Syllabus for Multi-Disciplinary Minor (MDM) Degree

In

Surface Coating Technology

Under the National Education Policy- NEP 2020

(2023-2024)

Offered by

DEPARTMENT OF POLYMER AND SURFACE ENGINEERING

Institute of Chemical Technology

(University Under Section-3 of UGC Act, 1956)

Elite Status and Center for Excellence

Government of Maharashtra

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A. PREAMBLE

Welcome to the Department of Polymer and Surface Engineering, where innovation meets material science. Our commitment to advancing the field is unwavering, fostering a dynamic environment for research, learning, and discovery. Explore the intricate world of polymers and surfaces as we embark on a journey to shape the future of materials engineering.

Within the Department of Polymer and Surface Engineering, we delve into the fascinating realm of polymers, examining their diverse applications and manipulating their properties to meet the evolving needs of technology and industry. Our focus extends beyond conventional materials as we explore cutting-edge advancements in polymer science.

The department also places a significant emphasis on surface engineering, a crucial discipline that addresses the interface between materials and their environments. Through meticulous research and experimentation, we unravel the complexities of surface interactions, paving the way for innovative solutions in areas such as adhesion, coatings, and biomaterial interfaces.

Our faculty comprises distinguished experts and researchers, dedicated to pushing the boundaries of knowledge in polymer and surface engineering. Students within our programs benefit from a curriculum that blends theoretical foundations with hands-on experiences, preparing them for careers at the forefront of materials innovation.

Collaboration is at the heart of our ethos, as we engage with industry partners and interdisciplinary teams to tackle real-world challenges. Whether you are a student eager to explore the intricacies of materials or a researcher seeking a vibrant academic community, the Department of Polymer and Surface Engineering welcomes you to join us on this journey of discovery and transformation. The Surface Coating Technology Multidisciplinary Minor Degree is a career-focused curriculum that offers both technical and fundamental understanding of paint and coating technologies. One learns about the many fixings—pitch, polymers, colors, and so forth—that are used in the preparation and application of paint in this area of surface coating technology. Understanding the science behind each component of the paint and how it affects the final attribute of the paint is essential to coating or paint innovation. In Surface Coating Technology, students will study the many kinds of paints and resins, how they are synthesized, what are the components, how to use them, and the techniques that are used to apply them.

B. Programme Specific Outcomes (PSOs)

Multidisciplinary Minor Degree

Polymer Engineering and Technology

PSO1	**Polymer material analysis**: Able to analyze and classify different types of polymers and polymer chemistry.
PSO2	**Fundamentals of resin processing**: Able to understand and explain various resins and properties required for coating application.
PSO3	**Manufacturing of coating**: Fundamental knowledge of different types of machinery used for paints formation.
PSO4	**Evaluation and characterization of coating**: Different types of characterization methods for coatings and polymers.
PSO5	**Developing high performance coating**: Able to develop sustainable coating material that meets the specified needs with appropriate environmental considerations.

C. Recommended batch size: **Minimum 15; Maximum 35**

D. Duration: **Three years**

E. **Eligibility criteria:**

First and Second semester CGPA. If second semester CGPA is not available, then first semester CGPA and students HSC CET/ JEE percentile. In addition to this preference will be given to students based on their score in the first-year courses such as Chemistry theory and practical courses.

F. **Prerequisites:** 12th Standard Physics, Chemistry and Maths / JEE

G. **Pedagogy/ Teaching method:**

Lecture/Discussions: The course material will be covered in these sessions.
Experiential Learning: The sessions will involve demonstrating some machines used for Paint processing as well as coating characterizations.
Tutorials: Problem solving / case studies / relevant real-life applications / student presentations / home assignments / individual or group projects

