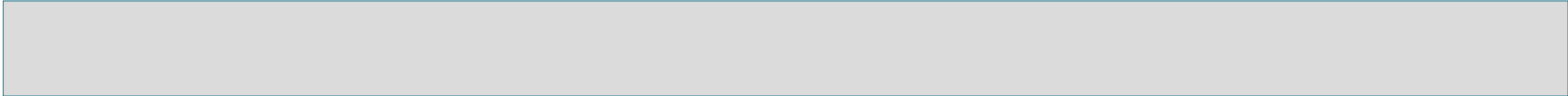




**Faculty of Science and
Technology**

**Proposed Honours* in major
Disciplines Bachelor of
Plastic and Polymer
Engineering
(With effect from A.Y. 2022-23)**



Bachelor of Plastic and Polymer Engineering With effect from 2022-23

Honours in Surface Coating Technology

Year & Semester	Course Code	Course	Teaching Scheme Hours / Week			Examination Scheme and Marks								Credit Scheme		
			Theory	Tutorial	Practical	Mid-Semester-1	Mid-Semester-2	CIE	Teachers Assessment	End-Semester	Term work	Practical	Total Marks	Theory / Tutorial	Practical	Total Credit
SY IV	PPE901	Introduction to Paint Technology	04	--	--	15	15	10	10	50	--	--	100	04	--	04
	PPE971	Laboratory	--	--	02	--	--	--	--	--	25	--	25	--	01	01
		Total		04	-	02			100			25	--	125	04	01
Total Credits=05																
TY V	PPE902	Corrosion Science and Technology	04	--	--	15	15	10	10	50	--	--	100	04	--	04
		Total	04	-	-			100			--	--	100	04	--	04
Total Credits=04																
TY VI	PPE903	Coating Technology	04	--	--	15	15	10	10	50	--	--	100	04	--	04
	PPE972	Laboratory	--	--	02	--	--		--	--	25	--	25	--	01	01
		Total	04	--	02			100			25	--	125	04	01	05
Total Credits=05																
Final B. Tech. VII	PPE904	Advanced Surface Coating Technology	04	--	--	15	15	10	10	50	--	--	100	04	--	04
		Total	04	--	--			100			--	--	100	04	--	04
Total Credits=04																
Final B. Tech. VIII	PPE973	Mini Project	--	02	--	--	--		--	--	25	25	50	--	02	02
		Total	--	02	--	--	--		--	--	25	25	200	--	02	02
Total Credits=02																
Total Credit for Semester IV+V+VI+VII +VIII= 20																

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Department of Plastic and Polymer Engineering Syllabus of S. Y. B. Tech. Honours/Minor (Semester-IV)	
Course Code: PPE901 /PPE971 Course: Introduction to Paint Technology Teaching Scheme: Theory: 04 Hrs/week Tutorial: 00 Hr/week Practical: 02 Hrs/week	Credits: 4-0-1 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs
Prerequisite	Basics of Polymer Chemistry
Objectives	<ul style="list-style-type: none"> The students will have basic understandings of the commonly used terminologies, various ingredients and their role in paint formulations. The students will have in-depth exposure to manufacturing, characterizations, and applications of paint.
Unit-I	Introduction: Definition, importance, classification of paint, basic concept and definition of monomer; polymer; oligomer; telomer; macromolecules; functionality; polymerization. Molecular weight of polymer: its distribution and determination, classification of Polymer. Structure and property of polymer. <p style="text-align: right;">(10 Hrs)</p>
Unit-II	Components of paint: Base, Binders: Chemistry and Technology of Synthetic resins viz. Alkyds, Polyester, Phenolics, Amino, Acrylic & Vinyl resins: Raw materials for these resins, Chemistry of synthesis of these resins, processing techniques, properties & applications of these resins for surface coatings. Pigments, Filler, drier, thinner, extenders, solvents etc. <p style="text-align: right;">(8 Hrs)</p>
Unit-III	Paint Manufacturing: Principles of paint formulation, steps in paint manufacture- mixing, grinding, letdown, thinning, tinting (shade matching), straining, phenomenon of wetting, grinding and dispersion. Paint manufacturing methods and equipments: sand mill, ball mill, high speed disperser (HSD). General hazards. <p style="text-align: right;">(6 Hrs)</p>
Unit-IV	Surface modification and paint application methods: Importance of surface preparation, various surface preparation methods such as chemical, electrochemical, mechanical like sand blasting, shot peening, vapor phase degreasing, carburizing, nitriding, cyaniding, hot dipping, galvanizing, chromating, anodizing, phosphating etc. Laser assisted surface modification, Paint application and curing methods, paint defects: settling, skinning, orange peels, pin holes, crater, etc. <p style="text-align: right;">(8 Hrs)</p>
Unit-V	Additive used in paint formulation: Definition and function of additives, use of wetting and dispersing agents, anti-skin, rheology modifier (flow promoter, sag, leveling agents, shear thickener, shelf stability promoter etc.), mar resistance, anti-foam, anti-settling, corrosion inhibitor, biocide, adhesion promoter and photo-stabilizers. <p style="text-align: right;">(8 Hrs)</p>
Unit-VI	Characterization: Viscosity, specific gravity, drying time, hardness (pencil hardness, pendulum hardness, scratch hardness etc.), brief idea about rheological, optical and morphological characterization of paint, thermal barrier, corrosion, chemical and weather resistance properties. <p style="text-align: right;">(8 Hrs)</p>

