DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO. ACAD / NP /S.Y. B.Tech. /Syllabi/87/2012

It is hereby notified for the information of all concerned that, the Academic Council at its meeting held on 06-07-2012 **has accepted the** following **syllabi in all Braches of S. Y. B.TECH.** under the Faculty of Engineering & Technology **as appended herewith :-**

Sr. No.	Revised Syllabi
[1]	Second Year B.Tech. [CIVIL ENGINEERING],
[2]	Second Year B.Tech. [MECHANICAL / PRODUCTION ENGINEERING],
[3]	Second Year B.Tech. [ELECTRONICS & TELECOMMUNICATION ENGINEERING],
[4]	Second Year B.Tech. [COMPUTER SCIENCE & ENGINEERING],
[5]	Second Year B.Tech. [AGRICULTURAL ENGINEERING],
[6]	Second Year B.Tech. [PLASTICS AND POLYMER ENGINEERING],
[7]	Second Year B.Tech. [INSTRUMENTATION & CONTROL ENGINEERING],

This is effective from the academic year 2012-2013 and onwards.

All concerned are requested to note the contents of this circular for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO. ACAD/ NP/ S.Y.B.TECH./
2012/19011-33
A.C.S.S. I.No.82

Date:- 31-07-2012.

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Director,
Board of College and
University Development.

Copy forwarded with compliments to :-

1] The Principals, affiliated concerned Colleges,
Dr. Babasaheb Ambedkar Marathwada University.

Copy to :-

1] The Controller of Examinations,
2] The Superintendent, [Engineering Unit],
3] The Superintendent, [Eligibility Unit] ,
4] The Record Keeper,
Dr. Babasaheb Ambedkar Marathwada University.

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S/310712/-*

Dr BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD

Revised Syllabus of Second Year

B.TECH.

PLASTICS AND POLYMER ENGINEERING

EFECTIVE FROM - 2012-13 & ONWARDS

FACULTY OF ENGINEERING AND TECHNOLOGY

Revised Structure of Second Year for 2012-13

Revised Structure of Second Year

Plastics & Polymer Engineering

Sub No.	SEMESTER-III	Contact Hrs / Week				Examination Scheme						
	Subject	L	T	P	Total	CT	ESE	T A	P	Total	Credits	Duration of Theory Exam
BSH201	Engineering Mathematics-III	3	1	-	4	20	80	-	-	100	4	3 Hrs
PPE202	Materials Engineering	3	1	-	4	20	80	-	-	100	4	3 Hrs
PPE203	Organic Chemistry	3	1	-	4	20	80	-	-	100	4	3 Hrs
PPE204	Mechanical Operation	3	1	-	4	20	80	-	-	100	4	3 Hrs
PPE205	Introduction to Polymer Engineering	3	1	-	4	20	80	-	-	100	4	3 Hrs
PPE206	Polymer Testing	2	-	-	2	10	40	-	-	50	2	2 Hrs
PPE221	Lab I Organic Chemistry	-	-	2	2	-	-	25	25	50	1	
PPE222	Lab II Mechanical Operation	-	-	2	2	-	-	25	25	50	1	
PPE223	Lab III Introduction To Polymer Engineering -I	-	-	2	2	-	-	25	25	50	1	
PPE224	Lab IVIntroduction To Polymer Engineering -II	-	-	2	2	-	-	25	25	50	1	
BSH225	Lab V Development of Skills - II	-	-	2	2	-	-	50	-	50	1	
	Total of semester-III	**17**	**5**	**10**	**32**	**110**	**440**	**150**	**100**	**800**	**27**	

Sub No.	SEMESTER-IV	Contact Hrs / Week				Examination Scheme						
	Subject	L	T	P	Total	CT	ESE	T A	P	Total	Credits	Duration of Theory Exam
BSH251	Engineering Mathematics-IV	3	1	-	4	20	80	-	-	100	4	3 Hrs
PPE252	Process Calculation	3	1	-	4	20	80	-	-	100	4	3 Hrs
PPE253	Physical Chemistry of Polymers	3	1	-	4	20	80	-	-	100	4	3 Hrs
PPE254	Fluid Mechanics	3	1	-	4	20	80	-	-	100	4	3 Hrs
PPE255	Thermoplastic Resins	3	1	-	4	20	80	-	-	100	4	3 Hrs
PPE256	Additives of Polymers	2	-	-	2	10	40	-	-	50	2	2 Hrs
PPE271	Lab VI Physical Chemistry of Polymers	-	-	2	2	-	-	25	25	50	1	
PPE272	Lab VII Fluid Mechanics	-	-	2	2	-	-	25	25	50	1	
PPE273	Lab VIII Thermoplastic Resins -I	-	-	2	2	-	-	25	25	50	1	
PPE274	Lab IX Thermoplastic Resins -II	-	-	2	2	-	-	25	25	50	1	
PPE275	Lab X Design Lab-I(CAD)	-	-	2	2	-	-	50	-	50	1	
	Total of semester-IV	**17**	**5**	**10**	**32**	**110**	**440**	**150**	**100**	**800**	**27**	
	Grand Total of III & IV									**1600**	**54**	

L: Lecture hours per week T: Tutorial hours per week P: Practical hours per week CT: Class Test:01 hour

ESE: End Semester Examination TA: Teachers Assessment P: Practical/Oral Examination

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

Code No.:BSH201
Teaching Scheme:04hrs/week
Theory: 3hrs/week
Tutorial: 1hr/batch/week
Credits: 4

Title: Engineering Mathematics –III
Class Test: 20 marks
Theory Examination (Duration): 3 Hours
Theory Examination (Marks): 80

Objectives	:	The contents aims to develop the knowledge of the student in the direction of solving the practical problem in the engineering and technology related to differential equation, Fourier Transforms, Statistical techniques Vectors and Probability.
Unit-I	:	**Linear Differential Equation**: Solution of linear differential equation of order n with constant coefficients: The complementary function, Method of finding particular integral: Short method, General method, Method of variation of parameters Equations reducible to linear form: i) The Cauchy's linear equation. ii) The Legendre's linear equation. Simultaneous differential equations. Application of linear differential equations to: i). Mechanical system. ii). Electrical System iii). Beam and Shafts (15Hrs)
Unit-II	:	**Vector Differentiation:** Differentiation of vectors, Radial, Transverse, Normal And tangential components of velocity and acceleration, Scalar and vector point function , Gradient of scalar point function, Divergence and curl of vector point function ,Second order differentiation operator Irrotational and solenoid fields. (10Hrs)
Unit-III	:	**Statistics:** Measures of central tendency: Mean Median, Quartiles and Mode. Measures of dispersion: Quartile deviation, Mean deviation, Standard deviation, coefficient of variation, Moments, Skewness, Kurtosis. (5Hrs)
Unit-IV	:	**Laplace Transform:** Definition. Laplace Transform of elementary function and its table. Theorem and properties of Laplace Transform: First shifting theorem, Second Shifting Theorem, Multiplication by t^n, Division by t. Change of scale property, Laplace Transform of integral, Laplace Transform of Derivative. Laplace Transform of some special functions: Bessel's function, Periodic function, Error Function, Heaviside Unit Step Function, Displaced Heaviside Unit Step Function Laplace Transform using Heaviside Unit function, Dirac delta function. Method to find inverse Laplace Transform: i. Use of Laplace Transform table ii. Use of Theorem and properties of Laplace iii. Use of partial fraction

		iv. Convolution theorem v. Use of development of Heaviside Unit Step Function Application of Laplace Transform to solve linear differential equation ,Simultaneous differential equation. (15Hrs)
Unit-V	:	**Fourier Transform**: Fourier integral: Complex form of Fourier integral, sine and cosine integral, Fourier transform and inverse transform. D.U.I.S. rule (only statement), Fourier transform and inverse transform for even and odd function. Fourier sine and cosine transform and inverse transform. (10Hrs)
Unit-VI	:	**Probability:** Introduction, Probability Distribution: Binomial Distribution, Poisson Distribution, Normal Distribution (5Hrs)