H. Method of Evaluation/Delivery:

Subject Code	Semester	Course	Method of Evaluation	Methods of Delivery
PST1101	III	Polymer Science & Technology I	• Mid-Semester Examination • End-Semester Examination • Four class tests • Assignments • Seminar/ Presentation • Report submission on case studies	• Lectures • Tutorials • Case studies • Presentations • Practical/ Demonstrations • Projects (Individual and/or group)
SCT1201	IV	Introduction to Coating Technology	• Mid-Semester Examination • End-Semester Examination • Four class tests • Assignments • Seminar/ Presentation • Report submission on case studies	• Lectures • Tutorials • Case studies • Presentations • Practical/ Demonstrations • Projects (Individual and/or group)
PST1303	V	Polymer Chemistry and Technology	• Mid-Semester Examination • End-Semester Examination • Four class tests • Assignments • Seminar/ Presentation • Report submission on case studies	• Lectures • Tutorials • Case studies • Presentations • Practical/ Demonstrations • Projects (Individual and/or group)
PST1612	VI	Technology of Thermoset Polymers	• Mid-Semester Examination • End-Semester Examination • Four class tests • Assignments • Seminar/ Presentation • Report submission on case studies	• Lectures • Tutorials • Case studies • Presentations • Practical/Demonstrations • Projects (Individual and/or group)
SCT1703	VII	Additives and Processing of Paint	• Mid-Semester Examination • End-Semester Examination • Four class tests • Assignments • Seminar/ Presentation • Report submission on case studies	• Lectures • Tutorials • Case studies • Presentations • Practical/Demonstrations • Projects (Individual and/or group)
SCT1801	VIII	Paint Technology II	• Mid-Semester Examination • End-Semester Examination	• Lectures • Tutorials

			• Four class tests • Assignments • Seminar/ Presentation • Report submission on case studies	• Case studies • Presentations • Practical/Demonstrations • Projects (Individual and/or group)

I. Structure of MDM Course:

Semester	Course Code	Subjects	Credits	Hrs/Week			Marks for various Exams			
				L	T	P	CA	MS	ES	Total
III	PST1101	Polymer Science & Technology I	2	1	1	0	20	30	50	100
IV	SCT1201	Introduction to Coating Technology	2	1	1	0	20	30	50	100
V	PST1303	Polymer Chemistry and Technology	4	3	1	0	20	30	50	100
VI	PST1612	Technology of Thermoset Polymers	2	1	1	0	20	30	50	100
VII	SCT1703	Additives and Processing of Paint	2	1	1	0	20	30	50	100
VIII	SCT1801	Paint Technology II	2	1	1	0	20	30	50	100
		TOTAL:	**14**	**8**	**6**	**0**				**600**

J. Instructors (Tentative):

Semester	Course Code	Subjects	Faculty
III	PST1101	Polymer Science & Technology I	APM
IV	SCT1201	Introduction to Coating Technology	ASS
V	PST1303	Polymer Chemistry and Technology	VF (MAS)
VI	PST1612	Technology of Thermoset Polymers	VF (SJ)
VII	SCT1703	Additives and Processing of Paint	ASS/ VF
VIII	SCT1801	Paint Technology II	VF

K. Detailed Syllabus:

MDM-I	Course Code: PST1101	Course Title: MDM-I: Polymer Science & Technology I	Credits = 2		
			L	T	P
	Semester: III	Total Contact Hours: 30	1	1	0

List of Prerequisite Courses
HSC (Science)
List of Courses where this course will be prerequisite
Introduction to Coating Technology, Polymer Chemistry and Technology, Technology of Thermoset Polymers, Additives and Processing of Paint, Paint Technology II
Description of relevance of this course in the MDM programme
To train the students with respect to the basics of polymers, Overview of Polymer and Coating Industry Manufacturing Chemistry, properties applications of monomers for synthetic and natural polymers and their handling hazards.

	Course Contents (Topics and Subtopics)	Required Hours
1	Overview of Polymer and Coating Industry, Historical developments in polymeric materials with introduction and classification of polymers	5
2	Basic concepts & definitions: monomer & functionality, oligomer, polymer, repeating units, degree of polymerization, molecular weight & molecular weight distribution commodity engineering polymers specialty polymer definitions	15
3	Manufacturing Chemistry, properties applications of raw material for synthetic polymers like Ethylene, propylene, butadiene, vinyl chloride, vinylidene dichloride, styrene etc.	10
	Total	**30**

