GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3163621

Semester – VI
Subject Name: Corrosion Science & Technology

Type of course: Open Elective

Prerequisite: The students have already undertaken course work with different types of corrosion Basic knowledge of Chemistry is also required

Rationale: The main objective of this subject is to make students aware about the causes and factors influencing the rate of corrosion, various preventive methods of corrosion and various industrial methods.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
1	**UNIT-I: Chemical and Electrochemical Corrosion:** Introduction - gravity, cause, Chemical and Electrochemical corrosion, Pilling – Bed worth rule, effect of nature of oxide layer on rate of chemical corrosion, Galvanic corrosion, electrochemical series and galvanic series. Formation of anodic and cathodic areas, Differential aeration corrosion -pitting, water line corrosion & crevice corrosion, stress corrosion, corrosion fatigue. Passivation of metals, polarization curve of passivating metals, effect of pH and potential-pH diagram for iron and polarization curve of iron. Factors influencing corrosion a. Nature of metal: Relative position of metal in galvanic series, Over voltage, Relative areas of anode & cathode and Nature of corrosion product. b. Nature of environment: Temperature, pH and Humidity.	**12**
2	**UNIT-II: Corrosion Control by Metallic Coatings Metallic coatings:** Types - anodic & cathodic. Pre treatment of surface of base metal. Methods of application of metallic coatings: Hot dipping- galvanization - applications of galvanized RCC steel bars. Cladding, Electro plating & Electroless plating- Principle and their differences. Electroplating of Cu coating on Fe, Electroless plating of Ni coating on Insulators, Preparation of PCB using Electroless plating.	**10**
3	**UNIT-III: Corrosion Control by Inhibitors and Organic Coatings** Corrosion Inhibitors: Anodic, Cathodic and Vapour phase inhibitors. Organic Coatings: Paints – constituents and their functions. Vitreous enamel coatings. Varnishes. Super hydrophobic and self healing coatings. Epoxy coatings on RCC steel bars- Impervious coatings.	**10**
4	**UNIT-IV: Corrosion Control by Cathodic Protection and Surface Conversion Cathodic protection:**	**08**

	Principle, Sacrificial Anodic Protection (SAP), Impressed Current Cathodic Protection (ICCP). Application of Cathodic protection for bridges, ship hulls and underground pipelines. Surface conversion coatings: Carburizing, Nitriding, Cyaniding.	

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
35	**20**	**20**	**10**	**10**	**05**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Pub, Co., New Delhi (2002) 2. S.S. Dara "A text book of engineering chemistry" S.Chand&Co.Ltd., New Delhi (2006).
3. Chemistry of Engineering Meterials by R.P Mani and K.N.Mishra, CENGAGE learning 4. Shasi Chawla, "Text Book of Engineering Chemistry", Dhanpat Rai Publishing Company, NewDelhi (2008).
4. Principles and prevention of corrosion: Denny A Jones, Prentice Hall, 1996.
5. Derek Pletcher and Frank C. Walsh, "Industrial Electrochemistry", Chapman and Hall, New York, 1993
6. Fundamentals of Corrosion: Michael Henthorne, Chemical Engineering
7. Corrosion Engineering: Mars G Fontana, Mc Graw Hill, 1987

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	To explain different types of corrosion with suitable examples and analyze the given case study and diagnose the type of corrosion in a given corrosion problem	15%
CO-2	To discuss different factors that affect corrosion and passivation of metals and select a suitable metallic coating for corrosion control of the equipment in a given application	10%
CO-3	To explain the mechanism by which organic coatings and inhibitors control corrosion of metals	15%
CO-4	To discuss the principles and application of cathodic protection and surface conversion coatings for corrosion control	20%
CO-5	To apply the knowledge of various methods of corrosion control to suggest a solution for corrosion control of a given equipment in a given industrial application	25%
CO-6	To evaluate different corrosion control strategies in order to suggest a suitable strategy for corrosion control in a given application	15%

List of Open Source Software/learning website:

- Literature available in any laboratory manual of Chemical Process Technology.
- NPTEL
- MIT Open course lecture available on Internet