Department of Polymer & Surface Engineering
Four Semesters
Master of Technology Degree Examination Syllabus

Surface Coating Technology

Semester III

Laboratory project work on the title of the thesis registered for the degree of M. Tech. in Polymer Engineering and Technology

Semester IV

Laboratory project work on the title of the thesis registered for the degree of M. Tech. in Polymer Engineering and Technology

Total credits: SEM I+SEM II = 42

Semester I

No		Course code	Subjects	Hours/ week (L + T)	Marks	Credits
1	Core I	**PST 2201**	Advanced Polymer Science	2+1	50	3
2	Core II	**PST 2202**	Advanced Surface Coating Technology I	2+1	50	3
3	Core III		Physical Methods of Analysis	2+1	50	3
4	Elective I	**PST 2602**	Environment Friendly Coatings	2+1	50	3
5	Elective II		To be selected from the pool of electives*	2+1	50	3
6	Project I	**PSP 2101**	Literature Review of Research Topic.	2+1	50	3
7	Project II	**PSP 2201**	Seminar	2+1	50	3
			TOTAL	**14+7**	**350**	**21**

Semester II

No		Course code	Subjects	Hours/week (L + T)	Marks	Credits
1	Core IV	**PST 2402**	Additives for Coatings	2+1	50	3
2	Core V	**PST 2203**	Advanced Surface Coating Technology II	2+1	50	3
3	Core VI	**PST 2503**	High Performance Coatings	2+1	50	3
4	Core VII	**PST 2105**	High Polymer Chemistry	2+1	50	3
5	Elective III	**PST 2701**	Corrosion Science and Corrosion Prevention	2+1	50	3
6	Elective IV		To be selected from the pool of electives*	2+1	50	3
7	Project I	**PSP 2301**	Literature Review of Research Topic.	2+1	50	3
			TOTAL	**14+7**	**350**	**21**

*Electives offered from our own or any other department

Note: Department will offer the subject provided more than 5 students are opting the course.

Elective I & III: No restriction on students if the students from other Department are willing to take this course.

SEMESTER I
SYLLABUS

Code & Title of the Course	**PST 2201 Advance Polymer Science** Core I
Marks	**50**
Number of Hours per Week	L + T (2**+1**)
Credits	**3**
Class	**M.Tech. Surface Coating Technology**
Semester	**I**

Sr.No.	**Topic**	**Hrs**
1	Mechanism of polymerization. Stereospecific polymerization. Newer methods of synthesis of polymers. Special purpose polymers.	24
2	Characterization and properties of polymers.	8
3	Polymer solutions. Relation between properties and structure, crystallinity and orientation. Crosslinking of Polymer & Elastomers. Polymer degradation.	18

Textbooks/Sourcebooks:

1. Textbooks/Sourcebooks: Nanomaterials: from research to applications by Hideo Hosono
2. Nanomaterials: an introduction to synthesis, properties and application by Dieter Vollath
3. Nanomaterials: synthesis, properties, and applications by Alan S. Edelstein, Robert C. Cammarata
4. Nanomaterials handbook by Yury Gogotsi

Code & Title of the Course	**PST 2202 Advance Surface Coating Technology-I** Core II
Marks	**50**
Number of Hours per Week	L + T (2**+1**)
Credits	**3**
Class	**M.Tech. Surface Coating Technology**
Semester	**I**

Sr.No.	Topic	Hrs
1	Newer developments in chemistry and synthesis of surface coating binders such as epoxies, urethancs, acrylics, silicones and others.	12
2	Various formulations based on these binders for different applications. Inorganic binders.	18
3	Developments in pigments for typical end applications.	6
4	Concept of ecofriendly pigments in surface coatings.	8
5	Developments in Resin & Testing Methods.	6

Textbooks/Sourcebooks:

1) Introduction to Paint Chemistry by Turner
2) Pigment Hand Book Part 1, 2,3 by Patton
3) Encyclopedic Hand book of Emulsions Technology by Sjoblom
4) Paint Film Defects by Hess
5) Industrial Organic Pigments by W. Herbst
6) High Performance Pigments by Huge M. Smith
7) Application Properties of Pigments by A. Karnik
8) Coatings Technology Handbook by Arthur A. Tracton
9) Paint and Coatings: applications and Corrosion Resistance by Philip A. Schweitzer
10) Paints, coatings, and solvents by Dieter Stoye, Werner Freitag