List of Textbooks/Reference Books	
1	Raw Materials for Industrial Polymers by H Ulrich, Hanser Publication1989.
2	Principles of Polymer Science, by Bahadur and Sastry, Narosa Publishing House 2002.
3	Polymer Science by Gowarikar, Johan wiley and Sons 1986.
4	Encyclopedia of Polymer Science and Technology, Johan Wiley and Sons, Inc 1965.
5	Encyclopedia of Polymer Science and Engineering, Johan Wiley and Sons, Inc 1988.
6	Petrochemicals: The Rise of an Industry by Peter H. Spitz, Johan Wiley and sons 1988.
7	Polymer Chemistry by Malcolm P. Stevens, Oxford University Press, Inc, 1990
Course Outcomes (Students will be able to….)	
CO1	Identify the basic concept of monomer, polymer and repeating units and their properties (K1)
CO2	Define the physical and chemical properties of raw materials (K1)
CO3	Describe the manufacturing routes and impurities in monomers and raw materials (K1)
CO4	Demonstrate plan about evaluation of raw materials and reactants for synthesis & manufacturing of resins and polymers. (K2)

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)						
		PSO1	PSO2	PSO3	PSO4	PSO5
CO1	K1	3	3	2	3	3
CO2	K1	3	3	2	2	1
CO3	K1	3	3	1	3	2

CO4	K2	2	3	3	2	3
Course	K2	3	2	3	3	3

3, Strong Contribution; 2, Moderate Contribution; 1, Low Contribution; 0, No Contribution

K, Knowledge level from cognitive domain; A, Affective domain; P, Psychomotor domain

MDM-II	**Course Code: SCT1201**	**Course Title: MDM-II : Introduction to Coating Technology**	**Credits = 2**		
			L	**T**	**P**
	Semester: IV	**Total Contact Hours: 30**	**1**	**1**	**0**

List of Prerequisite Courses
HSC (Science), Polymer science and technology I
List of Courses where this course will be prerequisite
Polymer Chemistry and Technology, Technology of Thermoset Polymers, Additives and Processing of Paint, Paint Technology II
Description of relevance of this course in the MDM programme
To teach students basic concepts of coating industry so that they can have good base to learn other subjects

	Course Contents (Topics and Subtopics)	**Required Hours**
1	Introduction to the coating of materials and various subtract	6
2	Various types of resin materials	8
3	Various techniques for the application of paint	8
4	Types of paint anticorrosive, decorative, flame-retardant, antimicrobial, hydrophobic	8
	Total	**30**

List of Textbooks/Reference Books	
1	Surface coating (Volume 1) Oils and color coating association Australia
2	Basic of paint technology by V.C. malshe
3	Outlines of paint technology by morgan (hard cover)
4	Resins for surface coating by P.K.T.oldring
Course Outcomes (Students will be able to….)	
CO1	Define the fundamental principles of coating technology and its significance in protecting and enhancing material properties (K1)
CO2	Examine the characteristics and applications of various types of resin materials used in coating technology (K1)
CO3	Explain the different techniques employed for the application of paint, evaluating their advantages and limitations in specific contexts (K2)
CO4	Describe the distinct properties and purposes of anticorrosive, decorative, flame-retardant, antimicrobial, and hydrophobic paints, and compare their effectiveness in diverse settings (K2)

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)						
		PSO1	PSO2	PSO3	PSO4	PSO5
CO1	K1	3	1	3	2	1
CO2	K1	3	2	2	2	2
CO3	K2	3	3	3	3	2
CO4	K2	3	3	2	3	1

Course	K2	3	3	2	3	3

3, Strong Contribution; 2, Moderate Contribution; 1, Low Contribution; 0, No Contribution

K, Knowledge level from cognitive domain; A, Affective domain; P, Psychomotor domain

MDM -III	**Course Code: PST1303**	**Course Title: MDM-III : Polymer Chemistry & Technology**	**Credits = 4**		
			L	**T**	**P**
	Semester: V	**Total Contact Hours: 60**	**3**	**1**	**0**

List of Prerequisite Courses

HSC (Science), Polymer Science & Technology, Introduction to Coating Technology

List of Courses where this course will be prerequisite

Technology of Thermoset Polymers, Additives and Processing of Paint, Paint Technology II