	Sr. No.	Title	Author	Publication	Edition
References	1.	Basics of Paint Technology, Vol I	V.C. Malshe		1 st ed. 2000
	2.	Basics of Paint Technology, Vol II	V.C. Malshe		1 st ed. 2008
	3.	Introduction to Paint Chemistry & Principle of Paint Technology	Turner G.P	Chapman & Hall.	3 rd ed., 1988
	4.	Paints and Surface Coatings	R.Lambourne,TA Strivens	Elsevier	2 nd edition, 1999
	5.	Testing of paints : technical analysis of paints and paint raw materials	Shreekant Patil	Colour Pub	2009
	6	Paint flow and pigment dispersion.	T.C.Patton		2 nd ed,1979
	7	Outlines of Paint Technology	W.M.Morgans		3 rd Ed.

List of Practical (Any 8 practical to be conducted)

- 1) Synthesis & characterization of various surface coating resins.
- 2) Preparation of different architectural & industrial coatings.
- 3) Preparation of organic & inorganic pigments.
- 4) Paint application & curing, shade matching.
- 5) Determination of acid value, iodine value and saponification value of oils.
- 6) Determination of the physical properties of liquid paints, varnishes & lacquers such as color, weight per liter, fineness of grind, viscosity, non volatile content, spreading capacity.
- 7) Determination of the physical properties of dry films of paints, varnishes & lacquers
- 8) Determination of mechanical properties of dry film paints, varnishes & lacquers.
- 9) Determination of optical properties of dry films of paints, varnishes & lacquers.
- 10) Determination of chemical resistance properties of dry films of paints, varnishes & lacquers.

