Subject Description Form

Subject Code	ME571
Subject Title	Corrosion Control
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Students should have basic knowledge in Engineering Materials. Exclusion: ME538 Corrosion Controls in Pollution Management
Objectives	To provide students with comprehensive knowledge about corrosion/ materials degradation and preventive methodologies.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. possess state-of-the-art knowledge and skills in the area of metal corrosion and protection technology; b. think critically and holistically in dealing with real corrosion problems, and generate practical solutions; and c. have recognition of the need for, and an ability to engage in life-long learning.
Subject Synopsis/ Indicative Syllabus	***Significance of Corrosion and Materials Degradation:*** Definitions and forms of corrosion and materials degradation; implications to economy and human society. ***Oxidation & Its Control:*** Oxidation at elevated temperature; thermodynamics and kinetics of oxidation; oxide structures; oxidation rate; effects of alloying; high temperature alloys and coatings for oxidation control. ***Corrosion Theory:*** Structure of water and aqueous solution; concept of pH; thermodynamics of corrosion; electrodes and electrode potentials; Nernst equation; corrosion products and passivity; classification of corrosion; corrosion rate. ***Metallurgical Cells and Environmental Cells:*** Effect of purity and crystal defects; galvanic corrosion; dealloying; stress cell and concentration cells; effect of velocity and temperature; crevice corrosion; pitting; microbial corrosion. ***Corrosive-mechanical Interaction:*** Erosion corrosion; corrosive wear; corrosion fatigue; hydrogen damage; stress corrosion cracking. ***Protective Coatings:*** Surface preparation; electrodeposition; hot-dip coatings; conversion coatings; paint coatings for metals. ***Corrosion Control of Common Metals:*** Iron and steels; aluminium and its alloys. ***Corrosion Control in Aviation:*** Airframes; gas turbine engines. ***Corrosion Control in Automobile:*** Automobile bodies, engines, and bright trim. ***Corrosion Control in Food Processing:*** Tinplate for food and beverage cans; dairy industries; brewing. ***Corrosion Control in Building Construction:*** Structures of buildings; cladding; metal roofs; siding and flashing; pumping and central heating; timber; leisure pool. ***Materials Selection and Design for Corrosion Control*** **Laboratory works:** • AFM examination of surface morphology • Corrosion rate measurement of steel • Oxidation kinetics of copper

Teaching/Learning Methodology

1. The teaching and learning methods include lectures/tutorial sessions, homework assignments, test, case study report and examination.
2. The continuous assessment and examination are aimed at providing students with integrated knowledge required for corrosion control.
3. Technical/practical examples and problems are raised and discussed in class/tutorial sessions.

Teaching/Learning Methodology	Intended subject learning outcomes		
	a	b	c
1. Lecture	√	√	√
2. Tutorial	√	√	√
3. Homework assignment	√	√	√
4. Case study report and presentation	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed		
		a	b	c
1. Homework assignment	20%	√	√	√
2. Test	20%	√	√	
3. Case study report and presentation	10%	√	√	√
4. Examination	50%	√	√	√
Total	100%			

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

$0.50 \times$ End of Subject Examination + $0.50 \times$ Continuous Assessment

The continuous assessment consists of three components: homework assignments, test, and case study report & presentation. They are aimed at evaluating the progress of students study, assisting them in self-monitoring of fulfilling the respective subject learning outcomes, and enhancing the integration of the knowledge learnt.

The examination is used to assess the knowledge acquired by the students for understanding and analyzing the problems critically and independently; as well as to determine the degree of achieving the subject learning outcomes.

Student Study Effort Expected

Class contact:	
▪ Lecture	24 Hrs.
▪ Tutorial/Case study/Laboratory	15 Hrs.
Other student study effort:	
▪ Self Study	42 Hrs.
▪ Case study report preparation and presentation	24 Hrs.
Total student study effort	105 Hrs.

Reading List and References

1. David Talbot and James Talbot (1998), "*Corrosion Science and Technology*", *H749.H34B78*, latest edition.
2. Denny A. Jones (1996), "*Principles and Prevention of Corrosion*", *TA462.J59,* latest edition.
3. Mars G. Fontana (1986), "*Corrosion Engineering*", *TA418.74.F6*, latest edition.
4. J.C. Scully (1990), "*The Fundamentals of Corrosion*", *TA462.S39*, latest edition.
5. Samuel A. Bradford (2001), "*Corrosion Control*", *TA462.B648*, latest edition.