Description of relevance of this course in the MDM programme

To teach students basic concepts of Polymer chemistry & Technology so that they can have good base to learn other subjects

	Course Contents (Topics and Subtopics)	**Required Hours**
1	Detailed classification of polymers Addition, condensation, commodity engineering and speciality copolymers, Monomer structure and Polymerizability. Crystalline/amorphous, step growth /chain growth, homochain / heterochain, crystalline / amorphous polymers, confirmation etc.	5
2	Homo& copolymers, graft, block alt, ladder etc. & nomenclature, configuration: cis/trans; tacticity, branched/ crosslinked, Addition and condensation polymerization mechanism	5
3	Techniques of polymerization: bulk, solution, suspension, emulsion, plasma etc.	5
4	Molecular weight and its distribution determination methods (Mn to Mz+1& MWD, Poly dispersity Index), calculations & problems based on it,	5
5	Carothers equation for condensation polymers & conditions to get high or desired molecular weight, calculations & problems based on it.	5
6	Transition temperatures such as Tg, Tc, Tm, their relevance to properties &processing and factors affecting them	5
7	Solubility parameter, solution properties, temperature, good/ bad solvent.	5
8	Different initiating systems such as free radical polymerization, redox with examples & their use choice of initiator half-life period. Measurement of polymer viscosity by different method	5
9	Copolymerization, reactivity ratios & kinetics of copolymerization (copolymer composition equation). Polymerization: Probability and statistics-statistics of polycondensation, chain polymerization, branching and gelation. Copolymer sequence distribution	5
10	Basic Rheological concepts of polymer solutions and melts, Newtonian / non Newtonian, time dependent/ independent	5
11	Mixing operations: Typical agitation system, dissolution, suspension, removal of water condensates high speed (low viscosity) stirring, low speed (high viscosity) stirring selection criterion, power consumption. Heat transfer characteristics, powder mixing times etc	5

12	Commercial applicability of Polymers as Plastics, paints, rubbers, fibers & adhesives	5
	Total	**60**
List of Textbooks/Reference Books		
1	Principles of Polymer Science, Bahadur and Sastry, Narosa Publishing House 2002	
2	Polymer Science, Gowarikar, Johan wiley and Sons 1986	
3	Encyclopedia of Polymer Science and Technology, Johan Wiley and Sons, Inc 1965	
4	Encyclopedia of Polymer Science and Engineering, Johan Wiley and Sons, Inc 1988	
5	Polymer Chemistry, Malcolm P. Stevens, Oxford University Press, Inc, 1990.	
6	Text book of polymer Science, Billmeyer, John Wiley ans Sons 1984.	
7	Principles of Polymer Systems, Rodriguez, Hemisphere Publishing Corpn, 1982	
8	Introduction to Polymer Science and Technology, H. S. Kaufman and J. J. Falcetta, Wiley – Inter science Publication, 1977	
9	Principles of polymerization, G. Odian, Wiley – Inter science (1981)	
Course Outcomes (Students will be able to…..)		
CO1	Define the basics of polymers, various terminologies and classifications of polymers. (K1)	
CO2	Calculate the problems regarding Calculation of MW – MWD & its relevance (K3)	
CO3	Interpret the basics of rheology & its effect on processing & application, mixing operations. (K2)	
CO4	Differentiate various techniques of polymerization & initiating systems (K2)	
CO5	Classify the various types of copolymerization & their commercial applications. (K2)	

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)						
		PSO1	PSO2	PSO3	PSO4	PSO5
CO1	K1	3	2	3	2	1
CO2	K3	3	3	2	3	2
CO3	K2	2	2	3	2	1
CO4	K2	3	3	2	3	2
CO5	K2	3	3	2	3	2
Course	K3	3	3	2	3	2

3, Strong Contribution; 2, Moderate Contribution; 1, Low Contribution; 0, No Contribution

K, Knowledge level from cognitive domain; A, Affective domain; P, Psychomotor domain