Code & Title of the Course	PST 2602 Environment Friendly Coatings Elective I
Marks	**50**
Number of Hours per Week	L + T (2+**1**)
Credits	**3**
Class	**M.Tech. Surface Coating Technology**
Semester	**I**

Sr.No.	Topic	Hrs
1	Types of Environment Friendly Coatings	5
2	Water Borne Coatings	6
3	High solid coatings, powder coatings. Techniques of preparation. Different Techniques for preparation of High Solid and Powder coatings.	4
4	Fundamentals of emulsions. Functions of ingredients in emulsion polymers	6
5	Functions and importance of surface active agents	4
6	Types of polymers used in water borne coatings	5
7	Solubilizations of binders in water.	5
8	Application methods & Rheology	5
9	Issues related Conventional Coatings.	5
10	Testing and characterization coatings etc.	5

Textbooks/Sourcebooks:

1. Outline of Paint Technology, W.M. Morgans (3rd Edition – Recently CBS Publishers.
2. Paints, Coatings and Solvents, Dieter Stage (ED.) – 2nd Edition – Wernon Freitag Ltd., (Eds).
3. Principle & Paint Formulation, R. Woodbroidge (Ed.) – 1991.
4. Performance Enhancement in Coatings by Edward W. Orr
5. Paints, Coatings, and Solvents by Dieter Stoye, Werner Freitag
6. European coatings handbook By Thomas Brock, Michael Groteklaes, Peter Mischke
7. UV coatings: basics, recent developments and new applications By Reinhold Schwalm

Code & Title of the Course	**PST 2402 Additives for Coatings** Core IV
Marks	**50**
Number of Hours per Week	L + T (2**+1**)
Credits	**3**
Class	**M.Tech. Surface Coating Technology**
Semester	**II**

Sr.No.	Topic	Hrs
1	Type of additives, additives like Uv stabilizer, antioxidants, anti-ozonents,	11
2	Coupling agents etc.	6
3	Rheological modifiers etc.	4
4	Anti-microbial etc, Chemistry of additives	8
5	Evaluation of additives	5
6	Mechanism of additives	6
7	Newer trends in additives	5
8	Functional additives.	5

Textbooks/Sourcebooks:

1) R.Gachter and H. Muller, "Plastics Additives Hand Books", Hanser Publications, Munich (1993).
2) J.A. Brydson, "Plastics Materials" Buterworth – Heinmann, Oxford (1999).
3) J.Murphy, "The additives for Plastics Hand Book", Elsevier, Odxford (1996).
4) Baileman, Hand Book of Additives.
5) Calbo, Coating Additives.

Code & Title of the Course	**PST 2203 Advanced Surface Coating Technology-II** Core V
Marks	**50**
Number of Hours per Week	L + T (2**+1**)
Credits	**3**
Class	**M.Tech. Surface Coating Technology**
Semester	**II**

Sr.No.	Topic	Hrs
1	Developments in formulation and methods of manufacture of coatings such as radiation cure, automotive paints, OEM paints.	20
2	Developments in high solids, waterborne and such eco-friendly coating compositions.	15
3	Various functions and importance of ingredients used in the formulations.	8
4	Advances in methods of application and film formation of surface coatings.	7

Textbooks/Sourcebooks:

1. Introduction to Paint Chemistry by Turner
2. Pigment Hand Book Part 1, 2,3 by Patton
3. Encyclopedic Hand book of Emulsions Technology by Sjoblom
4. Paint Film Defects by Hess
5. Industrial Organic Pigments by W. Herbst
6. Pigment Hand Book Part 1, 2,3 by Patton
7. Coatings formulation: an international textbook by Bodo Müller, Urlich Poth
8. Surface Coatings: Raw materials and their usage by Oil and Colour Chemists' Association.

