

Subject Description Form

Subject Code	ENG2001
Subject Title	Fundamentals of Materials Science and Engineering
Credit Value	3
Level	2
Pre-requisite / Co-requisite/ Exclusion	Nil
Objectives	<ol style="list-style-type: none"> 1. To realize the impact of the development of engineering materials on human civilization; 2. To enable students to establish a broad knowledge base on the structure and properties of materials for solving engineering problems. 3. To enable students to understand the applications and selection of engineering materials based on the consideration of properties, cost, ease of manufacture, environmental issues and their in service performance.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> a. comprehend the importance of materials in engineering and society; b. explain the properties and behaviour of materials using fundamental knowledge of materials science. c. apply the knowledge of materials science to analyze and solve basic engineering problems related to stress, strain and fracture of materials; d. select appropriate materials for various engineering applications taking into consideration of issues in cost, quality and environmental concerns.
Subject Synopsis/ Indicative Syllabus	<ol style="list-style-type: none"> 1. <u>Introduction</u> Historical perspective; Evolution of engineering materials; Materials science and engineering; Classification of materials 2. <u>Atomic Structure and Structures of Materials</u> Atomic structure; Bonding forces and energies; Primary interatomic bonds and secondary bonding; Crystalline and non-crystalline materials; Phase diagram and microstructure of alloys 3. <u>Electrical and Optical Properties of Materials</u> Conductors and insulators; Semi-conductor materials; N-type and P-type semiconductors; P/N junction; Light interactions with materials; Light emitting diode (LED) and photovoltaics; Light propagation in optical fibers; Liquid crystal; Photoelasticity

	<p>4. <u>Mechanical Properties of Materials</u> Concept of stress and strain; Stress-strain behaviour; Elastic and plastic properties of materials; Concepts of dislocations and strengthening mechanisms; Tensile properties; Elastic recovery after plastic deformation; Hardness; Stress concentration; Impact energy, Fracture toughness; Design and safety factors</p> <p>5. <u>Introduction to Failure Analysis and Prevention</u> Fundamentals of fracture: ductile, brittle, fatigue and creep; Corrosion; Nondestructive testing; Techniques for failure analysis and prevention</p> <p>6. <u>Selection of Engineering Materials</u> Characteristics of metallic, polymeric, ceramic, electronic and composite materials; Economic, environmental and recycling issues</p>																																																						
<p>Teaching/Learning Methodology</p>	<p>The subject will be delivered mainly through lectures but tutorials, case studies and laboratory work will substantially supplement which. Practical problems and case studies of material applications will be raised as a focal point for discussion in tutorial classes, also laboratory sessions will be used to illustrate and assimilate some fundamental principles of materials science. The subject emphasizes on developing students' problem solving skills.</p>																																																						
<p>Assessment Methods in Alignment with Intended Learning Outcomes</p>	<table border="1" data-bbox="443 1093 1465 1630"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>1. Assignments</td> <td>15%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>2. Test</td> <td>20%</td> <td></td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>3. Laboratory report</td> <td>5%</td> <td></td> <td>√</td> <td>√</td> <td></td> <td></td> <td></td> </tr> <tr> <td>3. Examination</td> <td>60%</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> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>The assignments are designed to reflect students' understanding of the subject and to assist them in self-monitoring of their progress.</p> <p>The laboratory report is designed to assess the capability of students in analyzing and reporting experimental data relates to learning outcome (b).</p> <p>The test and examination are for determining students' understanding of key concepts as well as for assessing their achievement of the learning outcomes.</p>	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)						a	b	c	d			1. Assignments	15%	√	√	√	√			2. Test	20%		√	√	√			3. Laboratory report	5%		√	√				3. Examination	60%		√	√	√			Total	100 %						
Specific assessment methods/tasks	% weighting			Intended subject learning outcomes to be assessed (Please tick as appropriate)																																																			
		a	b	c	d																																																		
1. Assignments	15%	√	√	√	√																																																		
2. Test	20%		√	√	√																																																		
3. Laboratory report	5%		√	√																																																			
3. Examination	60%		√	√	√																																																		
Total	100 %																																																						

Student Study Effort Expected	Class contact:	
	▪ Lectures, tutorials, practical	39Hrs.
	Other student study effort:	
	▪ Guided reading, assignments and reports	37Hrs.
	▪ Self-study and preparation for test and examination	47Hrs.
	Total student study effort	123Hrs.
Reading List and References	<ol style="list-style-type: none"> 1. William D. Callister, Jr., David G. Rethwisch, <i>Fundamentals of materials science and engineering</i>, 4th edition, <i>E-Text</i> John Wiley & Sons; ISBN: 978-1-118-53126-6 2. William D. Callister, Jr., David G. Rethwisch, <i>Materials Science and Engineering</i>, 8th edition, <i>E-Text</i> John Wiley & Sons; ISBN: 978-1-118-37325-5 3. Materials World (Magazine of the Institute of Materials, Minerals and Mining) 	

Revised (April 2014)