Reference Books:

Sr. No.	Title	Author	Publication	Edition
1.	A Text Book Of Applied Mathematics Volume-III	P.N. Wartikar J.N.Wartikar	Vidyaryhi Griha Prakashan,Pune	9th
2.	Advanced Engineering Mathematics	H.K.Dass,	S.Chand and Co.Ltd,	18th
3.	Higher Engineering Mathematics	Dr.B.S.Grewal		
4.	Higher Engineering Mathematics	B.V.Ramana		
5.	Solution to Higher Engineering Mathematics Volume –III	C.P.Gandhi		

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
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Syllabus of S. Y. B. Tech. (Plastics and Polymer Engineering) Semester-III

Code No.:PPE202
Teaching Scheme:04hrs/week
Theory: 3hrs/week
Tutorial: 1hr/batch/week
Credits: 4

Title: Materials Engineering
Class Test: 20 marks
Theory Examination (Duration): 3 Hours
Theory Examination (Marks): 80

Objectives	:	To provide students with an elementary understanding of different materials used in engineering. To teach students how the materials are related, the fundamentals of material structure/property relationships.
Unit-I	:	**a. Introduction:** Material, Material Classification, Engineering requirements of materials, Classification of Engineering materials. (2Hrs)
		b. Atomic structure and Bonding of Materials: Crystal structure of materials, crystal systems, unit cells and space lattices, determination of structures of simple crystals by x-ray diffraction, miller indices of planes and directions, packing geometry in metallic, ionic and covalent solids. Concept of amorphous, single and polycrystalline structures and their effect on properties of materials. Crystal growth techniques. Imperfections in crystalline solids and their role in influencing various properties. (6Hrs)
Unit-II	:	**Diffusion:** Fick's first law & second law of Diffusion, Atomic model of diffusion, other diffusion processes. Application of diffusion in sintering. (5 Hrs)
Unit-III	:	**a. Metals and Alloys:** Solid solutions, solubility limit, phase rule, binary phase diagrams, intermediate phases, intermediate compounds, iron-iron carbide phase diagram, heat treatment of steels cold, hot working of metals, recovery, recrystallization & grain growth. Microstructure, properties and applications of ferrous and nonferrous alloys. (10 Hrs)
		b. Processing of Materials: Casting. Forging. Hot working. Cold rolling. Sintering .Welding . Piercing. stamping. (7 Hrs)
Unit-IV	:	**Mechanical Properties:** Stress strain diagrams of metallic, polymers and ceramic materials, modulus of elasticity, yield strength, tensile strength, toughness, elongation, plastic deformation, Effect of grain size, Solute atoms of dislocations, viscoelasticity,

		hardness, impact strength, creep, fatigue, ductile and brittle fracture, fracture Toughness, Ductile-brittle Transition, Protection against fracture, Fatigue fracture surface hardening of metals. (10 Hrs)
Unit-V	:	**Electronic Properties:** Concept of energy band Diagram for materials-conductors, semiconductors and insulators. electrical conductivity- effect of temperature on conductivity , intrinsic and extrinsic semiconductors. doping of semi conductor, dielectric properties. (10 Hrs)
Unit-VI	:	**Optical Properties:** Reflection, refraction, absorption and transmission of electromagnetic radiation in solids, lasers and optical fibres. (5 Hrs)
		Magnetic Properties: Origin of magnetism in metallic and ceramic materials, paramagnetism, ferromagnetism, ferrimagnetism, magnetic hysterisis . (5 Hrs)

Reference Books: :

Sr. No.	Title	Author	Publication	Edition
1.	Materials Science & Engineering: An Introduction	William D Callister	Wiley	7th
2.	Material Science & Metallurgy	Dr.V.D.Kodgire	Everest Publication House	
3.	Materials Science & Engineering	V.Raghvan	Prentice Hall of India	
4.	Materials Science & Processes	Hajra & Chaudhuri		
5.	Essentials of Materials Science and Engineering-SI Version	Donald R. Askeland, D.K. Bhattacharya, Pradeep P. Fulay	Thomson Engineering	

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
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Syllabus of S. Y. B. Tech. (Plastics and Polymer Engineering) Semester-III

Code No.:PPE203
Teaching Scheme: 04hrs/week
Theory: 3hrs/week
Tutorial: 1hr/batch/week
Credits: 4

Title: Organic Chemistry
Class Test: 20 marks
Theory Examination (Duration): 3 Hours
Theory Examination (Marks): 80

Objectives	:	To teach students an understanding of different organic materials used in preparation of different polymers. To teach students how the organic materials are related, the fundamentals of materials, nomenclature, different reaction mechanisms.
Unit-I	:	**Nomenclature of Organic Compounds** Common Name System IUPAC Name System (5 Hrs)
Unit-II	:	**Fundamentals of Organic Reactions:** **a. Electronic theory:** Introduction, Types of bonds, Bond fission, Generation, Structure, Stability and reactions of Reaction intermediates(Carbocation, Carbanion, Free radicals and Carbene) Inductive Effect, Resonance effect and Steric effect. (6 Hrs)
		b. Organic Reaction Mechanism: Types of reactions: Addition, Substitution, Elimination, Rearrangement reactions Electrophilic and Nucleophilic substitution reactions of Benzene (Nitration, Sulphonation, Halogenation) (6 Hrs)
Unit-III	:	**Stereochemistry :** Stereoisomerism, Structural isomerism, Configurational & Conformational strereoisomer, Geometric isomerism, Optical isomerism, Enantiomers ,Diastereomers,Mesomers, Concept of chirality, , methods of racemisation and resolution, E & Z nomenclature, R-S system of nomenclature, Sharpless Asymmetric Epoxidation. (13 Hrs)
Unit-IV	:	**Selective Organic Name Reactions and Rearrangements:** Aldol Condensation, Knovengel condensation, Darzen Reaction, Reformatsky Reaction, Chichibabin Reaction , Arndt eist Reaction, Beckmann Rearrangement **Ring Opening Reactions:** Prevost Woodward hydroxylation, Epoxide opening reactions, Electrocylic reactions and Gabriel Synthesis (10 Hrs)

