BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
HYDERABAD CAMPUS
SECOND SEMESTER 2023-2024

Course Handout Part II

Date: 9th Jan 2024

In addition to part -I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : **CHE F433** **Lectures: M,W, F: 10-11 AM**
Course Title : **Corrosion Engineering** *Room no: F 204*
Instructor-in-charge : **Dr. Ramesh Babu Adusumalli**

Scope and Objective:
Corrosion knowledge is required for materials, mechanical, civil and petrochemical engineers. Corrosion represents a tremendous economic loss for many process industries and much can be done to reduce it. Costs of corrosion will escalate substantially in near future because of extensive use of metals and alloys in Industrial and house-hold applications and aggressive corrosion environments in the variety of applications such as automobile, paper and petrochemical industries. Production of metals used for corrosion resistance such as stainless steel requires large amount of energy, thus compounding the nature's energy problems. Corrosion engineering is the application of science and art to prevent or control corrosion damage economically and safely. The first objective is to train a student about types of corrosion and identify the corrosion like galvanic corrosion due to two different metals used in nut-bolt assembly or crevice corrosion due to stagnant water between flange and gasket. The second objective is to learn corrosion prevention methods (cathodic protection or replacement of metals by high grade metal alloys or fibre reinforced composites- FRP)

Learning outcomes:
1. Identifying the corrosion types like Galvanic corrosion, Stress corrosion cracking, Pitting, etc.
2. Corrosion mechanism in metals and metal alloys
3. Corrosion testing methods
4. Corrosion prevention: Design and other aspects such as change of environment
5. Corrosion prevention: Stainless steel alloy, Titanium and fibre reinforced composites (FRP)

Text Book:
Fontana Mars. G., "Corrosion Engineering", TATA McGraw-Hill Book Co., 1986, 3rd ed (13th reprint 2012)

Reference Book:
Zaki Ahmad, "Principles of Corrosion Engineering and Corrosion Control", Butterworth-Heinemann, 2006.

Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Textbook Chap/Sec.
1	Introduction	Environments, Corrosion damage, Classification of corrosion	1
2-3	Corrosion principles	Introduction, corrosion rate expressions. Electrochemical aspects: Electrochemical reactions, polarization, passivity.	2.1-2.5
4-6		Environmental effects such as velocity, temperature, galvanic coupling. Metallurgical and other aspects	2.6-2.13

7-8	Forms of Corrosion	Galvanic corrosion or two metal corrosion	3.1-3.6
9-10		Crevice corrosion: environmental factors, mechanism, combating crevice corrosion,	3.7-3.10
11-12		Pitting: pit shape and growth, velocity, metallurgical variables; evaluation of pitting damage	3.11-3.17
13-14		Intergranular corrosion: Weld decay, knife line attack	3.18-3.22
15-18		Selective leaching and Erosion corrosion	3.23-3.37
19-21		Stress corrosion and Hydrogen damage	3.38-3.52
21-24	Corrosion Testing	Testing: Surface preparation, Exposure techniques, Huey test, Sea water test, Streicher test, Stress corrosion, Slow strain rate test, Nomograph for corrosion rates	4.1-4.18
25-34	Corrosion Prevention including selection of Materials	Prevention: Selection of metals and nonmetals *Metals and alloys*: Cast iron, steel, Al, Mg, Ti, Metallic composites *Non-metallics* : Thermoplastics, Thermosets, laminates or Fibre reinforced plastics (FRP), Rubbers, Wood, Ceramics, Carbon&Graphite Degradation of Polymer: Swelling and Dissolution, Bond rupture	5.3- 5.21 5.22-5.43
35-39		Prevention: alteration of environment such as changing mediums, lowering temperature etc.; Inhibitors of various types;	6.1-6.5, Class notes
40-42		Design: wall thickness, design rules, Cathodic protection etc., Selected coating techniques	6.6-6.12

Evaluation Scheme:

Component	Duration	Weightage	Date & Time	Remarks
Midterm	90 min	30%	12/03 - 4.00 - 5.30PM	CB
Surprise tests[1]		15 %		OB
Seminars[2]		15 %		OB
Comprehensive Exam.	3 hours	40 %	09/05 AN	OB (1 hr, 15%) + CB

[1]Total three surprise tests will be conducted. Best two will be taken for 15 % weightage.
[2]Seminar topics will be given for those who maintains 50 % attendance.

7. **Chamber Consultation Hour:** Monday 11 AM-1 PM **(Chamber: D 207)**

8. **Notice:** Notice will be displayed on CMS
9. Make-up policy: Make-up will be granted after he /she maintains minimum 50 % attendance in the class. Certificate from authenticated doctor from the Medical Center must accompany make-up application and follow the guidelines for midterm and compre exams.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Dr. Ramesh Adusumalli
Instructor-in-Charge CHE F433