M.Sc. - Surface Coating Technology

Course Description and Learning Outcome

SEMESTER - 1

Subject: PS01CSCT 21- Chemistry & Technology of Oils & Polymer Science

Faculty: Dr. Parag Karia

Course Description

To enable the students to understand the importance of vegetable oils in coating industry as a one of the bio-based raw material and its industrial application, basic concept of polymer, mechanism and various techniques of polymerization, characterization of polymers by molecular weight and by advanced instrumental Techniques viz. TGA, DSC, FTIR etc.

Learning Outcomes/Capability Development

Upon completion of this course:

- Students will be able to develop the availability of source, classification, modification of vegetable oils and its application in surface coating industry.
- Student should be able to understand the basic concept of monomer, polymer and repeating units and their properties
- Students will be able to develop the knowledge in the concepts of polymers, their classifications and nomenclature.
- Students will able to evaluate the mechanism and kinetics of free radical cationic and anionic polymerization.
- Students will able to appraise the mechanism and kinetics of copolymer free radical the synthesis techniques for polymer.
- Students will able to determine the concept of functionality, concept of molecular weight of the polymer and understand the techniques used for determination.

M.Sc.-Surface Coating Technology

Course Description and Learning Outcome

SEMESTER - 1

Subject: PS01CSCT 22- Chemistry & Technology of Inorganic Pigments

Faculty: Dr. Tejas Shah

Course Description

The course provides an introduction to theory of Colour, classification of Inorganic pigments and its reaction chemistry, synthesis and its application. Chemistry and technology of Extenders. Manufacture, properties and application of anticorrosive pigments in Protective and Maintenance Coating.

Learning Outcomes/Capability Development

Upon completion of this course:

- Students will have a broad and fundamental understanding of Theory of Colour. The mechanism of color formation and effect of various factors on shade and hue of pigment.
- Understand the topics like Physico-Chemical Characteristics of Pigments, Analysis & testing of pigments.
- Students will understand Chemistry, Properties and Applications of White pigments like Titanium Dioxide, Zinc Oxide etc.;
- Students will learn application, uses, Chemistry & technology of Extenders and Fillers.
- Students will understand the Manufacturing process, Properties & Application of anticorrosive pigments used to make anticorrosive paints and coatings.

M.Sc.-Surface Coating Technology

Course Description and Learning Outcome

SEMESTER - 1

Subject: PS01CSCT 23- Surface Chemistry & Surface Engineering

Faculty: Dr. Mayank Patel

Course Description

The course provides basic information about Application of surface chemistry, Interfacial tension, Free energy changes, wetting & emulsification; Chemistry & Technology of Surfactants. Also Introduction to Electroplating; Thermal Spray Coating; Cold Gas Dynamic Coating; Diffusion Coating; CVD & PVD; Plasma Immersion Ion implantation; DLC thin film; Sol Gel Coating; Laser Assisted Surface Engineering; Micro Arc Oxidation; Electro Spark Coating etc.

Learning Outcomes/Capability Development

Upon completion of this course:

- Understand the basic theory behind the application of surface chemistry, Concept of surface/interfacial energy and surface/ interfacial tension and behaviour of surfactants.
- Understand Chemistry & Technology of Surfactants and how to select a particular surfactant for a surface coating application.
- Students have comprehensive background for understanding various manufacturing processes of engineering coatings and surface treatments, structure and properties of coatings, and their industrial use in technical applications.
- Student will be able to have understanding of: - Principles of coating deposition and surface modification methods - Fundamental coating properties and their relationship - Introduction to corrosion and wear protection, and various functionalities obtainable by coatings and surface treatments.

