Subject Description Form

Subject Code	ABCT4741
Subject Title	Industrial Electrochemistry
Credit Value	3
Level	4
Pre-requisite / Co-requisite/ Exclusion	Pre-requisite: Intermediate Physical Chemistry / Physical Chemistry II Co-requisite: Inorganic Chemistry II
Objectives	This subject aims to provide students with the fundamental concepts on electrochemistry and electrode processes. Examples of application of electrochemistry are also presented.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. comprehend the fundamental concepts of electrochemistry and reactions on electrode surfaces; b. integrate the fundamental concepts with electrochemical applications such as electroplating, batteries, fuel cells, corrosion and electroanalysis; c. describe and appreciate the most recent developments in electrochemical technology; d. develop their logical and critical thinking through problem solving.
Subject Synopsis/ Indicative Syllabus	<u>Fundamental Concepts</u> Brief review of Faraday Processes; Fundamental concepts of the electrical double layer; Phenomena associated with the properties of the double layer with adsorption. The Tafel equation and its interpretations of overpotentials; Kinetics of electrode reactions; Electrocatalysis; Mass transfer by migration, diffusion and forced convection. <u>Metal Finishing Technology</u> Overviews on the application of electrode processes to electroplating of common metals and alloys on metal and non-metal substrates; Concepts of throwing power and levelling; Relations of kinetics of electrocrystallization with physical and chemical properties of electrodeposits; Organic additives in electroplating. The anodization and colouring processes in surface treatment of aluminium alloys. <u>Corrosion</u>

<table>
<tr><td></td><td>Mechanism of corrosion; The mixed potential theory. Concepts of polarisation and passivation; The Pourbaix diagram; Techniques in anodic and cathodic protections; Corrosion inhibition and control.

<u>Other Applications</u>

Selected topics on industrial electrochemical processes and applications such as batteries, fuel cells and electrochemical sensors.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Lectures: key concepts of the subjects will be provided. Students are expected to read and understand the contents from textbook and reference books after classes. To enhance their learning and knowledge, supplementary materials will be taken from daily examples and journal articles to illustrate the application and most recent developments of electrochemistry.
Tutorials: Students are encouraged to discuss and present their solutions to problem sets to gauge their leaning and performance. These problem sets provide them opportunities to apply the knowledge gained from the lecture. They also help the students consolidate and familiarize with what they have learned. Furthermore, students can develop a deeper understanding of the subject through group discussion and self-study</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td></td><td></td></tr>
<tr><td>1.Test</td><td>30</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td></td></tr>
<tr><td>2. Examination</td><td>70</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="6"></td></tr>
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Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Tests and written exams are used to gauge how much students have learned in the fundamental concepts of electrochemistry and electrode reactions and the industrial application of electrochemistry. Writing skills will be assessed in all the assessment methods.</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture</td><td>26 Hrs.</td></tr>
<tr><td>▪ Tutorial</td><td>13 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
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	▪ Self study ▪ (reading textbooks and reference books etc)	52 Hrs.
	▪ Homework assignment	13 Hrs.
	Total student study effort	104 Hrs.

Reading List and References

Essential

Pletcher, D.; Walsh, F. C.	Industrial Electrochemistry 2nd ed.	Chapman & Hall 1990

Supplementary

Lowenheim, F. A.	Electroplating	McGraw Hill 1978
Schlesinger, M.; Paunovic, M.	Modern Electroplating	John Wiley 2000
Dell, R. M.; Rand, D. A. J.	Understanding Batteries	Royal Society of Chemistry 2001
Trethewey, K. R.	Corrosion for Science and Engineering, 2nd ed.	Harlow: Longman 1995
Bradford, S. A.	Corrosion Control, 2nd ed.	CASTI Publishing Inc. 2001