Unit-V	:	**Study of some Organic Compounds-I** **(Structure , Reactivity and Reactions):** **Hydrocarbons & Sub. Hydrocarbons** :Ethylene, Propylene, isobutylene, Butadiene, Styrene, Vinyl chloride **Carboxylic Acids** : Adipic Acid, Terpthalic acid, maleic acid **Alcohols** : Vinyl Alcohol, Ethylene glycol, glycerol. **Phenols :** Phenol, Cresol, Resorcinol **Amines** : Methyl amine, Hexamethylene diamine, Hexamethylene tetramine, Melamine, Aniline (10Hrs)
Unit-VI	:	**Study of some Organic Compounds-II** **(Structure , Reactivity and Reactions):** **Esters:** Dibutyl terpthalate, Acrylic acid ester, α-cyanoacrylate, Methylene malonate, Methyl acrylate **Amide:** Acrylamide, Urea, e-caprolactum. **Nitrile :** Acrylonitrile **Aldehydes:** Formaldehyde, Acetaldehyde. **Carbohydrates :** Glucose, Fructose, Starch, Cellulose. **Heterocyclic Compounds :** Introduction to Heterocyclic Compounds, Pyrrole, benzimidazoles, Oxazoles (10 Hrs)

Reference Books: :

Sr. No.	Title	Author	Publication	Edition
1.	Text book of Organic Chemistry	Bahl &Bahl	S Chand	18th
2.	Stereochemistry of Organic Compounds	P. S. Kalsi	New Age	5th
3.	Reactions, Reagents and Rearrangements	S. N. Sanyal	Bharti Bhavan	1st
4.	Organic Chemistry by F. A. Carry	F. A. Carry	Mc Graw Hill	3rd
5.	Organic Chemistry	T.W. Graham Solomons and Craig B.Fryle	John Wiley and Sons	7th
6.	Practical Organic Chemistry	Frederick G.Mann and Bernard Charles Saunders	Longman Inc,New York	4th

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
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Syllabus of S. Y. B. Tech. (Plastics and Polymer Engineering) Semester-III

Code No.:PPE204
Teaching Scheme:04hrs/week
Theory: 3hrs/week
Tutorial: 1hr/batch/week
Credits: 4

Title: Mechanical Operation
Class Test: 20 marks
Theory Examination (Duration): 3 Hours
Theory Examination (Marks): 80

Objectives	:	Provide students with a thorough understanding and knowledge of the mechanical operating elements and adjustments. To make them aware of basics of different operations like size reduction, sedimentation, mixing, separation etc
Unit-I	:	**Particulate Solids:** Properties of solids, characterisation of solid particles, types of mixers, equipments like gravity settling, classifier, hydraulic jig, cyclones, Agglomeration, particle size analysis. (10 Hrs)
Unit-II	:	**Size Reduction and Separation:** Principles and laws of crushing, construction and working of equipments like jaw crusher, pulveriser, ball mill. Screening and screen efficiency, open and closed circuit grinding, power requirements, electrostatic separation,classifiers. (12 Hrs)
Unit-III	:	**Sedimentation and filtration:** Free and hindered settling, thickeners and settlers.Filter media, filter aids,constant pressure filtration,constant rate filtration,equipments like plate and frame press,rotary drum filter and filter leaf. Centrifugal filtration .floating agents. (12 Hrs)
Unit-IV	:	**Mixing and Agitation:** Agitation and mixing of liquids, power requirement and mixing index, dispersion operations, design of agitator and its effects on viscocity of liquids (10 Hrs)
Unit-V	:	**Membrane separation Process:** Classification of membrane processes, microfiltration, ultrafiltration, liquid membranes, membranes in filtration (10 Hrs)
Unit-VI	:	**Storage and conveying of solids:** Conveyors, elevators, pneumatic conveying, different methods of solids storage. (6 Hrs)

Reference Books:	:	Sr. No.	Title	Author	Publication	Edition
		1.	Unit Operations In Chemical Engineering	McCabe and Smith	McGraw Hill	
		2.	Chemical Engineering Vol.No.2	Richardson and Coulson	Butterworth Heinemann Titles	5th
		3.	Chemical Engineers Handbook	Perry and Chilton.	McGraw Hill	
		4.	Principles of Unit operations	Foust A.S and associates	John Wiley and Sons	

Section A: Includes Unit I, IV, V; **Section B**: Includes Unit II , III 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
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Syllabus of S. Y. B. Tech. (Plastics and Polymer Engineering) Semester-III

Code No.:PPE205
Teaching Scheme:04hrs/week
Theory: 3hrs/week
Tutorial: 1hr/batch/week
Credits: 4

Title: Introduction to Polymer Engineering
Class Test: 20 marks
Theory Examination (Duration): 3 Hours
Theory Examination (Marks): 80

Objectives	:	To provide a general overview of polymers, their types, molecular weight concept, structure- property relationship.
Unit-I	:	**Introduction to Polymers** Introduction to Historical Background of Polymer Science, Various applications of polymers, Raw materials, Market and future of polymers, India in global scenario. Macromolecular concept, structural features of polymers, Basic concepts and terminology like monomers, oligomers, telomers, polymers low polymers, high polymers, copolymers, functionality, degree of polymerization, thermoplastics, thermosets, elastomers/rubbers, plastics, fibers, adhesives. (10Hrs)
Unit-II	:	**Classification of Polymers** Classification based on structure, origin, fabrication, properties etc. Linear, branched, crosslinked polymers etc. Classification Nomenclature of polymers, Crystalline and Amorphous polymers. Brief idea of polyethylene, polypropylene, polystyrene, polyvinyl chloride, Novolac and resol, natural rubber, Styrene butadiene rubber. Adhesives. Fibers and surface coatings, Blends. (10Hrs)
Unit-III	:	**Molecular Weight & Molecular Weight Distribution:** Concept of average molecular weight of polymers Molecular Weight Distribution , Mw, Mn, Mv and Mz. Polydispersity index. (10Hrs)
Unit-IV	:	**Structure –Property Relationship (A):** Glass transition temperature, factors affecting glass transition temperature, melting point and factors affecting it, melt viscosity, Factors affecting Tensile strength, yield strength, modulus, density, impact strength. Heat Distortion Temperature, Vicat Softening Point, hardness. (10Hrs)
Unit-V	:	**Structure –Property Relationship (B):** Effect of thermal, photochemical and high energy radiation, ageing and weathering, diffusion and permeability, toxicity, fire & plastics. (10Hrs)

Unit-VI	:	**Structure –Property Relationship (C):** Dielectric constant, power factor and structure, quantitative relationships of dielectrics, electronic application of polymers, electrically conductive polymers, optical properties. (10Hrs)				
Reference Books:	:	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
		1.	Polymer Science & Technology	Joel R. Fried	Prentice Hall of India Pvt.Ltd.	3rd
		2.	Polymer Science & Technology of Plastics & Rubbers	P. Ghosh,	TataMcGraw Hill	2nd
		3.	Text Book of Polymer Science	F.W. Billmeyer	Wiley Interscience	3rd
		4.	Principles of Polymerisation	George Odian	Wiley Interscience	4th

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
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Syllabus of S. Y. B. Tech. (Plastics and Polymer Engineering) Semester-III

Code No.:PPE206
Teaching Scheme: 02hrs/week
Theory: 2hrs/week
Tutorial: -
Credits: 2

Title: Polymer Testing
Class Test: 10 marks
Theory Examination (Duration):2 Hours
Theory Examination (Marks): 40