Code & Title of the Course	**PST 2503 High Performance Coating** Core VI
Marks	**50**
Number of Hours per Week	L + T (2**+1**)
Credits	**3**
Class	**M.Tech. Surface Coating Technology**
Semester	**II**

Sr.No.	**Topic**	**Hrs**
1	Powder coatings and other high performance coatings & their importance	5
2	Polymers used in powder coatings, thermoplastic	8
3	Powder coatings based on vinyls, polyolefins, nylons, polyesters etc.	5
4	Thermosetting powder coatings based on epoxy, urethanes, acrylics etc.	10
5	Curing reactions, monitoring of curing process, crosslinkers used in thermosetting powder coating.	6
6	Industrial thermoplastic and thermosetting powder coatings, parameters influencing powder coating properties, thermosetting powder coatings,	6
7	Parameters influencing powder coating properties	4
8	Technology of production of powder coating, application techniques, newer developments	6

Textbooks/Sourcebooks:

1. A Guide to High-performance Powder Coating by Bob Utech
2. User's Guide to Powder Coating, Fourth Edition by Nicholas Liberto
3. Beginning Powder Coater's Handbook: An Introduction to Powder Coating by Tracy Norris.

Code & Title of the Course	PST 2105 High Polymer Chemistry Core VII
Marks	50
Number of Hours per Week	L + T (2+1)
Credits	3
Class	M.Tech. Polymer Engineering and Technology
Semester	I

Sr.No.	Topic	Hrs
1	Synthesis of polymers by addition Polymerization.	15
2	Condensation Polymerization and similar routes	15
3	Kinetics of polymerization	5
4	Physical chemistry of polymer solutions	5
5	Structure-property relationship	10

Textbooks/Sourcebooks:

1. High Polymer lattices- (1966)- by Blackly D.C.
2. Chemistry of High Polymer, Degradation Processes – (1956) by Grassic. N
3. Principles of high Polymer – Theory & practise, by Schmidt
4. Chemistry of High Polymer, by – Brain
5. Chemistry in Industry High Polymer by Toolcy
6. Progress in High Polymer, by Rood, J. C.
7. Nature & Chemistry of High Polymer, by – O' Driscoll

Code & Title of the Course	PST 2701 Corrosion Science & Corrosion Prevention

	Elective III
Marks	**50**
Number of Hours per Week	L + T (2+**1**)
Credits	**3**
Class	**M.Tech. Surface Coating Technology**
Semester	**II**

Sr.No.	Topic	Hrs
1	Fundamentals of corrosion phenomenon.	2
2	Various types of corrosion.	5
3	Methods of osion prevention and control.	10
4	Polymers used in corrosion prevention.	10
5	Corrosion inhibitors and various methods of corrosion inhibition	5
6	Treatment of metal surface for corrosion protection	6
7	Pigments pigmented coatings	5
8	Inorganic coatings	2
	Testing and specifications	5

Textbooks/Sourcebooks:

1. Electroactive Polymers for Corrosion Control by Peter Zarras, John D. Stenger-Smith, Yen Wei
2. Corrosion of Polymers and Elastomers by Philip A. Schweitzer
3. Handbook of conducting polymers, Volume 1 edited by Terje A. Skotheim, John R. Reynolds.

Code & Title of the Course	PST 2504 Polyelectrolytes & Ionomers

	Elective IV
Marks	**50**
Number of Hours per Week	L + T (2+1)
Credits	**3**
Class	**M.Tech. Surface Coating Technology**
Semester	**II**

Sr.No.	Topic	Hrs
1	Fundamentals of Polyelectrolytes & Ionomers,	10
2	Mechanism of electrolysis process, structural requirements for polymers to be polyelectrolyte.	8
3	Polyelectrolytes & ionomers, difference with low molecular weight and conventional electrolytes,	12
4	Various ingredients and their functions in Polyelectrolytes & Ionomers formulations, industrial applications.	8
5	Theories of Polyelectrolytes, specific polymeric electrolytes based on acrylics, styrenics etc. Applications of Polyelectrolyte &Ionomers.	12

Text/ Source Books

1. Surface Coatings Science and Technology by Swaraj Paul
2. Coatings from A to Z: A Concise Compilation of Technical Terms By Paolo Nanetti
3. European coatings handbook By Thomas Brock, Michael Groteklaes, Peter Mischke.
4. Polyelectrolytes: Science and Technology by Masanri Hara.
5. Ionomers: Synthesis, Structure, Properties and Applications by Martin R. Tant, K.A. Mauritz, Garth L. Wilkes.

