
3	Engineering Polymer Sourcebook	Raymond B. Seymour	McGraw-Hill, USA	1st Edition, 1990
4	Polymers for High Technology Electronics and Photonics	M.J. Bowden and S.R. Tumer	Amer. Chem. Soc.	1st Edition, 1987
5	Smart Polymers and Their Applications as Biomaterials	M.R.Aguilar, C. Elvira, A. Gallardo, B. Vázquez, and J.S. Román	R Reis & E Chiellini	1st Edition, 2007
6	Handbook of Industrial Membrane Technology	Mark C. Porter	Noyes Publication	1st Edition, 1990
7	Conductive Polymers and Plastics	James M. Margolis	Chapman & Hall, New York	1st Edition, 1989

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

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

For 40 marks Paper:
1. Minimum ten questions
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for six marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 7 marks each from remaining questions from each section A and B be asked to solve.

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of T. Y. B. Tech. (Plastics and Polymer Engineering) Semester- VI

Code No: PPE371 **Title: Lab V- Polymer Processing Technology**
Teaching Scheme: 02 Hrs/week **Teachers Assessment: 25 Marks**
Practical: 25 Marks **Credit: 1**

Objectives : To provide the practical exposure of polymer processing equipments in the laboratory.

List of Practicals :

1. To produce an article from hand operated injection moulding machine.
2. To produce an article from reciprocating screw type injection moulding machine.
3. To understand the working of extrusion moulding machine.
4. To produce an article from blow moulding machine.
5. To understand the working of compression moulding machine.
6. Study of transfer moulding machine and producing an article from it.
7. Study of rotational moulding machine and producing an article from it.
8. Study and working of calendaring machine.

Any other experiments related to above topics can be performed.

Reference Books :

Sr. No.	Title	Author	Publication	Edition
01	Plastics Engineering Handbook	J.Frados	Van Nostrand Reinhold Company	Fourth Edition, 2007
02	Plastics Processing Handbook	A S Athalye	Colour Publications (Pvt.) Ltd.	First Edition - 2002
03	SPI Plastics Engineering Handbook	Michael Berins	Springer	Fifth Edition - 1991
04	Principles of Polymer Processing	Tadmor A. and Gagos C.G.	John Wiley & Sons, New York,	Second Edition 2006

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.

Practical Examination
The practical examination shall consist of performing an experiment based on the practical work done during the course, the record of the experiment performed by the candidate and viva-voce based on the syllabus. The assessment will be based on
1. Performing the experiment.
2. Record of experiment performed by the candidate.
3. Viva-voce on the syllabus.

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad

(Faculty of Engineering & Technology)

Syllabus of T. Y. B. Tech. (Plastics and Polymer Engineering) Semester- VI

Code No: PPE372 **Title: Lab VI- Polymer Reaction Engineering**

Teaching Scheme: 02 Hrs/week **Teachers Assessment: 25 Marks**

Practical: 25 Marks **Credit: 1**

Objectives : To study the order and kinetics of various chemical reactions.

List of Practicals :

1. To study the zero order reaction.
2. To study the hydrolysis of an ester in presence of hydrochloric acid.
3. To determine the order of reaction by hydrolysis of ethyl acetate in presence of sodium hydroxide.
4. To determine energy of activation of the reaction.
5. Residence time distribution of CSTR.
6 Residence time distribution of PFR.
7. To study effect of monomer concentration on rate of polymerization.
8. To study effect of change in initiator concentration on rate of polymerization.

Any other experiments related to above topics can be performed.

Reference Books :

Sr. No.	Title	Author	Publication	Edition
1	Chemical reaction Engineering	Levenspiel	John Wiley& Sons	3rd Edition, 1999
2	Chemical Engineering Volume I & II	Richardson & Coulson	Butterworth-Heinemann	3rd Edition, 2002
3	Reaction Engineering of Step Growth Polymerization	Gupta S. & Anilkumar	Plenum Press, New York	1st Edition, 1987.
4	Encyclopedia of Polymer Science & Engg.	H. F. Mark, N. M. Bikales, C. G. Overberger and G. Menges	Wiley-Interscience, New York	2nd Edition, 1985
5	Polymer Reactor Engineering	McGreavy, Blackie Academic & Professional,	Chapman & Hall	1st Edition, 1994

		6	Elements of Chemical Reaction Engineering,	H.Scott Fogler	Prentice Hall International	4th Edition, 2005
		7	Principles of Polymerisation	George Odian	John Wiley& Sons	4th Edition, 2004
		8	Introduction to Polymer science & Technology	Dr.Shrikant Dawande	Denett & Co	1st Edition, 2006

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.