Objectives	:	To study and understand the necessity of testing of various polymers.
Unit-I	:	Basic Concepts, Specifications and Standards, purpose of specifications, Purpose of testing, Basic specification format. (2 Hrs)
Unit-II	:	**Testing of polymers -I:** **a. Mechanical Properties:** Introduction, Tensile tests, Flexural properties, Compressive properties, Impact properties, Shear strength, Abrasion, Fatigue resistance, Hardness Tests. (4 Hrs)
		b. Thermal Properties: Introduction, Tests for elevated temperature performance-Heat distortion temperature, Vicat softening temperature, Long term heat resistance test, Thermal conductivity, Thermal expansion, Brittleness temperature (3 Hrs)
Unit-III	:	**Testing of polymers -II:** **a. Electrical Properties:** Introduction, Dielectric strength, Dielectric constant and dissipation factor, Electrical resistance test, Arc resistance. (3 Hrs)
		b. Optical properties: Introduction, Refractive Index, Luminous Transmittance and Haze, Visual colour evaluation, Gloss. (3 Hrs)
Unit-IV	:	**Testing of polymers -III:** **a. Material characterisation test:** Melt flow index, Capillary rheometer test, Viscosity test,Gel permeation chromatography, Material characterisation tests for thermosets – bulk density, bulk factor and pourability of plastic, viscosity tests for thermosets. (5 Hrs)
		b. Analytical Tests: Specific gravity tests, Density by density gradient technique, Water absorption tests, Moisture analysis, Burst strength test. (3 Hrs)

Unit-V	:	**Flammability:** Introduction, Flammability test, Ignition properties of plastics, Ignition temperature determination, Oxygen index test, UL 94 flammability test. (3 Hrs)
Unit-VI	:	**Chemical Properties:** Introduction, Immersion tests, Sfain resistance test, Solvent stress cracking resistance, Environmental stress cracking resistance, Acetone immersion test. (4 Hrs)

Reference Books:

Sr. No.	Title	Author	Publication	Edition
1.	Handbook of Plastics Test Methods	R.P. Brown	Longman Scientific and Technical	
2.	Handbook of Plastics Testing Technology	Vishu Shah	A Wiley Interscience	2nd
3.	Testing & Evaluation of Plastics.	Mathur & Bhardwaj	Allied publisher Pvt Ltd	
4.	Handbook of Plastics Test Methods.	J. A. Mead,G.V.Eves		
5.	Identification and Testing of Plastics	A.S. Athalye	Multi-Tech Publishing	

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 eight questions
2. Four 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 S. Y. B. Tech. (Plastics and Polymer Engineering) Semester-III

Code No.:PPE221 **Title: Organic Chemistry**
Teaching Scheme:02hrs/week **Teachers' Assessment**
Practical : 25 marks **Credits:1**
Termwork: 25 marks

Course Objectives	:	To study the Organic Chemistry applicable to Plastics and Polymer Engineering.
List of Practicals	:	1. Identification of functional groups : primary amine, carboxylic, phenolic, carbonyl, aromatic hydrocarbon. etc. 2. Solubility test and classification of the compound. 3. Preparation of derivative, conclusion, naming of the compound / structure of compound. 4. Detection of N, S and halogens in organic compounds. 5. Estimation of Phenol from given solution. 6. Estimation of Formaldehyde from given solution 7. Determination of the percentage purity of Styrene. 8. Determination of Iodine value of given compound. 9. Molecular weight determination by acid base titration method. 10.Determination of melting point of solid and boiling point of liquid organic compounds.

List of Reference Books :

Sr. No.	Title	Author	Publication	Edition
1.	Text book of Organic Chemistry	Bahl &Bahl	S Chand	18th
2.	Stereochemistry of Organic Compounds	P. S. Kalsi	New Age	5th
3.	Reactions, Reagents and Rearrangements	S. N. Sanyal	Bharti Bhavan	1st
4.	Organic Chemistry	F. A. Carry	Mc Graw Hill	3rd
5.	Practical Organic Chemistry	Frederick G.Mann and Bernard Charles Saunders	Longman Inc,New York	4th
6.	Organic Chemistry	T.W. Graham Solomons and Craig B.Fryle	John Wiley and Sons	7th

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 consists 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 S. Y. B. Tech. (Plastics and Polymer Engineering) Semester-III

Code No.:PPE222
Teaching Scheme:02hrs/week
Practical : 25 marks
Termwork:25 marks

Title: Mechanical Operation
Teachers Assessment
Credits:1

Course Objectives	:	To understand the working principles of various unit operations required in Plastics and Polymer Engineering.
List of Practicals	:	1. To find particle size distribution by sieve analysis. 2. To determine the effectiveness of double deck vibrating screen. 3. To determine the crushing efficiency, reduction ratio in jaw crusher. 4. To determine the crushing efficiency of pulveriser. 5. To determine the effect of dry grinding, critical speed of ball mill and effect of grinding with change in number of balls. 6. To determine the effect of wet grinding, critical speed of ball mill and effect of grinding with change in number of balls. 7. To determine the effect of diameter of the tank on batch settling. 8. To study constant pressure filtration characteristics and washing of cake in a plate and frame filter. 9. To study filter characteristics using vacuum filter. 10. To determine the efficiency of the grinder.

List of Reference Books :

Sr. No.	Title	Author	Publication	Edition
1	Unit Operations In Chemical Engineering	McCabe and Smith	McGraw Hill	
2	Chemical Engineering Vol.No.2	Richardson and Coulson	Butterworth Heinemann Titles	5th
3	Chemical Engineers Handbook	Perry and Chilton.	McGraw Hill	
4	Principles of Unit operations	Foust A.S and associates	John Wiley and Sons	

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 consists 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 S. Y. B. Tech. (Plastics and Polymer Engineering) Semester-III

Code No.:PPE223 | **Title: Introduction to Polymer Engineering-I**
Teaching Scheme:02 hrs/week | **Teachers Assessment**
Practical : 25 marks | **Credits:1**
Termwork:25 marks

Course Objectives	:	To study and test the various properties of plastic materials.
List of Practicals	:	1. Identification of polymers by i. Preliminary Tests like Cut Test, Drop Test, Float Test ii. Heating Tests, Solubility Tests iii. Confirmatory tests of specific polymers 2. Some Ready Tests for Identification of Specific polymers i. Tests for Cellulose and Cellulosics ii. Tests for Polyamides iii. Tests for Polystyrene 3. Determination of MFI of given polymer sample. 4. Determination of electrical properties like surface and volume resistivity of polymer. 5. Determination of acid value. 6. Determination of saponification value. 7. Determination of amine value.

List of Reference Books :

Sr. No.	Title	Author	Publication	Edition
1.	Polymer Science & Technology	Joel R. Fried	Prentice Hall of India Pvt.Ltd.	3rd
2.	Polymer Science & Technology of Plastics & Rubbers	P. Ghosh,	TataMcGraw Hill	2nd
3.	Handbook of Plastics Testing Technology	Vishu Shah	A Wiley Interscience	2nd
4.	Principles of Polymerisation	George Odian	Wiley Interscience	4th

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 consists 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 S. Y. B. Tech. (Plastics and Polymer Engineering) Semester-III

Code No.:PPE224 | **Title: Introduction to Polymer Engineering-II**
Teaching Scheme:02 hrs/week | **Teachers Assessment**
Practical : 25 marks | **Credits:1**
Termwork:25 marks

Course Objectives	:	To study and test the various properties of plastic materials.
List of Practicals	:	1. Measurement of viscosity average molecular weight of polymer. 2. Determination of heat deflection temperature of plastics. 3. Determination of Vicat softening point of plastics. 4. Determination of impact strength of given polymer sample. 5. Determination of specific gravity of polymers. 6. Determination of Mechanical Properties like Tensile strength, modulus. 7. Determination of hardness of polymers.