<p style="text-align: center;">Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Department of Plastic and Polymer Engineering Syllabus of T. Y. B. Tech. Honours/Minor (Semester-V)</p>					
Course Code: PPE902 Course: Corrosion Science and Technology Teaching Scheme: Theory: 04 Hrs/week Tutorial: 00 Hr/week Practical: 00 Hrs/week			Credits: 4-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs		
Prerequisite	Physical chemistry of materials.				
Objectives	<ul style="list-style-type: none"> • To enable the students to understand the methodologies for predicting, measuring, and analyzing corrosion performance of materials. • To enable the students to identify various methods of corrosion prevention. 				
Unit-I	Introduction: Electrochemical and thermodynamic principles, electrode potential of metals, EMF and galvanic series, Faraday's laws, Theory of corrosion, action of corroding environment. <div style="text-align: right;">(6 Hrs)</div>				
Unit-II	Electrochemical Kinetics of corrosion: Corrosion rate expressions, exchange current density, polarization, passivity, electrochemical behaviour of active-passive metals, factors governing metals exhibiting passivity, mixed potential theory and its application. <div style="text-align: right;">(9 Hrs)</div>				
Unit-III	Corrosion in industries: Corrosion in fossil fuel & power plants, automotive industry, aerospace industry, chemical processing industries, corrosion in petroleum production operations and refining, corrosion of pipelines. Corrosion in space environment. <div style="text-align: right;">(9 Hrs)</div>				
Unit-IV	Forms of Corrosion: Atmospheric, galvanic, crevice, pitting, stress corrosion cracking, intergranular corrosion, corrosion fatigue, cavitation, fretting corrosion and high temperature oxidation-description. <div style="text-align: right;">(8 Hrs)</div>				
Unit-V	Corrosion prevention: Corrosion prevention by design improvements, material selection, anodic and cathodic protection, metallic, non-metallic and inorganic coatings, mechanical and chemical methods and various corrosion inhibitors, pigments, binders & additives for corrosion prevention, recent developments in corrosion protection materials <div style="text-align: right;">(8 Hrs)</div>				
Unit-VI	Corrosion measurement & testing: Purpose of testing, laboratory, semi-plant and field tests, susceptibility tests of Intergranular corrosion, stress corrosion cracking and pitting, ASTM standards for corrosion testing; polarization methods to measure corrosion rate, surface characterisation techniques. <div style="text-align: right;">(8 Hrs)</div>				
References	Sr. No.	Title	Author	Publication	Edition
	1.	Principles and Prevention of Corrosion	D. A. Jones	Prentice Hall, USA,	2nd edition, 1996

	2.	Corrosion Engineering	Fontana, M.G.	McGraw-Hill, USA	3 rd edition
	3.	Corrosion Control	Samuel A. Bradford	Springer	1 st edition, 1993
	4.	Fundamentals of corrosion: mechanisms, causes, and preventative methods	Philip A. Schweitzer	CRC Press	1 st edition, 2009

<p align="center">Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Department of Plastic and Polymer Engineering Syllabus of T. Y. B. Tech. Honours/Minor (Semester-VI)</p>					
Course Code: PPE903/PPE972 Course: Coating Technology Teaching Scheme: Theory: 04 Hrs/week Tutorial: 00 Hr/week Practical: 02 Hrs/week		Credits: 4-0-1 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs			
Prerequisite	Basics of paint technology				
Objectives	<ul style="list-style-type: none"> To make the students aware of the essential components of paints and coatings To make the students familiar with the basic and recent advancements in coating technologies 				
Unit-I	Introduction: Concepts & terminologies, classification of coatings interfacial tension, free energy changes, wetting, dispersion, cohesive and adhesive forces, chemistry & technology of surfactants. <p align="right">(6 Hrs)</p>				
Unit-II	Technology of water based paints & coatings: Preparation of latex for paints, chemistry and technology of emulsion and latex paints, developments in waterborne coating <p align="right">(6 Hrs)</p>				
Unit-III	Various surface coatings: Preparation and characteristics of Coil coating, UV cured coating, Anti-corrosive coating, Non stick coating, Automotive coating, Road marking coating, Insulating coating, Metallic coating, Leather coating, and Fire-retardant/Fire resistive coating. <p align="right">(12 Hrs)</p>				
Unit-IV	Powder coatings, Varnishes and Lacquers: Powder coating, Dry distempers, Cement paints, Oil based distempers and paints, Other stiff paints, Putties, Technology of manufacturing varnishes, lacquers and their applications. <p align="right">(8 Hrs)</p>				
Unit-V	Technology of construction chemicals: Adhesives & sealants, Waterproofing compounds, and Polymeric additives for concrete admixtures. Specific application of paints and coatings: Wood finishes, Road marking paint and Novelty finishes <p align="right">(6 Hrs)</p>				
Unit-VI	Study of important characteristics of surface coating : Rheological properties, Optical properties, Adhesion and mechanical properties, Corrosion and chemical resistance properties, Film thickness, Liquid paint analysis according to ASTM, BIS and BS standards, Characterization of varnishes according to ASTM, BIS and BSS Standards. <p align="right">(10 Hrs)</p>				
References	Sr. No.	Title	Author	Publication	Edition
	1.	Chemistry, Materials and Properties of surface coatings	Gungor Gundoz	Destech Pub	