Code & Title of the Course	PST 2505 Industrial Coatings Elective IV
Marks	**50**
Number of Hours per Week	L + T (2+**1**)
Credits	**3**
Class	**M.Tech. Surface Coating Technology**
Semester	**II**

Sr.No.	Topic	Hrs
1	Coatings required for specific industries and their formulations, testing and specifications. Industrial coatings.	15
2	Appliance Finishes	8
3	Automotive finishes.	5
4	Coil Coatings	7
5	Can Coatings	5
	Aircraft Coatings Paints for water proofing etc. formulation testing and specifications thereof.	10

Text/ Source Books:

1. Ionomers: characterization, theory, and applications by Shulamith Schlick
2. Introduction to ionomers by Adi Eisenberg, Joon-Seop Kim.

Code & Title of the Course	PST 2506 Insulating Coating Elective II
Marks	**50**
Number of Hours per Week	L + T (2+1)
Credits	**3**
Class	**M.Tech. Surface Coating Technology**
Semester	**I**

Sr.No.	Topic	Hrs
1	Fundamentals of electrical insulations testing of electrical insulation by various Methods.	12
2	Classification of polymeric electrical insulation, structural requirements for insulation and properties of polymeric electrical insulation.	10
3	Various types of polymers used in electrical insulation, formulation principles, effect of ingredients in formulation,	8
4	Other insulations-thermal, acquatic and vibrational,	12
5	Application methods for electrical insulation,	8

Text/ Source Books

1. Additives for plastics handbook by John Murphy
2. Electrical insulation in power systems by N. H. Malik, Nazar Hussain Malik, A. A. Al-Arainy, Mohammad Iqbal Qureshi
3. Selection of polymeric materials: how to select design properties from different

material by E. Alfredo Campo
4. Expanding monomers: synthesis, characterization, and applications by Rajender K. Sadhir, Russell M. Luck

Code & Title of the Course	**PST 2706 Printing Processes and Printing Inks Elective II**
Marks	**50**
Number of Hours per Week	L + T (2**+1**)
Credits	**3**
Class	**M.Tech. Surface Coating Technology**
Semester	**I**

Sr.No.	**Topic**	**Hrs**
1	Development in the processes of printing on different metallic and non-metallic substrates.	10
2	Developments in formulation in formulation of printing inks for different applications.	25
3	Different printing processes such as offset, screen printing, digital printing, pad printing etc.	10
4	Latest developments in printing and printing inks	5

Text/ Source Books:

1) Physical chemistry of Polymers, A. Tager, Mir Publishers, 197
2) Printing ink Formulations principles by Ronal Todd
3) Text book of Polymer Science by Billmeyer, John Wiley and Sons 1984.
4) Application properties of Pigments by A. Karnik
5) Printing Ink Manual by L.C. Leach.

Code & Title of the Course	PST 2507 Radiation Curing Coatings Elective II
Marks	**50**
Number of Hours per Week	L + T (2+**1**)
Credits	**3**
Class	**M.Tech. Surface Coating Technology**
Semester	**I**

Sr.No.	Topic	Hrs
1	Theory of radiation curing.	8
2	Methods of radiation curing and radiation curing techniques, selection of uv-source.	12
3	UV-curing-: Fundamentals of Photo polymerisation, Photo initiators types oligomer-polymers used, pigmentation.	10
4	Electron-beam curing, EB-generators, Factors affecting EB-curing, application, polymers used	12
5	Applications	8

Text/ Source Books

1. Surface Coatings Science and Technology by Swaraj Paul
2. Paint and Surface Coatings by Lambourne and Strivens
3. UV coatings: basics, recent developments and new applications By Reinhold Schwalm
4. Radiation curing of coatings by J. V. Koleske

5. Radiation Curing by Patrick Gloeckner
6. Polyurethanes: coatings, adhesives and sealants by Ulrich Meier-Westhues
7. Radiation Curing in Polymer Science and Technology: Fundamentals and methods by Jean-Pierre Fouassier, J. F. Rabek
8. Radiation curing: Science and Technology by Socrates Peter Pappas.
9. Radiation Cure Coating by P.K.T. Oldring