List of Reference Books :

Sr. No.	Title	Author	Publication	Edition
1.	Polymer Science & Technology	Joel R. Fried	Prentice Hall of India Pvt.Ltd.	3rd
2.	Polymer Science & Technology of Plastics & Rubbers	P. Ghosh.	TataMcGraw Hill	2nd
3.	Handbook of Plastics Testing Technology	Vishu Shah	A Wiley Interscience	2nd
4.	Principles of Polymerisation	George Odian	Wiley Interscience	4th

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 consists 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 S. Y. B. Tech. (Plastics and Polymer Engineering) Semester-III

Code No.:BSH 225 **Title: Development of Skills-II**
Teaching Scheme:02 hrs/week **Teachers Assessment**
Practical : - **Credits:1**
Termwork: 50 marks

Course Objective :	:	Students should adequately equip to face the highly competitive and very demanding corporate world of today.Soft skills encompass personal, social, communication, and self-management behaviors. They cover a wide spectrum of abilities and traits: being self-aware, trustworthiness, conscientiousness, adaptability, critical thinking, attitude, initiative, empathy, confidence, integrity, self-control, organizational awareness.			
List of Practicals	:	**Sr No**	**Section**	**Contents**	**Duration**
		1.	Soft skills and Functional English.	Basic of soft skills,Dimensions of soft skills, Misconception of soft skills. The changing business environment and its impact on soft skills, Presentation: Preparation, delivery, etc.Interview technique ,Group Discussion and Debate	5 Hrs
		2.	Nonverbal Communication. And Corporate etiquettes.	Body Language and its different aspects. Voice dynamics and voice modulation,ProfessionalAppearance, Clothing etiquettes and Corporate dressing, Dinning table etiquettes. etc.	6 Hrs
		3.	Business Correspondence	Official Drafting:Letter writing, Inquiry, Request, Complain, Sales, Follow-up. etc. Office documents like circulars, notices, minutes, agenda and memos. Report Writings: Types of reports, Data Interpretation: Compréhension of data, Analyses and Interprétations of data	6 Hrs
		4.	E-communication	Email communication and Email etiquettes ,Video Conferencing, and other e- communication	4 Hrs
		6.	Problem-Solving and self confidence	Collaborative problem-solving, Benefits of collaboration, Effective Conflict Communication, Conflict resolution styles, Defusing conflict, Evaluating the conflict, How to build confidence, How confident are you? Thinking like a confident person	5 Hrs

List of Reference Books	:	Sr. No.	Title	Author	Publication	Edition
		1.	The Ace of soft skills	Gopalaswamy Ramesh, Mahadevan Ramesh,	Pearson	
		2.	Presenting to Win	Jerry Weissman	Prentice Hall	
		3.	Technical communication	William Sanborn Pfeiffer, T.V.S.Padmaja	Pearson	
		4.	Presentation Skills for Managers		Mcgraw Hills	
		5.	Personality Development and soft skills		Oxford University Press	
		6.	Technical Report Writing Today:	DanielG.Riordan, Steven E .Pauley		
		7.	Technical Writing	B.N.Basu		
		8.	365 steps of self confidence	David Lawrence Preston	How To Books Ltd	

The term work shall be done on the ten assignments based on the topics mentioned above .And oral examination would be conducted internally on the syllabus mentioned.

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 S. Y. B. Tech. (Plastics and Polymer Engineering) Semester- IV

Code No.: BSH251
Teaching Scheme:04Hrs/week
Theory: 3hrs/week
Tutorial: 1hr/batch/week
Credits: 4

Title: Engineering Mathematics -IV
Class Test: 20 marks
Theory Examination (Duration):3 Hours
Theory Examination (Marks): 80

Objectives	:	The contents aims to develop the knowledge of the student in the direction of solving the practical problem in the engineering and technology related to Function of complex variable, transforms, Numerical Methods, Vectors.
Unit-I	:	**Function of complex variable** : Introduction , Analytic function ,Cauchy-Riemann equation in Cartesian and polar coordinates ,Harmonic function, orthogonal system , Integration in complex plane: Line integral, Contour integral, Cauchy's integral theorem , Cauchy's integral formula, Extension of Cauchy's theorem on multiply connected region Taylor's and Laurent's series(without proof), Singularities, Residues, Cauchy's residue theorem. (15Hrs)
Unit-II	:	**Application of Complex Variable:** Evaluation of real integrals: Integration along unit circle and along the upper half semi circle, Conformal Transformation, Bilinear transformation. (5Hrs)
Unit-III	:	**Vector Integration:** Line integral, Surface integral, Gauss divergent theorem, Stoke's theorem, Green's theorem, Curvilinear coordinates: Cylindrical and Spherical polar coordinates. (10Hrs)
Unit-IV	:	**Application of partial differential equation** : Solution of partial differential equation by method of separation variable Application to i. Vibration of a string (The wave equation), ii. One dimensional heat flow (The diffusion equation) iii. Two dimensional heat flow.(The-Laplace equation) (10Hrs)
Unit-V	:	**Z- transform :** Definition, Z-transform of elementary function , properties of Z-transform , Inverse Z-transform :Partial fraction method, inversion integral method(Residue method),Solution of Difference equation by using Z-transform. (8Hrs)
Unit-VI	:	**Numerical Method:** Solution of algebraic and transcendental equation, Newton Raphson method, Lagrange's interpolation, Solution of linear simultaneous equation; by Gauss elimination method, The Guass-seidal method,Solution of ordinary differential equations: Taylor series method, Fourth order Runge-Kutta method. (12Hrs)

Reference Books:	:	Sr. No.	Title	Author	Publication	Edition
		1.	A Text Book of Applied Mathematics Volume-II	P.N. Wartikar and J.N.Wartikar		
		2.	A Text Book Of Applied Mathematics Volume-III	P.N. Wartikar and J.N.Wartikar.		
		3.	Advanced Engineering Mathematics	H.K.Dass		
		4.	Higher Engineering Mathematics		Khanna Publishers	
		5.	Higher Engineering Mathematics	B.V.Ramana		
		6.	Solution to Higher Engineering Mathematics Volume–III	C.P.Gandhi		

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 S. Y. B. Tech. (Plastics and Polymer Engineering) Semester-IV

Code No.:PPE252
Teaching Scheme: 04hrs/week
Theory: 3hrs/week
Tutorial: 1hr/batch/week
Credits: 4

Title: Process Calculation
Class Test: 20 marks
Theory Examination (Duration): 3 Hours
Theory Examination (Marks): 80