MDM -IV	**Course Code: PST1612**	**Course Title: MDM-IV: Technology of Thermoset Polymers**	**Credits = 2**		
			L	**T**	**P**
	Semester: VI	**Total Contact Hours: 30**	**1**	**1**	**0**
List of Prerequisite Courses					
Polymer Science & Technology, Introduction to Coating Technology, Polymer Chemistry & Technolog					
List of Courses where this course will be prerequisite					
Additives and Processing of Paint, Paint Technology II					
Description of relevance of this course in the MDM programme					
To give understanding of alkyd resins, types, synthesis, properties and modification of alkyd resins. Understanding of polyester resins, raw materials used and various curing systems. Basics of Phenolics,					

polyurethane, silicone and acrylics resins. Their synthesis, modification, processing, chemistry and applications.		
	Course Contents (Topics and Subtopics)	**Required Hours**
1	Alkyd resins Basic components like polyfunctional alcohols, poly-basic acids, vegetable oils/fatty acids. Different types of drying oils: drying, semi-drying and non-drying with examples. Influence of all these components in the synthesis and properties of the final alkyds obtained.	5
2	Polyesters Resins – unsaturated polyesters resins: Raw material: poly-basic acids, polyfunctional glycols. Curing of resins through unsaturation of the resin/polymer backbone. Curing systems, catalysts and accelerators. Molding compositions, fibre and film forming compositions	5
3	Phenolics. Basic Components of the polymer. Different kinds of phenols to aldehyde on the nature and the property of the polymer. Theory of resinification and effect of pH on the reaction mechanism and the reaction product. Curing of Phenolics.	5
4	Polyurethanes – Theromoplastic and Thermoset: Basic components diisocyanates and diols, different diisocyanates and diols used Reactions of isocyanates with various other functional groups synthesis of polymers polyurethane foams, polyester and polyether foams.	5
5	Thermosetting acrylics: Synthesis of acrylic polymers and co- polymers, different techniques. Structure property relationship application of thermosetting acrylics, like anaerobic adhesives, laminating resins, etc	5
6	Miscellaneous thermosetting polymers	5
	Total	**30**
List of Textbooks/Reference Books		
1	Text book of Polymer Science by Bill Meyer, John Wiley Ans Sons 1984.	
2	Encyclopedia of Polymer Science and Technology, Johan Wiley and Sons, Inc 1965.	
3	Encyclopedia of Polymer Science and Engineering, Johan Wiley and Sons, Inc 1988.	
4	Polymer Chemistry by Malcolm P. Stevens, Oxford University Press, Inc, 1990.	
5	Introduction to Polymer Science and Technology by H. S. Kaufman and J. J. Falcetta, Wiley – Interscience Publication, 1977	
6	Handbook of Thermoplastics, O. Olabisi, Marcel Dekker, 1997.	
7	Resins for Surface Coatings, Polyurethanes Polyamides Phenolplasts Aminoplasts Maleic Resins (Waterborne & Solvent Based Surface Coatings Resins & Applications) (Volume III) Volume III Edition	
8	Resins for Surface Coatings, Volume 1 2nd Edition, Resins for Surface Coatings: Acrylics and Epoxies 2nd Edition by H. Coyard (Author), P. Deligny (Author), N. Tuck (Author), P. K. T. Oldring (Editor)	
9	Resins for surface coating- Oldring series	
10	Basics of Paint Technology Part I, V. C. Malshe.	
11	Organic coatings science and technology, third edition, Zeno Wicks, 2007	
12	Plastics Materials J. A. Brydson, Butterworth Scientific, 1990.	
13	Polymer chemistry, Seymour and Carraher, Marcel Dekker, 2003.	
14	Polymer and Resins; Their Chemistry and Chemical Engg, Brage Golding, D. Van Nostrand Company Inc, 1959.	
15	Structures of Cellulose, Atlla, American Chemical society, 2003.	