M.Sc.-Surface Coating Technology

Course Description and Learning Outcome

SEMESTER - 1

Subject: PS01ESCT22- Fundamental Mechanical Engineering for Coating Technologist

Faculty: Dr. Hemant Thakkar

Course Description

The course provides an Introduction to; Engineering Materials & Their Properties; Elements of power transmission, Couplings & Seals; Metal Cutting Machines; Sheet Metal Operations; Welding & Casting; Abrasive Machining Process; Hydraulic & Pneumatic systems; Nozzles & Spray Guns; Spraying Systems; Robotics; Forging & Rolling

Learning Outcomes/Capability Development

Upon completion of this course:

- Students will have understanding of various modern engineering materials and their properties.
- Ability to learn Elements of power transmission, couplings and seals, , metal cutting machines, different welding methods and their defects
- List equipment used in spray painting, Gravity feed, Single pressure pot, Pumped feeds. Manifold supplies, Spray gun atomizing and air control, Needle settings and caps.
- Students will have understanding and Classification of forging processes. Forging defects and inspection. Rolling: Classification of rolling processes. Rolling of bars and shapes.

M.Sc.-Surface Coating Technology

Course Description and Learning Outcome

SEMESTER - 2

Subject: PS02CSCT21- Polymer Physics & Properties of Polymer

Faculty: Dr. Parag Karia

Course Description

The course provides basic information about the Chain Topology; Glass Transition Temperature; Physical, chemical, thermal, mechanical and electrical properties of polymers; Structure property relationship in polymers; Crystallinity; Concept of Cross Linking & Cross Link Density, its effect on polymer properties, Solubility criteria for the polymers, Solubility parameter, Solution properties, thermodynamics of polymer solutions, Phase separation in polymer solutions, Rheology of polymers; Degradation of Polymers

Learning Outcomes/Capability Development

Upon completion of this course:

- Student will understand molecular arrangement in polymers.
- Student will able to demonstrate the orientation processes in polymer.
- Student will acquire the knowledge in solubility behaviour of polymers.4
- Student will acquire the basic concept of Rheology of Polymer.
- Students will be aware about degradation mechanism of polymers and chemical reaction of polymers.

M.Sc.-Surface Coating Technology

Course Description and Learning Outcome

SEMESTER - 2

Subject: PS02CSCT22 - Chemistry & Technology of Organic Pigments, High Performance Pigments, Additives & Solvents

Faculty: Dr. Tejas Shah

Course Description

The first part of the course aims to introduce basic concepts of Dyes & Organic Pigments. It covers Technology & Applications of High Performance Pigments & Special Effect Pigments. The second part of the course introduces the concept of Types, preparation, and applications of Metallic Driers; Additives used in aqueous and non-aqueous paint systems for wetting and dispersion, Storage stability and application properties. Classification of Solvents and Plasticizers.

Learning Outcomes/Capability Development

Upon completion of this course:

- Students will understand the Chemistry, Properties and Applications of Organic Pigments, High Performance Pigments & Special Effect Pigments used in surface coating applications.
- Will specify the effects of pigments in paints and coatings.
- Will classify the additives in aqueous and non-aqueous paint systems.
- Will classify the Solvents, their characteristics, uses and application.
- Will classify the plasticizer, its theory, characterization and application in surface coating application.

M.Sc.-Surface Coating Technology

Course Description and Learning Outcome

SEMESTER - 2

Subject: PS02CSCT23**-** Coating Properties & Analysis of Coating

Faculty: Dr. Kalpesh Patel

Course Description

The course introduces to the Study of important characteristics of surface coating viz. Rheological properties, Optical Properties, Adhesion and Mechanical properties, Corrosion and Chemical resisting properties, Film thickness, Liquid Paint. Surface Coating defects and Durability of coatings.

Learning Outcomes/Capability Development

Upon completion of this course:

- Student will be having through understanding of analysis of paint and coatings according to ASTM, BIS and BS Standards, Characterization of Varnishes according to ASTM, BIS and BSS Standards
- Identify various coating defects and describe remedial measures
- Understand the durability of the paint and coating via Natural and Accelerated methods.

M.Sc.-Surface Coating Technology

Course Description and Learning Outcome

SEMESTER - 2

Subject: PS02ESCT21**-** Chemical Engineering Operations

Faculty: Dr. Mayank Patel

Course Description

The course aims to introduce various Concept of Unit Operations; Types of Pumps, Principles of Operation of Pumps; Vacuum producing devices; Compressors; Blowers; Size reduction– crushing and grinding; Filtration; Drying; Distillation; Mixing; Heat exchangers, Principles of heat transfer, types of heat transfer, different types of heating media..