Objectives	:	To study the calculations required in polymer process plants .
Unit-I	:	Basic units and conversion, Vapor pressure, Partial pressure, Ideal gas law, Weight percent, Mole percent and volume percent, Density of gas mixture. (15 Hrs)
Unit-II	:	Material balance without chemical reaction, Material balance with chemical reaction, Limiting reactant, Excess reactant, (9 Hrs)
Unit-III	:	Selectivity and yield, Recycle, Purge and bypass calculation. (6 Hrs)
Unit-IV	:	Thermochemistry, Energy balance with chemical reaction, Heat capacity, Standard heat of reaction, Standard heat of formation, Standard heat of combustion. (10 Hrs)
Unit-V	:	Humidity and saturation, Solubility and crystallization, Evaporation. (10 Hrs)
Unit-VI	:	Fuels and combustion, Theoretical and excess calculations. (10 Hrs)

Reference Books:

Sr. No.	Title	Author	Publication	Edition
1.	Stoichiometry	Bhatt and Vora	Tata McGraw Hill	4th
2.	Chemical Process Principles, Vol-I	Hougen and Watson	Asia Publishing House	2nd
3.	Basic principles and calculations in Chemical Engineering	D.M.Himmelblau	Prentice – Hall India	6th
4.	Introduction to Process Calculations	K.A. Gavhane	Nirali Prakashan	19th

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
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Syllabus of S. Y. B. Tech. (Plastics and Polymer Engineering) Semester-IV

Code No.:PPE253
Teaching Scheme:04hrs/week
Theory: 3hrs/week
Tutorial: 1hr/batch/week
Credits: 4

Title: Physical Chemistry of Polymers
Class Test: 20 marks
Theory Examination (Duration): 3 Hours
Theory Examination (Marks): 80

Objectives	:	Study of the physical structure of polymers and how their properties are dependent upon their internal structure.
Unit-I	:	Potential energy and conformational energy of molecules - Staggered and eclipsed states - conformations and configurations, Isomerism in polymers - Tacticity, stereoisomerism, geometric isomerism, Kinetic and thermodynamic flexibility of chain. (10 Hrs)
Unit-II	:	Determination of Molecular Weight : End Group Analysis, Osmometry, Light Scattering method, Viscosity Method, Gel Permeation Chromatography, Cryoscopic. (10 Hrs)
Unit-III	:	Spectral Analysis of Polymers: IR and Raman Spectra, UV and Visible absorption spectra, NMR and ESR Spectra, Mass Spectra. (10 Hrs)
Unit-IV	:	Polymer Solutions : Good solvent, bad solvent, theta solvent, solubility parameter, viscosity, Thermodynamics, theory, phase equilibrium, phase separation, mechanisms, kinetics, conformation of macromolecules in solution. (7 Hrs)
Unit-V	:	Thermal Analysis of Polymers: Thermogravimatric analysis, Differential Thermal Analysis, Differential Scanning Calorimetry, TMA-DTMA. (8 Hrs)
Unit-VI	:	**Polymerization Techniques** Idea of Bulk, Solution, suspension, emulsion and Interfacial Polymerization methods. (5 Hrs)
		Kinetics of Polymerisation Step growth and Chain growth polymerization, Ionic polymerization, Copolymerization , Coordination polymerization. (10 Hrs)

Reference Books:	:	Sr. No.	Title	Author	Publication	Edition
		1.	Organic Spectroscopy	William Kemp	Macmillan	
		2.	Introduction to Physical Polymer Science	L.H. Sperling	Wiley-Interscience, 2006.	
		3.	The Elements of Polymer Science and Engineering	A. Rudin	Academic Press, 1999	
		4.	Characterization of Polymers (Encyclopedia Reprints)	Edited by Norbert M. Bikales	Wiley - Interscience	
		5.	Stereochemistry of Organic Compounds: Principles and Applications	D. Nasipuri	New Age International (P) Ltd	
		6.	Polymer Chemistry: An Introduction - 3rd Edition"	Malcolm P. Stevens	Oxford University Press, New York	

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 S. Y. B. Tech. (Plastics and Polymer Engineering) Semester- IV

Code No.:PPE254
Teaching Scheme: 04hrs/week — **Title: Fluid Mechanics**
Theory: 3hrs/week — **Class Test: 20 marks**
Tutorial: 1hr/batch/week — **Theory Examination (Duration):3 Hours**
Credits: 4 — **Theory Examination (Marks): 80**

Objectives	:	Introduce concepts, principles, laws, observations, and models of fluids at rest and in motion. Provide basis for understanding fluid behavior and for engineering design and control of fluid systems.
Unit-I	:	Fluid static and its application, Fluid flow phenomenon, Newtonian & Non Newtonian behavior, Viscosity and momentum flux, nature of turbulence, deviating velocities in turbulent flow (10 Hrs)
Unit-II	:	Intensity and scale of turbulence, eddy viscosity, laminar and turbulent flow Basic equation of fluid flow, Continuity equation, Friction factors (8 Hrs)
Unit-III	:	Measurement of fluid flow, Orifice meter,Venturi meter,Pivot tube, Rota meter and other types of metering equipments like magnetic meter, turbine meter (12 Hrs)
Unit-IV	:	Laminar and Turbulent flow in pipes and closed channels, distribution of velocities, effect of fittings and valves, flow of compressible fluids (8 Hrs)
Unit-V	:	Pumps, centrifugal pump, design & operating characteristics of centrifugal pump, positive displacement pumps, reciprocating pump, vacuum pumps (12 Hrs)
Unit-VI	:	Flow past immersed bodies, drag coefficient, flow through beds of solids, motion of particles through fluids, mechanism of fluidization, pressure drop in fluidized bed, packed bed, Introduction to Computational fluid dynamics (10 Hrs)

Reference Books:	:	Sr. No.	Title	Author	Publication	Edition
		1.	Unit Operations in Chemical Engineering	McCabe and Smith	McGraw Hill	7th
		2.	Chemical Engineering Vol.No.I	Richardson and Coulson	Butterworth Heinemann Titles	5th
		3.	Fluid and Practical Mechanics	Michell S.J.	McGraw Hill	
		4.	Fluid Mechanics	V.I.Streeter	McGraw Hill	1st
		5.	Fluid Mechanics & Hydraulic Machinery	R.K.Bansal	Laxmi Publication	9th
		6.	Chemical Engineers Handbook	Perry and Chilton	McGraw Hill	8th
		7.	Introduction to Chemical Engineering	Badger and Banchero	McGraw Hill	
		8.	Chemical Engineering Fluid Mechanics	Ron Darby	Dekkar Publications	2nd

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 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
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Syllabus of S. Y. B. Tech. (Plastics and Polymer Engineering) Semester-IV

Code No.:PPE255
Teaching Scheme: 04hrs/week
Theory: 3hrs/week
Tutorial: 1hr/batch/week
Credits: 4

Title: Thermoplastic Resins
Class Test: 20 marks
Theory Examination (Duration): 3 Hours
Theory Examination (Marks): 80