2.	Surface Coating Technology Handbook	NPCS Board	Asia Pacific Business Press	
3.	Modern Technology of Paints, Varnishes & Lacquers	NIIR Board	National Institute Of Industrial Research	January 2005
4.	Paints and Surface Coatings	R.Lambourne,TA Strivens	Elsevier	2 nd edition, 1999
5.	Testing of paints : technical analysis of paints and paint raw materials	Shreekant Patil	Colour Pub	2009
6.	Coating Technology Handbook	Edited by Arthur A. Tracton	Taylor & Francis	3 rd Edition, 2005
7.	Modern Surface Technology	Edited by F. W. Bach, K. Mohwald, A. Laarmann, T. Wenz	WILEY-VCH	2006

List of Practical (Any __8__ practical to be conducted)

1. To determine opacity of paint film.
2. To determine the drying time of a paint film.
3. To determine the temperature stability of paint film.
4. Determining the washability and cleanability of paint film.
5. Evaluate alkyd resin based on long, medium and short oil alkyd and phthalic content.
6. Analyse synthetic enamel based on its gloss and scratch resistance.
7. To test the solvent, acid, alkali and light resistance of pigments.
8. Formulate a paint using different pigment value concentration values.
9. Analyse emulsion paint for its non volatile matter content and % solids content.
10. Analyse a synthetic enamel based on its corrosion resistance by salt spray.

<p align="center">Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Department of Plastic and Polymer Engineering Syllabus of Final Year B. Tech. Honours/Minor (Semester-VII)</p>					
Course Code: PPE904 Course: Advanced Surface Coating Technology Teaching Scheme: Theory: 4 Hrs/week Tutorial: 00 Hr/week Practical: 00 Hrs/week			Credits: 4-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs		
Prerequisite	<ul style="list-style-type: none"> • Physical chemistry of materials. • Fundamentals of paint technology • Basics of corrosion science and technology 				
Objectives	<ul style="list-style-type: none"> • To develop understanding of various surface modification techniques to improve the surface properties and to evaluate their properties • To provide a comprehensive overview of the latest developments in thin films • To develop competence and skills to select the suitable thin film deposition techniques/surface modification methods for a certain application • To understand the types and uses of advanced coatings, their application, and associated quality control 				
Unit-I	Surface modification techniques: Surface engineering by material removal and material addition; Surface modification of ferrous and nonferrous metals- carburizing, nitriding, cyaniding, hot dipping, galvanizing, chromating, anodizing, phosphating of aluminium; Surface engineering by energy beams, Plasma for surface engineering, Laser assisted surface modification <p align="right">(8 Hrs)</p>				
Unit-II	Film deposition techniques: Sputter deposition of thin films and coatings by RF, MF, DC, Magnetron, Pulsed laser, Ion beam, Ion implantation, electroplating, electroless plating, electro polishing, electroforming, chemical vapour deposition (CVD) and plasma enhanced CVD, atomic layer deposition, atomic layer chemical vapour deposition, molecular beam epitaxy, lithography, Langmuir Blodgett, Spin coating <p align="right">(8 Hrs)</p>				
Unit-III	Inter diffusion, reactions and transformations in thin films: Fundamentals of diffusion, Inter-diffusion in thin metal films, Mass transport in thin films; Properties and characterization of thin films- optical, electrical, mechanical and magnetic, structural morphology of deposited films and coating <p align="right">(8 Hrs)</p>				
Unit-IV	Surface engineering of nanomaterials: Hybridization of nanomaterials, microencapsulation, synthesis, processing and characterization of nanostructured coatings and their application <p align="right">(8 Hrs)</p>				
Unit-V	Various smart coatings: Electrodeposition coating, Hygienic coating, High temperature coating, Aerospace coating, Thermal sensitive coating, Electrical conducting coating, Optical fiber coating, Pharmaceutical tablet coating, Textiles for coating, Self cleaning and self healing coatings. <p align="right">(10 Hrs)</p>				
Unit-VI	Marine coatings: Fouling of surfaces, Paint optimization, Paint formulation, Surface preparation, Theoretical and practical coverage, Paint application <p align="right">(8 Hrs)</p>				
References	Sr	Title	Author	Publication	Edition