Learning Outcomes/Capability Development

Upon completion of this course:

- Student will understand the types and principles operation of Pumps.
- Student will understand the underlying concepts and methods behind Blowers & Compressors
- The student will understand the ability to use appropriate size reduction machines.
- Student should ability to understand the filtration techniques
- Understand the relevance and importance of the Heat Exchangers, principle of heat transfer and types.

M.Sc.-Surface Coating Technology

Course Description and Learning Outcome

SEMESTER - 3

Subject: PS03CSCT21 - Technology of Resins for Surface Coating - I

Faculty: Dr. Kalpesh Patel

Course Description

The course is divided into two units. The first unit highlight on Chemistry and Technology of Synthetic resins viz. Alkyds, Polyester, Phenolics, Amino, Acrylic & Vinyl resins. The second unit covers Chemistry and Technology of Natural resins like rosin, shellac, Bitumen, Asphalts and Coal tar – Their modifications & uses.

Learning Outcomes/Capability Development

Upon completion of this course:

- Student will understand the types Raw materials for these resins, Chemistry of synthesis of these resins, its formulation parameters, processing techniques, plant layout, properties & applications of these resins for surface coatings.
- Student will understand the availibity of Natural resins, their extraction process, modification and application in surface coatings.
- Student should able to understand structure properties and relationships of resins.
- Student should able to understand curing systems of various resins.

M.Sc.-Surface Coating Technology

Course Description and Learning Outcome

SEMESTER - 3

Subject: PS03CSCT22 - Technology of Paint Manufacturing

Faculty: Dr. Tejas Shah

Course Description

The course emphasises on Principles of Paint Formulation, Theory of pigment Wetting and Dispersion technology, Coating manufacturing equipment, Plant Location & Paint Factory Layout; Important concepts of production Management. Pollution & its control in paint industry; Safety & Hygiene in Paint Industry.

Learning Outcomes/Capability Development

Upon completion of this course:

- Student will understand the fundamental principles of Paint and Coating Formulation.
- Ability to understand various factors affecting the stability of paint
- Ability to handle various machineries and equipment used in laboratory as well as commercial scale.
- Ability to understand concept of Total Quality Management (TQM).
- Understand the Air, Water and Soil Pollution and its control in paint and coating industry.
- Ability to understand Safety & Hygiene in Paint, Coating and Allied Industry.

M.Sc.-Surface Coating Technology

Course Description and Learning Outcome

SEMESTER - 3

Subject: PS03CSCT 23 **-** Technology of Architectural Coating, Industrial Coatings & Construction Chemicals

Faculty: Dr. Kalpesh Patel

Course Description

The course introduces various Classification of coatings, Mechanisms of film formation in surface coatings, Technology of solvent based architectural & industrial coatings, Technology of Water based Paints & coatings, Technology of Powder coatings and Technology of Construction Chemicals.

Learning Outcomes/Capability Development

Upon completion of this course:

- Student should ability to understand the coating system via classification and film formation mechanisms.
- To be able to decide basic criteria for paint and coating recipe.
- Basic understanding of designing Solvent and Water base paint formulation considering various ingredients.
- Student should ability to understand safety issues, VOC in industries, Zero or Low VOC techniques.
- Will classify different types of adhesives, sealant, water proofing chemicals and its application.

M.Sc.-Surface Coating Technology

Course Description and Learning Outcome

SEMESTER - 3

Subject: PS03ESCT22- Technology of Packaging and Printing Inks

Faculty: Dr. Mayank Patel

Course Description

The course covers in Printing Ink: Difference between Paints and Inks, The different printing Processes, Classification of Inks on the basis of Printing Processes, Specialty Inks.

The course covers in Packaging: Elements of packaging, Packaging materials and their forms, Plastic as packaging material in different forms

Learning Outcomes/Capability Development

Upon completion of this course:

- Student should able to understand formulations of Printing Ink based on different printing processes.
- Ability to understand testing methods for printing Inks.
- Ability to understand the surface preparation methods for printings and printing defect.
- Will apply and examine the knowledge of properties for selection of packaging materials.