Code & Title of the Course	**PST 2106 Biopolymers** **Elective II**
Marks	**50**
Number of Hours per Week	L + T (2**+1**)
Credits	**3**
Class	**M.Tech. Surface Coating Technology**
Semester	**I**

Sr.No.	**Topic**	**Hrs**
1	Problem associated with non biodegradable polymers, Synthetic Biodegradable Polymer.	12
2	Importance of biopolymer, Source of biopolymers, Types of biopolymers	8
3	Definition & classification of bio-degradable polymers natural & synthetic – bio-degradable polymers	10
4	Factors affecting biodegradation, polymer modification,	5
5	Biodegradation conditions and test procedures	7
6	Bio-nano composites, applications of bio-degradable coatings and polymers in various applications	8

Text/ Source Books

1. The Role Of Peroxides In The Photo-Degradation Of Polymers, Developments In Polymer Degradation, G Scott, N. Grassie, App. Sci. Pub., London , 1979

2. Mechanism Of Antioxidant Action, Developments In Polymer Stabilization, G.Scott, Scott, App. Sci. Publication. London, 1981, Chapter 1.
3. Chemistry and Technology Of Biodegradable Polymers, G.J.L. Griffin, Blackie Academic Professional, 1994.
4. Degradable Polymer – Principles & Applications, Gerald Scott & Dan Gilad, Chapman & Hall,
5. Biodegradable Plastics And Polymers, Y.Doi And K.Fukuda (Eds), Elsevier (1994)
6. Absorbabale & Biodegradable Polymers – S.N.Shalaby & K.J.L. Burg, CRC Press (2003).
7. Handbook of biodegradable polymers by Abraham J. Domb, Joseph Kost, David M. Wiseman
8. Biodegradable polymers and plastics by Emo Chiellini, Roberto Solaro
9. Advances in Biodegradable Polymers G. F. Moore, S. M. Saunders

Code & Title of the Course	**PST 2707 Nano Materials** **Elective IV**
Marks	**50**
Number of Hours per Week	L + T (2+**1**)
Credits	**3**
Class	**M.Tech. Surface Coating Technology**
Semester	**II**

Sr.No.	**Topic**	**Hrs**
1	Importance of nano materials	4
2	Natural nano materials	8
3	fullerenes, applications, (filtrations, biomedical, textiles, electrical and optical) modifications	10
4	Synthesis, applications & treatments of nano silica & analogues materials , silver, ZnO, gold, nano fibers, single and MW- CNTs, iron oxide,	14
5	Different methods of characterization of nano materials.	4
6	Self assembled layers,	6
7	Issues related to handeling of nano-materials etc.	4

Text book:

1. Paint and Surface Coatings by Lambourne and Strivens
2. Organic Coatings Science and Technology by Zeno Wicks et al

3. Surface Coatings Science and Technology by Swaraj Paul
4. Polymer Chemistry, C. E. Carrshar, Marcel Dakker Inc, 2003.
5. Physical chemistry of Polymers, A. Tager, Mir Publishers, 197
6. Text book of Polymer Science by Billmeyer, John Wiley ans Sons 1984.
7. Encyclopaedia of Polymer Science and Technology, Johan Wiley and Sons, Inc 1965.
8. Encyclopaedia of Polymer Science and Engineering, Johan Wiley and Sons, Inc 1988.
9. Hand Book of Nanotechnology.
10. Encyclopaedia of Nanotechnology

Code & Title of the Course	**PST 2508 Marine Paints** **Elective IV**
Marks	**50**
Number of Hours per Week	L + T (2+**1**)
Credits	**3**
Class	**M.Tech. Surface Coating Technology**
Semester	**II**

Sr.No.	**Topic**	**Hrs**
1	Introduction to marine paints	5
2	Types of marine paints.	15
3	Marine paints for different submerged structure.	12
4	Formulation and performance.	10
5	Corrosion phenomena in marine environment.	6
6	The recent developments in marine paints	2

Text book:

1. Manufacture of antifouling paints in Germany-
   By- Borrows
2. German Marin Pints – London
   By – Lawrence – GD
3. Encyclopaedia of Chemical Technology
   By- KIRK OTHMER

4. Encyclopaedia of Industrial chemicals Ullman
5. Encyclopaedia of chemical processing & Design
By – Mcketta