Practical Examination

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

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

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(Faculty of Engineering & Technology)

Syllabus of T. Y. B. Tech. (Plastics and Polymer Engineering) Semester- VI

Code No: PPE373 **Title: Lab VII- Mass Transfer**

Teaching Scheme: 02 Hrs/week **Teachers Assessment: 25 Marks**

Practical: 25 Marks **Credit: 1**

Objectives : To study various unit operations of chemical engineering

List of Practicals :

1. Verification of Rayleigh's equation for differential distillation
2. Preparation of boiling point diagram and plot of T-X-Y diagram for binary system at equilibrium.
3. Determination of HETP for packed column.
4. Determination of mass transfer coefficient in gas absorption column.
5. Preparation of ternary equilibrium curve for liquid liquid extraction.
6. Determination of diffusivity of volatile liquid vapor into air.
7. Determination of mass transfer coefficient of naphthalene balls in air.
8. Determination of number of theoretical stages in distillation column
9. Determination of rate of drying in batch dryer.

Any other experiments related to above topics can be performed.

Reference Books :

Sr. No.	Title	Author	Publication	Edition
01	Mass Transfer Operation	R.E.Trybel	Mcgraw Hill Company	3rd edition, 1980
02.	Chemical Engineering Vol I & II	Richardson & Coulson	Mcgraw Hill Company	6th Edition, 2002
03.	Unit Operations of Chemical Engineering	McCabe & Smith	Mcgraw Hill Company	7th Edition, 2004
04.	Chemical Engineering Handbook	Robert Perrys	Mcgraw Hill Company	8th Edition, 2007

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.

Practical Examination

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

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

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(Faculty of Engineering & Technology)

Syllabus of T. Y. B. Tech. (Plastics and Polymer Engineering) Semester- VI

Code No: PPE374	**Title: Lab VIII- Design Lab-II**
Teaching Scheme: 02 Hrs/week	**Teachers Assessment: 50 Marks**
Practical: ---	**Credit: 1**

Objectives :

1. Understanding CAD - solid modeling, Surface modeling, assembly modeling and drafting of different engineering parts.
2. Students will be able to design and model the objects as per defined dimensions & features.
3. Students will be able to simulate the models of different assemblies.

List of Practicals :

1. Solid Modeling

a) Introduction: 3D modeling software package, basic 3D modeling concept, basics of sketching constraints, extrude, revolve, sweep, Boolean operations etc. **[4Hours]**

b) Model Editing: Edit, edge blend, shell, array, pattern, mirror etc. **[2Hours]**

2. Surface Modeling

Introduction to surface modeling, freeform modeling ruled, through curves, through curve mesh, swept and N-sided, Trim sheet, face blend, surface through points, X form, curve on surface. **[4Hours]**

3. Assembly Modeling

Basic assembly concepts, Bottom-up approach, top-down approach, creating assemblies, assembly constraints, components, assembly explosion. **[6Hours]**

4. Drafting

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, centerline symbols, additional drafting symbols like thread, weld, surface finish, annotation edit. **[2Hours]**

5. Motion simulation

Motion simulation of assemblies, defining links, joints & motors, assembly sequencing and motion. **[6Hours]**

Reference Books	:	Sr. No.	Title	Author	Publication	Edition
		01	Unigraphics NX6	Sham Tikoo	CADCIM Technologies	1st Edition, 2009
		02	CAD/CAM Principles & Applications	Rao	Tata McGraw-Hill Education	Third Edition, 2010
		03	CAD/CAM: Computer-Aided Design and Manufacturing	Grover	Prentice Hall	1st Edition, 2007
		04	Solid works 2013 for designers	Sham Tikoo	CADCIM Technologies	1st Edition, 2013

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 Engineering & Technology)
Syllabus of T. Y. B. Tech. (Plastics and Polymer Engineering) Semester-VI

Code No: PPE375	**Title: Lab-IX (Project-I)**
Teaching Scheme: 02 Hrs/week	**Teachers Assessment: 50 Marks**
Practical:---	**Credit: 1**

Course Objectives	**:**	The practical implementation of theoretical knowledge gained during your 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. This will definitely help in building the confidence in the student what he has learnt theoretically. The dependent study of the state of the art topics in a broad area of his/her specialization.

