



Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SECOND SEMESTER 2021-2022

Course Handout Part II

Date: 15/01/2022

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

Course No. : CHE F433
Course Title : Corrosion Engineering
Instructor-in-charge : Dr. Ramendra Kishor Pal

1. Scope and Objective:

Corrosion knowledge is essential for materials, mechanical, civil and petrochemical engineers. Corrosion represents a tremendous economic loss for many process industries and calls for significant attention to reducing it. Costs of corrosion will escalate substantially in the near future because of extensive use of metals and alloys in industrial and household applications and aggressive corrosion environments in various applications such as automobile, paper and petrochemical industries. Production of metals used for corrosion resistance, such as stainless steel, requires a large amount of energy, thus compounding to 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 students about types of corrosion and identify the corrosion like galvanic corrosion due to two different metals used in the 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).

2. Learning outcomes:

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

3. Textbook:

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

4. Reference Book:

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



5. Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
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		Prevention: Selection of metals and nonmetals <i>Metals and alloys</i> : cast iron, steel, Al, Mg, Ti, Metallic composites <i>Non-metallics</i> : 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

6. Evaluation Scheme:

Component	Duration	Weightage	Date & Time	Nature of component
Assignments	--	10 %	TBA in the class	Four assignments Evenly spaced throughout the semester (To be completed ten days before the last day of classwork)
Quizzes	During regular lectures	15%	TBA in the class	Two quizzes. Evenly spaced throughout the semester. OB [#]
Project/seminar	--	10 %	TBA in the class	One project (To be completed ten days before the last day of classwork)
Midterm Exam	90 minutes	30%	15/03 9.00am to 10.30am	OB [#]
Comprehensive Exam	120 minutes	35%	17/05 FN	OB [#] /CB [*]

*closed book, [#]open book

7. **Chamber Consultation Hour:** IC will announce during first class (**Chamber: D 321**).

8. **Notice:** Notice will be displayed on CMS.

9. **Make-up policy:** Make-up will be granted with prior permission from IC and has genuine reasons not to appear in the regular test. **50 % attendance is mandatory for any make-up request.**

10. **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.

Ramendra Kishor Pal



Instructor-in-charge CHE F433