M.Sc.-Surface Coating Technology

Course Description and Learning Outcome

SEMESTER - 4

Subject: PS04CSCT21- Technology of Resins for Surface Coating - II

Faculty: Dr. Kalpesh Patel

Course Description

The course is divided into two units. The first unit highlight on Chemistry and Technology of Synthetic resins viz. Polyamides, Epoxy, Polyurethanes, Silicone resin, Chlorinated Rubber:. The second unit covers Chemistry and Technology Chemistry and Technology of Cellulosic film formers e.g. Nitrocellulose and CAB modifications & uses.

Learning Outcomes/Capability Development

Upon completion of this course:

- Student will understand the types Raw materials for these resins, Chemistry of synthesis of these resins, its formulation parameters, processing techniques, plant layout, properties & applications of these resins for surface coatings.
- Student will understand the availibity of Cellulosic film formers e.g. Nitrocellulose and CAB modifications & uses.
- Student should able to understand structure properties and relationships of resins.
- Student should able to understand curing systems of various resins.

M.Sc.-Surface Coating Technology

Course Description and Learning Outcome

SEMESTER - 4

Subject: PS04CSCT22- Corrosion Technology & Heavy Duty Protective Coatings

Faculty: Dr. Parag karia

Course Description

The course provides an introduction to theory of Corrosion Science, Engineering and Technology**,** Practical forms of corrosion, Corrosion under various conditions, Corrosion in industries, Corrosion testing, Corrosion Inhibition, Technology of Heavy Duty Protective Coatings and Technology of Marine Coatings

Learning Outcomes/Capability Development

Upon completion of this course:

- Student will understand the Differentiation between erosion and corrosion and wet and dry corrosion.
- Student will understand the factors affecting corrosion.
- Student will understand the electrochemical reaction, redox reactions in corrosion; understand construction of the electrochemical cell and Differentiate between EMF and Galvanic series
- Student will understand the mechanisms for preventing Uniform corrosion, Galvanic, Crevice, Pitting, Inter granular, Stress, Erosion, Filiform corrosion and Selective leaching and Hydrogen damage
- Student will understand corrosion prevention techniques like Heavy Duty Protective Coatings and Technology of Marine Coatings.

M.Sc.-Surface Coating Technology

Course Description and Learning Outcome

SEMESTER - 4

Subject: PS04CSCT23- Coating Application & Specialty Coatings

Faculty: Dr. Tejas Shah

Course Description

The course is divided into three units. The first unit highlight on Techniques of Surface Preparation for different substrate. The second unit highlight on different paint application techniques and its efficiency. The third unit highlight on Study of Coil Coating, UV cured coating, Waterborne PU Coatings, Non Stick coatings, Smart Coatings, Hygienic Coatings

Learning Outcomes/Capability Development

Upon completion of this course:

- Students should be able to: - Decide the surface preparation methods suitable for different substrate materials.-Apply knowledge on properties offered by different Coatings based on the application requirement.
- Understand the basic concept of speciality coatings & interpret testing & evaluation.-explain importance of speciality coatings & its applications.

M.Sc.-Surface Coating Technology

Course Description and Learning Outcome

SEMESTER - 4

Subject: PS04ESCT22- Environmental Management

Faculty: Dr. Mayank Patel

Course Description

Concept of Green Chemistry & Technology, Introduction to environmental Legislations pertaining to paint & coating industries, Basic Environmental Chemistry, Management of water pollution, air pollution & hazardous waste, advanced technologies for environmental management, Cost benefit analysis of pollution abatement, Energy Conservation & renewable resource of energies, ISO standards for Environmental Management.

Learning Outcomes/Capability Development

Upon completion of this course:

- Student will understand the Concept of Green Chemistry & Technology, learn the environmental legislations pertaining to paint & coating industries.
- Student will understand how to manage water pollution, air pollution & hazardous waste and minimizing waste; Reducing air emissions; and Promoting environmental management systems.
- Student will understand to reduce generation and increase recycling of waste, as well as to address the life cycle impact of paint and coatings products.
- Student will also understand the importance of ISO standards for Environmental Management.