16	Polymer Technology by Miles and Briston Falcetta, Wiley – Interscience Publication, 1977
17	Polymer Technology by Miles and Briston
Course Outcomes (Students will be able to…..)	
CO1	To describe the basics of alkyd resins and differentiate between the various types of alkyds. To understand the chemistry of alkyd resins and provide inputs for modification of alkyds. (K1)
CO2	To describe the chemistry of polyurethanes. Compare the various raw materials and their reactivity for polyurethanes and provide inputs for modification (K1)
CO3	Explain the importance of polyester resins. (K2)
CO4	Interpret the role of various types of phenolic resin in polymer and paint industry (K2)
CO5	Differentiate between various chemistries of acrylic and polyester (K2)

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)						
		PSO1	PSO2	PSO3	PSO4	PSO5
CO1	K1	3	3	2	3	2
CO2	K1	3	3	2	3	2
CO3	K2	3	3	2	2	2
CO4	K2	3	2	1	2	1
CO5	K2	3	3	2	3	2
Course	K2	3	3	2	3	2

3, Strong Contribution; 2, Moderate Contribution; 1, Low Contribution; 0, No Contribution

K, Knowledge level from cognitive domain; A, Affective domain; P, Psychomotor domain

MDM-V	**Course Code: SCT1703**	**Course Title: MDM-V: Additives and processing of paint**	**Credits = 2**		
			L	**T**	**P**
	Semester: VII	**Total Contact Hours: 30**	**1**	**1**	**0**
List of Prerequisite Courses					
Polymer Science & Technology, Introduction to Coating Technology, Polymer Chemistry & Technology, Technology of thermoset polymers					
List of Courses where this course will be prerequisite					
Paint Technology II					
Description of relevance of this course in the MDM programme					
1. To study various properties of pigments and extenders 2. To understand the basics of pigment dispersion. 3. To study different processing techniques of paint. 45. To study properties and application of various additives.					
	Course Contents (Topics and Subtopics)		**Required Hours**		
1	An overview of paint additives, types of Coating additives, and the Main Technical Trends, need and importance additives.		3		
2	Pigment wetting and dispersing additives, Rheological additives, Substrate wetting additives.		3		
3	Defoamers and Antioxidants and formulation stabilizers, Surface control additives: flow, leveling, matting agents, Additives to improve adhesion, slip.		5		

4	Thickeners, Surface Active agents, and Additives for surface modification.	4
5	Machinery for grinding of pigments and extender, Paint manufacturing machinery for pigment dispersion (Ball mill, Sand mill, Attritor mills, basket mill, caddy mills, twin shaft dispenser, alpine mills, horizontal vs. vertical mills, etc.)	6
6	Manufacture of Powder Coatings, dry distempers, cement paints, oil-based distempers, paints, other stiff paints, putties, etc.	4
7	Manufacturing of alkyds, emulsions, and hard resins, filtration of resins, and paints; forming of hard resins, marking and labeling of packaged products, Plant layout, Inventory control.	5
	Total	**30**
List of Textbooks/Reference Books		
1	Additives for coating, Johan Bieleman , 2008	
2	Handbook Of Coating Additives, John J. Florio, Daniel J. Miller · 2004	
3	Basics of Paint Technology Part I, V. C. Malshe.	
4	Organic coatings science and technology, third edition, Zeno Wicks, 2007	
5	Encyclopedia of Polymer Science and Technology, Johan Wiley and Sons, Inc1965	
6	Encyclopedia of Polymer Science and Engineering, Johan Wiley and Sons, Inc1988	
Course Outcomes (Students will be able to….)		
CO1	Interpret and discuss about various pigments and additives for a particular application, need and working principle of each additive (K2)	
CO2	Describe synthesis techniques for alkyds and different commonly used paints (K2)	
CO3	Demonstrate activities related to the grinding and dispersion methods of pigments and extenders in paint formulations (K3)	
CO4	Compare the various pigments, the dosage and choose various types of additives based on formulation (K4)	

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)						
		PSO1	PSO2	PSO3	PSO4	PSO5
CO1	K2	2	2	3	2	1
CO2	K2	1	3	2	2	2
CO3	K3	2	2	3	1	2
CO4	K3	2	2	2	2	1
Course	K4	2	3	3	2	2

3, Strong Contribution; 2, Moderate Contribution; 1, Low Contribution; 0, No Contribution