Guidelines for students and faculty:

1. Students have to finalize their project title based on Industrial Assignments.
2. The projects selected should be such so as to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The term work will consist of a report prepared by the student on the project allotted to them.
3. Project topics may be chosen by the student or group of students (maximum 3 students) with advice from the faculty members.
4. The students are required to submit the report based on project work done.
5. Use appropriate tools (Microsoft Word/Latex) for the preparation of the report.
6. Each student/group is required to-
    a. Submit a one page synopsis before the project talk for display on the notice board in the first week of their academic semester.
    b. Give a 10 minutes power point presentation through PC, Laptop 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, should completed within next two weeks.

g. At the last but one week of end of academic semester the internal assessment of project will be done by panel of internal faculties and they will decide marks out 25 marks for term work (TA).

h. In the last week, student/group will submit final project report to guide and thereafter guide will finalize marks out of the remaining 25 marks for term work (TA).

7. Projects are to be scheduled in the weekly scheduled time-table during the semester and any change in schedule should be discouraged.
8. Every assigned faculty/s should maintain separate file for evaluating progress of each student or group.
9. Award 50 TA, Sessional marks based on the assessment done by internal guide and panel during semester and the involvement of student/group in the work assigned related to the topic and its application.
10. The format and other guidelines for the purpose of the Project Submission in hard bound copies should be as follows-

- Report Structure

I. Index/Contents/Intent
II. Introduction *(Necessity, objectives & theme)*
III. Literature survey [*Related information available in standard Books, Journals, Transactions, Internet Websites etc. till date (More emphasis on last three to five years)*]
IV. Experimental *(Materials, preparation, characterization)*
V. Results and discussion
VI. Conclusions
VII. Future scope
VIII. Acknowledgement
IX. References-

Author, "Title", Name of Journal/Transactions/ Book, Edition/Volume, Publisher, Year of Publication, page to page (pp.__).

These references must be reflected in text at appropriate places in square bracket

In case of web pages complete web page address with assessing date has to be enlisted

List of references should be as per use in the text of the report

X. List of Abbreviations
XI. List of Figures List of
XII. Graphs List of Tables
XIII. and List of if any other inclusion
XIV.

- General Guidelines
  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"

  All Greek words must be italic

  Report Heading -title case-16 Font

  Chapter heading-title case-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

  Title of the Report should not be more than two lines

  Text pages should be in times new roman

  The page of the Index/Contents/Intent heading should be below the words for appropriate sub chapter or sub-sub chapter as shown in sample copy

  Cover page should have (Mission statement of Institute) in inverted commas, Symbol of Institute, Name of Department, and Institute

  Suitable flap with name of the candidate, Department and Institute name and symbol can be used with nylon strip.

  For more information and sample of hard copy please contact the respective Guide

SAMPLE COPY

Report of Project

on

Polymer Nanocomposites for Food Packaging

by

Mr. Amit Gawde

(Roll No: T3703)

Submitted in partial fulfillment of the requirement for

Degree of Bachelor of Technology (Plastics & Polymer Engineering)

of

Dr. Babasaheb Ambedkar Marathwada University

Aurangabad

Department of Plastics & Polymer Engineering,

Maharashtra Institute of Technology,

Aurangabad.

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SAMPLE COPY

CERTIFICATE

This is to certify that the Project Report

Submitted by

Mr. Amit Gawde

(Roll No: T3703)

is completed as per the requirement of the Dr. Babasaheb Ambedkar Marathwada University, Aurangabad in partial fulfillment of

Degree of Bachelor of Technology

(Plastics & Polymer Engineering)

For the academic Year 201_ - 201_

(Name)	**(Name)**	**(Name)**
Guide	**Head of Department**	**Principal**