Objectives	:	To study various thermoplastic resins.
Unit-I	:	**Plastics Materials:** Introduction, Basic raw materials required for manufacturing of thermoplastics, Basic difference of resin and polymers, Natural and synthetic resins, Market and future for thermoplastics, Major thermoplastic producers in India.Position of India in global scenario, Identification codes of thermoplastics. (3 Hrs)
Unit-II	:	**Natural Plastics:** Casein: Chemical nature , Isolation of casein from milk, Production of casein plastics, properties and applications. Shellac: Occurrence and preparation, Chemical composition, properties, applications. Cellulose: Structure of cellulose, Nature and occurrence of cellulose, Preparation, Properties and application of various cellulose derivatives- Cellulose Esters(Cellulose acetate. Cellulose nitrate).Cellulose ethers, Viscose Rayon Starch: Occurance, Structure, Properties and Applications. Miscellaneous Plastics: Miscellaneous Protein Plastics, Bituminous Plastics,Silk,Wool. (12 Hrs)
Unit-III	:	**Olefins:** **a. Polyethylene:** Raw materials, Synthesis and Properties of ethylene homopolymers-LDPE,HDPE,CSM AND CPE. Raw materials , Synthesis and Properties of Ethylene copolymers-LLDPE, EVA, Ionomers, Applications of ethylene homo and copolymers. (8 Hrs)
		b. Polypropylene: Raw materials. Synthesis and properties of polypropylene, Atactic and Syndiotactic polypropylene, Chlorinated polypropylene, Ethylene propylene copolymer, BOPP, Cast polypropylene, Applications. (7 Hrs)

Unit-IV	:	**Polystyrene:** Polymerisation of styrene, Grades available, Structure and properties of PS, Modifications of PS to high impact grades, SAN copolymer, ABS, SMAn, Stereoregular Polystyrene, Applications. (6 Hrs)
Unit-V	:	**Poly vinyl chloride:** Polymerisation of vinyl chloride, Structure and properties of PVC, Characterisation of commercial polymers, Degradation and stabilization of PVC, Applications Miscellaneous products: Polyvinyl Alcohol, Polyvinyl Acetate, Crystalline PVC, Chlorinated PVC,Saran, Vinyl chloride-Propylene copolymer. (6 Hrs)
Unit-VI	:	**Engineering plastics:** **a. Acrylics:** Different types of acrylic plastics,Synthesis of PMMA,Structure ,properties and applications of PMMA,MMA with enhanced impact resistance and softening point, Thermosetting acrylic polymers , Synthesis of PAN,PAN fiber formation, Modacrylic fibers. (7 Hrs)
		b. Polyamides: Intemediates for aliphatic polyamides-Adipic acid,Hexamethylene diamine, ω-aminoundecaonic acid,Caprolactum,Dodecanlactum, ω -aminoenanthic acid,Nomenclature of nylon, General methods of synthesis of aliphatic polyamides-Nylon6,66,610,11,12, Properties and applications of nylons, Aromatic polyamides (7 Hrs)
		c. Polytetrafloroethylene: Preparation, Properties, Processing and Applications. (4 Hrs)

Reference Books: :

Sr. No.	Title	Author	Publication	Edition
1.	Textbook of Polymer Science	Golding	Van Nostrand Reinhold company	
2.	Plastics Materials	J.A.Brydson		6th
3.	Introduction to Polymer Science	MG Arora, M Singh	Amol	
4.	Textbook of Polymer Science	PL Nayak, S Lenka	Kalyani	2nd
5.	Introduction to Polymer Science	G S Mishra	Wiley Eastern Limited	

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
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Syllabus of S. Y. B. Tech. (Plastics and Polymer Engineering) Semester-IV

Code No.:PPE256
Teaching Scheme: 02hrs/week — **Title: Additives of Polymers**
Theory: 2hrs/week — **Class Test: 10 marks**
Tutorial: - — **Theory Examination (Duration):2 Hours**
Credits: 2 — **Theory Examination (Marks): 40**

Objectives	:	To study the properties and applications of various additives being used in polymers.
Unit-I	:	Introduction, basic requirement of use of additives in polymers, different types of additives used in plastics and rubbers. (2 Hrs)
Unit-II	:	**Fillers and reinforcements:** Carbon black-types and manufacturing processes, different grades, characterisation of carbon black: particle size, DBP absorption, tint value, acid value, pH, ash content, iodine number,, their practical significance, mechanism of reinforcement, effect of structure and particle size on processing and physical properties of rubbers, surface chemistry of carbon black and its effect on rubber filler interaction, Non-black reinforcing fillers and their manufacturing process, properties and applications, Carbon fibres, Boron Fibres, Ceramic Fibres, Whiskers, Electrically conducting fillers, Semi/non reinforcing fillers, calcium carbonate, clay, barytes, silicates, talc, grades and applications . (8 Hrs)
Unit-III	:	**Processing aids:** **a. Plasticisers:** Plasticisers and plasticising, anti plasticisers and anti plasticising, theories of plasticising and plasticiser effect-Lubrication theory, solvation theory, thermodynamic theory, polarity theory, Petroleum based process oils-aromatic, napthenic and paraffinic, their properties, characteristics, applications, Synthetic plasticisers – DOP, DBP, polymeric plasticisers, their properties, characteristics, applications,Testing of plasticisers. (3 Hrs)
		b. Lubricants : Types, effect of lubricants, rosins, factice, zinc stearate, importance. (2 Hrs)
Unit-IV	:	**Stabilisers:** Antioxidants, antiozonants, their mechanisms, testing of antioxidants, waxes, Photodegradation of polymers, mechanisms of UV stabilisation: UV absorbers, quenchers, hydroperoxide decomposers, free radical scavangers, PVC stabilsers: Organotin, Metal carboxylate, lead stabilisers, Ba/Ca, Ba/Zn, Ca/Zn stabilizers. (7 Hrs)

Unit-V	:	**Colourants:** Pigments and dyes: white pigments, Titanium dioxide, black colourants, Azo pigments, nonazo pigments, dyes. (4 Hrs)
Unit-VI	:	**Curing agents:** Vulcanising agents: Zinc oxide, stearic acid, accelerators, sulphur, organic peroxides as cross linking agents: hydroperoxides, alkyl peroxides, peroxyesters. (4 Hrs)

Reference Books:	:	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
		1.	Test Book of Polymer Science	F.W. Billmeyer	Wiley Interscience	3rd
		2.	Rubber Chemistry	J.A. Brydson		
		3.	Rubber Technology	C.M. Blow		
		4.	Natural & Synthetic Rubber	H.J. Stern		

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 eight questions
2. Four 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 S. Y. B. Tech. (Plastics and Polymer Engineering) Semester-IV

Code No.:PPE271
Teaching Scheme:02hrs/week
Practical : 25 marks
Termwork:25 marks

Title: Physical Chemistry of Polymers
Teachers Assessment
Credits:1

Course Objectives	:	To study the physical structure of polymers and understand how their properties are dependent upon their internal structure.
List of Practicals	:	1. End group analysis by Potentiometric titration. 2. Determination of molecular weight by conductometric titration. 3. Determination of softening point of polymer. 4. Determination of solubility parameter. 5. Determination of swelling parameter. 6. Determination of structure of polymer by UV. 7. Determination of structure of polymer by IR. 8. Determination of Tg and Tm of polymer by DSC. 9. Determination of refractive index of polymer solutions

List of Reference Books :

