

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
HYDERABAD CAMPUS
FIRST SEMESTER 2019-2020
Course Handout Part II

01/08/2019

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
Course Title : Corrosion Engineering
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 worldwide shortages of construction materials, higher energy costs, and aggressive corrosion environments in the variety of applications such as bleaching and petrochemical industries. Production of metals used for corrosion resistance such as stainless steel require 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 atmospheric corrosion or galvanic corrosion 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 methods – Design and other aspects such as change of environment
5. Corrosion prevention methods – high grade metal alloys and fibre reinforced composites (FRP)

Text Book:

Fontana Mars. G., "Corrosion Engineering", TATA McGraw-Hill Book Co., 1986, 3rd ed (thirteenth 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	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
22-25		Metals and alloys: Cast iron, steel, Al, Mg, Ti, Metallic composites	5.3-5.21
26-30	Materials	Non-metallics : Thermoplastics, Thermosets, laminates or Fibre reinforced plastics (FRP), Rubbers, Wood, Ceramics, Carbon&Graphite Degradation of Polymer: Swelling and Dissolution, Bond rupture	5.22-5.43
31-34	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
35-38	Corrosion Prevention	Prevention: Selection of metals and alloys, alteration of environment such as changing mediums, lowering temperature etc.; Inhibitors of various types;	6.1-6.5, Class notes
39-41		Design: wall thickness, design rules, Cathodic protection etc., Selected coating techniques	6.6-6.12

Evaluation Scheme:

Component	Duration	Weightage	Date & Time	Nature of component
Midterm	90 min	30%	30/9, 9.00 -- 10.30 AM	CB
Assignment		15%		OB
Surprise Quizzes (3)	15 mints	15%		CB
Comprehensive Exam.	3 hours	40%	4/12 FN	CB(30%)+OB (10%)

Chamber Consultation Hour: Every Monday 9-11 AM (**Chamber: D 207**).

Notice: Notice will be displayed on Chemical Engineering Notice Board and in CMS.

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.***

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.

Instructor-in-charge CHE F433