Annexure-VI

Department of Chemistry

Part III **Skill Enhancement Course (SEC) – II–Co-Curricular Courses (CoC)** For the students admitted from A.Y. 2021-2022 & onwards		
Offered by: Department of Chemistry	Offered to: (Please mark √ as applicable)	
	☐ Students across the University **other than** the offering department.	
	☑ Students across the University **including** the offering department. (The course should not be a part of regular curriculum of the offering department.)	
Semester : III – V (3 year programs)		
Course Code	Course Title	Course Credit and Hours
	Surface Coating Techniques	**2 Credit – 2hrs / wk**

Objective of the course:

1. Give an overview of various cleaning process for surface chemistry.
2. Train the student to formulate various electrolytes and to determine quality of electrolyte.
3. Be familiar with the different types of organic surface coating and inorganic surface coating
4. Discuss Formulation; Application; Properties of various additives like Solvent, Brighter and Emulsifiers.

Target Skills (Course outcomes) :

1. Decide the surface preparation methods suitable for different substrate materials
2. Understand the basic concept of electroplating & interpret testing & evaluation.-explain importance of electroplating & its applications
3. Student should ability to understand the fundamental principles of Paint and Coating Formulation via classification and film formation mechanisms.
4. Student should able to understand formulations of Electrolyte based on different processes.
5. Ability to handle various machineries and equipment used in laboratory as well as commercial scale.
6. Basic understanding of designing Solvent, Brighter and Emulsifiers for formulation of various electrolytes
7. Ability to understand testing methods for various electrolytes

Justification and references for the course (Mapping with NSDC/NSQF/Sector Skill Council/Regional needs/any other) :

- This course based on surface coating to area of surface finishing. Various types of courses from surface finishing sector are offering by Paints and Coatings Skill Council of India (ASCI-SSC).

References:
Link Regional needs of the course: https://nsdcindia.org/sector-skill-councils

Course Description:
The course provides basic information about theory and application of surface chemistry. To enable the students to understand the importance of Techniques of Surface Preparation for different substrata. The course introduces for highlights on different paint application techniques and its efficiency. The course introduces various Classifications of coatings, Mechanisms of film formation in surface coatings. The course emphasizes on Principles of Inorganic surface coating - Non-electric coatings, role of additive like Brighter, Solvent and Emulsifiers technology in electroplating techniques.

Course Content	**Hours**
Module-I: Fundamentals of Surface Coating	15hrs

• Introduction
• Classification of surface coatings (inorganic & organic)
• Preliminary treatment of surfaces.
  ➢ Ultrasonic cleaning
  ➢ Barrel cleaning
  ➢ Hand cleaning or scouring
  ➢ Alkaline cleaning
  ➢ Electrolytic cleaning
  ➢ Solvent cleaner
  ➢ Emulsifiable solvent cleaner:
  ➢ Diemulsifiable solvent cleaner.
• Current Efficiency
• Rate of Deposition
• Throwing Power
• Average Coating Thickness
• Solution
• Electrolytes & Electrolysis
• Current
• Resistance
• EMF	

Module-II : Inorganic Surface Coating	17hrs
• Basic process of electroplating • Theory and application of following electroplating techniques ➢ Silver plating ➢ Copper plating ➢ Nickel plating ➢ Chromium plating ➢ Gold plating ➢ Cadmium plating ➢ Zinc plating	
Module-III : Electroplating	14 hrs
• Brass plating ➢ Solution maintenance and plating process ➢ Barrel brass plating ➢ Brass plating for rubber adhesion • Passivation process for Zinc and Cadmium ➢ Chromate Passivation solution ➢ Heavy bronze Passivation • Tin and tin alloy plating ➢ Tin plating solution ➢ Alkaline tin plating process ➢ Acid tin plating process • Lead and indium plating ➢ Lead fluoborate plating solution ➢ Acid indium plating solution • Plating of platinum group metal	
Module-IV : Organic Surface Coating:	18hrs
• Theory and application of following electroplating techniques ➢ Electrophoretic coating ➢ Plating of plastic ➢ Phosphating Process ➢ Hot dipping ➢ Metal spraying ➢ Cementation ➢ Metal cladding ➢ Anodizing ➢ Vitreous coating ➢ Surface conversions ➢ Oil paint ➢ Water paint (emulsion paint) ➢ Varnishes	

Module-V : Process Control	**16hrs**
• Analysis of following plating solution ➢ Cadmium plating solution ➢ Chromium plating solution ➢ Copper plating solution ➢ Gold plating solution ➢ Nickel plating solution ➢ Silver plating solution • Physical test on solution ➢ Density ➢ p^H ➢ Surface tension ➢ Hull cell • Testing of electrodeposits ➢ Thickness test ➢ Accelerated and outdoor corrosion test ➢ Porosity tests ➢ Testing of surface crack patterns ➢ Ductility and stress determinations ➢ Adhesion testing	

Pedagogic tools:

1. Chalk and Talk
2. PPT and Videos.
3. Assignment
4. Group discussion
5. Seminar

Reference Books:

1. Coatings materials and surface coatings - Arthur A. Tracton (Editor), CRC Press, Tailor & Fransis Group.
2. Engineering chemistry - R. Gopalan, D. Venkappayya, S. Nagarajan.
3. Chemistry in engineering and technology volume -1 & 2 – J.C. Kuriacose & J. Rajaram
4. Engineering chemistry – Jain & Jain Industrial hygiene and chemical safety – M. K. Fulekar.
5. The Canning Handbook Surface Finishing Technology by Tromans B
6. Electroplating engineering handbook by Lawrence J. Durney

Methods of Assessment& Tools:

S.N.	Component	Content	Duration	Marks	Sub Total
1	**Attendance**	--	--	**10**	**10**
2	**Assignments**	--	--	**10**	**10**
3	**Practical Skill Assessment*** (Continuous Assessment during the semester)	**Module 1 and 2**	**1 Hr**	**20**	**40**
		Module 3,4 and 5	**1 Hr**	**20**	
4	**Course Mid Examination**	**Module 1 and2**	**1 Hr**	**20**	**20**
5	**Course End Examination**	**Module 3,4 and 5**	**1 Hr**	**20**	**20**
			Total	**100**	**100**

At the end of the course no marks are given, only remarks are given as follows:

REMARKS:

Range of Marks	Remarks
90-100	Excellent
75-89	Very Good
60-74	Good
40-59	Fair
< 40	Not Completed