No.				
1.	Coating Technology Handbook	Edited by Arthur A. Tracton	Taylor & Francis	3 rd Edition, 2005
2.	Modern Surface Technology	Edited by F. W. Bach, K. Mohwald, A. Laarmann, T. Wenz	WILEY-VCH	2006
3.	Modern Surface Technology	Edited by Friedrich-Wilhelm Bach, Andreas Laarmann, and Thomas Wenz	WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany	2006
4.	Frontiers of Thin Film Technology,	M. H. Francombe, S. M. Rossnagel, A. Ulman	Academic press, Vol. 28	2001
5.	Thin Film Phenomena, Deposition Technologies for Films and Coatings	K. L. Chopra,	McGraw Hill, R.F. Bunshah Noyes Publications, New Jersey	1982
6.	Materials Science of Thin Films	M. Ohring	2nd ed., Academic Press.	2002
7.	Electroplating	F. A. Lowenheim,	McGraw Hill, New York, 1978	
8.	Introduction to Tribology	B. Bhushan	John & Sons, New York	2002
9.	Engineering Tribology,	G.W. Stachowiak, A.W. Batchelor,	3rd ed., Elsevier-Butterworth-Heinemann,	2005
10.	ASM Metals Handbook, Surface Engineering,	-	American Society for Metals, Vol.5, 9th ed.,	1994

11.	Nanomaterials and Surface Engineering,	Edited by Jamal Takadoum	John Wiley & Sons, Inc., USA	-
12.	Marine Paint Web link: https://www.mistra.org/wp-content/uploads/2010/10/Marine-Paint-FinalReport_2003-2011-ENG.pdf			
13.	Marine Coatings, HILONG Web link: http://en.hilonggroup.com/uploads/files/MARINE%20Coatings%20Brochure.pdf		Shanghai Hilong Shine New Material Co.,Ltd	-

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

Course Code: PPE973
 Course: Mini Project
 Teaching Scheme:
 Practical: 04 Hrs/week

Teamwork: 25 Marks
 Practical: 25 Marks
 Credit: 2

Objectives

- To carry out a mini project and simple prototype in the area of interest based on knowledge gained in Surface Coating Technology. There will be three major reviews which will be carried out as listed below.

	Review	Requirement	Mark Weightage	
			Internal	External
	0	Area / Title selection	-	-
	1	Literature Review/Proposal for the mini project	10%	-
	2	Prototype Modelling	20%	-
	3	Final working presentation of project	20%	-
	End semester exam	Final viva project demonstration	-	50%

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.

Note:

1. No additional fees will be charged for students opting for Honours/ Minor Degree
2. All the courses in the Honours/ Minor will be conducted in offline mode.
3. Re-examination is not applicable in Honours and Minor Scheme. Student failing in any of the Minor or Honours courses, at any stage will be discontinued from the Scheme.

4.Examination Scheme:

A student shall be evaluated for his/her academic performance in a course through tutorials, practical, homework assignments, term papers, field work, seminars, quizzes, Mid Semester Examinations (MSE), and the End- Semester Examination (ESE) as applicable according to the guidelines formulated for this purpose.

There would be at least two MSE, out of which one may be online examination during the semester. The weightage of the MSE for the course having ESE of 60 marks will be of 15 for MSE-1 and 15 for MSE-2 having duration of 1 Hr and the MSE performance shall be considered as an addition of two MSEs.

At the end of the semester, there would be an End Semester Examination as per syllabus. The minimum percentage for passing for each course code, term work and practical examination is 40 %, failing which he/she will get D grade for that course code. This rule will be progressively applicable for higher classes in next consecutive years.

5.Rule for combined passing:

- 1.To pass the examination a candidate must obtain minimum 40% of Marks in each Mid Semester Examination (MSE), Teachers Assessment (TA) and End Semester Examination (ESE), taken together, however the candidate must obtain minimum 35% of Marks in the End Semester Examination.
- 2.To pass a Course where there is no provision of MSE, the candidate must obtain 40% of Marks in the End Semester Examination.
- 3.Minimum two-MSEs should be conducted in semester for a Course, if provided. The addition of performances in two-MSEs should be forwarded to the Controller of Examinations.
- 4.If the candidate remains absent for the MSE, his/her performance should be treated as 'Zero' Marks.