K, Knowledge level from cognitive domain; A, Affective domain; P, Psychomotor domain

MDM -VI	**Course Code: SCT1801**	**Course Title: MDM-VI: Paint Technology II**	**Credits = 2**		
			L	**T**	**P**
	Semester: VIII	**Total contact hours: 30**	**1**	**1**	**0**
List of Prerequisite Courses					
Polymer Science & Technology I, Introduction to Coating Technology, Polymer Chemistry and Technology Technology of Thermoset Polymers, Additives and Processing of Paint					
List of Courses where this course will be prerequisite					
NIL					

Description of relevance of this course in the MDM programme		
To give understanding of industrial manufacturing processes, properties and applications, processing of various types of high-performance paints and coatings. Knowledge of subject will help students conduct research and development in high-performance paints and coatings, their formulation development, etc. To make aware of Environmental concerns of high-performance paints and coatings e.g., release of VOCs and the effect of VOCs on the environment.		
Sr. No.	**Course Contents (Topics and subtopics)**	**Required Hours**
1	Paints industry overview, Problems, and prospects	2
2	Formulation of Primers, zinc rich epoxy, Micaceous iron oxide, zinc chromate and tetraoxy and terraoxy chromate zinc phosphate- based primers, wash primers	5
3	Anti-fouling coatings, Paints for marine environments, vinyl paints	3
4	Road marking paints, Cement paints	2
5	Automotive protection products, paints, finishing and refinishing, Electrodeposition coatings, UV curable coatings	4
6	Coatings for high temperature, Coatings for aerospace and aircraft	3
7	Electrical insulation coatings, Electrical conducting coatings, Thermal-sensitive paints, Thermal Insulating paints	4
8	Metallic paints, Powder coatings, Coil coatings, Wood finishing, strippable coatings, lacquers	4
9	Treatment of air for paint application, Surface treatment, and paint application methods, Treatment of over sprays	3
10	Coatings for high temperature, Coatings for aerospace and aircraft	
	Total	**30**
List of Text Books/ Reference Books		
1	Polymer Chemistry: A Practical Approach (The Practical Approach in Chemistry Series)1st Edition Fred J. Davis Oxford University Press 2004.	
2	Basics of Paint Technology Part I, V. C. Malshe.	
3	Polymer Science by Gowarikar, John Wiley and Sons 1986.	
4	Resins for Surface Coatings, Polyurethanes Polyamides PhenolplastsAminoplasts Maleic Resins (Waterborne & Solvent Based Surface Coatings Resins & Applications) (Volume III) Volume III Edition	
5	Resins for Surface Coatings, Volume 1 2nd Edition, Resins for Surface Coatings: Acrylics and Epoxies 2nd Edition by H. Coyard (Author), P. Deligny (Author), N. Tuck (Author), P. K. T. Oldring (Editor)	
6	Basics of Paint Technology Part II, Part 2, V. C. Malshe, Prakash C. Malshe, 2008 - Coatings - 624 pages	
7	Principles of polymerization, G. Odian, Wiley – Interscience (1981)	
8	Outlines of Paint Technology Hardcover – December 1, 2000 by Morgan (Author)	
Course Outcomes (students will be able to….)		
CO1	Compare various types of paint based on their formulation and application (K2)	
CO2	Illustrate various factor affecting synthesis, application of paint and ability to solve the problems observed during either manufacturing or during application of paint. (K3)	
CO3	Experiment the paint recipe based on its final application. (K3)	
CO4	Explain methods of substrate surface treatment, paint application and curing mechanisms (K4)	
CO5	Select the various ingredients for paint formulations. (K4)	

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)						
		PSO1	PSO2	PSO3	PSO4	PSO5
CO1	K2	3	3	2	3	2
CO2	K3	3	3	2	3	2
CO3	K3	3	3	2	3	3
CO4	K4	3	2	2	1	2
CO5	K4	2	1	3	2	1
Course	K4	3	3	3	3	3

3, Strong Contribution; 2, Moderate Contribution; 1, Low Contribution; 0, No Contribution

K, Knowledge level from cognitive domain; A, Affective domain; P, Psychomotor domain