Sr. No.	Title	Author	Publication	Edition
1.	Organic Spectroscopy	William Kemp	Macmillan	
2.	Introduction to Physical Polymer Science	L.H. Sperling	Wiley-Interscience, 2006.	
3.	The Elements of Polymer Science and Engineering	A. Rudin	Academic Press, 1999	
4.	Characterization of Polymers (Encyclopedia Reprints)	Edited by Norbert M. Bikales	Wiley - Interscience	
5.	Polymer Chemistry: An Introduction -	Malcolm P. Stevens	Oxford University Press, New York	3rd
6.	Stereochemistry of Organic Compounds: Principles and Applications	D. Nasipuri	New Age International (P) Ltd	

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 consists 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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Code No.:PPE272
Teaching Scheme:02hrs/week
Practical : 25 marks
Termwork:25 marks

Title: Fluid Mechanics
Teachers Assessment
Credits:1

Course Objectives	:	To study and understand practically the concepts, principles, laws, observations, and models of fluids at rest and in motion.
List of Practicals	:	1. To find the nature of the flow by Reynolds's apparatus. 2. To find the discharge coefficient for orifice meter. 3. To find the discharge through venturimeter. 4. Bernoulli's equation. 5. Characteristics of Centrifugal pump. 6. Losses due to pipe fitting. 7. Flow through fittings. 8. To study different types of Valves and fittings. 9. Friction in straight venturimeter and orifice meter. 10. Flow through packed and fluidized bed.

List of Reference Books :

Sr. No.	Title	Author	Publication	Edition
1.	Unit Operations in Chemical Engineering	McCabe and Smith	McGraw Hill	7th
2.	Chemical Engineering Vol.No.I	Richardson and Coulson	Butterworth Heinemann Titles	5th
3.	Fluid and Practical Mechanics	Michell S.J.	McGraw Hill	
4.	Fluid Mechanics	V.I.Streeter	McGraw Hill	1st
5.	Fluid Mechanics & Hydraulic Machinery	R.K.Bansal	Laxmi Publication	9th
6.	Chemical Engineers Handbook	Perry and Chilton	McGraw Hill	8th
7.	Introduction to Chemical Engineering	Badger and Banchero	McGraw Hill	
8.	Chemical Engineering Fluid Mechanics	Ron Darby	Dekkar Publications	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.

Practical Examination

The practical examination shall consists 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 S. Y. B. Tech. (Plastics and Polymer Engineering) Semester-IV

Code No.:PPE273 | **Title: Thermoplastic Resins-I**
Teaching Scheme:02hrs/week | **Teachers Assessment**
Practical : 25 marks | **Credits:1**
Termwork:25 marks

Course Objectives	:	To prepare various thermoplastic resins.
List of Practicals	:	1. Acetic acid content in cellulose acetate. 2. To find out degree of acetylation in cellulose acetate. 3. Preparation of viscose rayon. 4. Preparation of cellulose film by solvent casting method. 5. Preparation of Polyvinyl alcohol from Polyvinyl acetate. 6. Synthesis of polymer by interfacial polymerisation technique. 7. Free radial polymerization of acrylamide.

List of Reference Books :

Sr. No.	Title	Author	Publication	Edition
1.	Textbook of Polymer Science	Golding	Van Nostrand Reinhold company	
2.	Plastics Materials	J.A.Brydsón		6th
3.	Introduction to Polymer Science	MG Arora, M Singh	Amol	
4.	Textbook of Polymer Science	PL Nayak, S Lenka	Kalyani	2nd
5.	Introduction to Polymer Science	G S Mishra	Wiley Eastern Limited	

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 consists 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 S. Y. B. Tech. (Plastics and Polymer Engineering) Semester-IV

Code No.:PPE274 **Title: Thermoplastic Resins-II**
Teaching Scheme:02hrs/week **Teachers Assessment**
Practical : 25 marks **Credits:1**
Termwork:25 marks

Course Objectives	:	To prepare various thermoplastic resins.
List of Practicals	:	1. Preparation of PS by emulsion polymerization technique. 2. Preparation of PMMA by bulk polymerization technique. 3. Precipitation polymerization of acrylonitrile. 4. Determination of moisture content of calcium carbonate, silica, carbon black, china clay. 5. Determination of pH of calcium carbonate, silica, carbon black, china clay. 6. Determination of ash content of calcium carbonate, silica, carbon black, china clay. 7. To determine the plasticizer absorption percentage of PVC. 8. To determine aniline point of process oils.

List of Reference Books :

Sr. No.	Title	Author	Publication	Edition
1.	Textbook of Polymer Science	Golding	Van Nostrand Reinhold company	
2.	Plastics Materials	J.A.Brydson		6th
3.	Introduction to Polymer Science	MG Arora, M Singh	Amol	
4.	Textbook of Polymer Science	PL Nayak, S Lenka	Kalyani	2nd
5.	Introduction to Polymer Science	G S Mishra	Wiley Eastern Limited	

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 consists 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 S. Y. B. Tech. (Plastics and Polymer Engineering) Semester-IV

Code No.:PPE275
Teaching Scheme:02hrs/week
Practical : -
Termwork:50 marks

Title: Design Lab-I(CAD)
Teachers Assessment
Credits:1

Course Objectives	:	To provide the student with an appreciation of the capabilities of the CAD - 2D software. Course topics include basic AutoCAD commands and functions as well as practical applications.

List of Practicals :

Unit	Contents	Duration
1	**Introduction:** **a.** Starting computer and opening AutoCAD **b.** Use and construct icons for drawing in AutoCAD **c.** Save, edit and start new drawings	2 Hrs.
2	**Layers, Colors and Line Type:** Manage drawing using layers, color and line types	2 Hrs.
3	**Creating Objects Dimensioning:** **a.** Make basic Geometric shapes **b.** Complete Basic CAD drawings, with borders, text and dimensions	4 Hrs.
4	**Creating Objects Dimensioning:** **a.** Use of Paper Space, and Model space **b.** Use and edit TEXT and TEXT styles	2 Hrs.
5	**Creating Objects Dimensioning:** Use of Break, Chamfer, Fillet, Measure, Divide, Rotate, Scale, Lengthen and Explode commands	2 Hrs.
6	**Editing Objects:** Edit drawings with ERASE, OOPS, COPY, EXTEND, TRIM, MIRROR, UNDO REDO and MOVE commands	4 Hrs.
7	**Editing Objects:** **a.** USE of Array, Modify and Hatch **b.**Use Grips, GRID, OSNAP, and Functions keys	2 Hrs.
8	**Layout, Plotting & Printing** Plot drawings in A, B, C, and D sizes to correct scales	2 Hrs.
9	**Blocks, Attributes & X-Ref:** **a.** Insert Blocks, Files and Raster images into drawings **b.** Create Blocks, Bitmaps and W blocks	2 Hrs.
10	**3D Modeling:** Use of AutoCAD for Modeling basic shapes in 3D	2 Hrs.

List of Reference Books	:	Sr. No.	Title	Author	Publication	Edition
		1.	AutoCAD 2012: A problem solving Approach	Sham Tickoo	Autodesk Press, USA	
		2.	AutoCAD 2012 Essentials	Scott Onstott	John Wiley & Sons	
		3.	AutoCAD 2012 Dummies	David Byrens	John Wiley & Sons	

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.