

## Subject Description Form

<b>Subject Code</b>	AP30006
<b>Subject Title</b>	Metallurgy and Ceramics Science
<b>Credit Value</b>	3
<b>Level</b>	3
<b>Pre-requisite/ Co-requisite/ Exclusion</b>	AP20002
<b>Objectives</b>	To provide a basic understanding of metallic and ceramic materials on the basis of fundamental concepts of materials science, to explain the principles and methods for property improvement of these materials, and to briefly describe their processing and applications.
<b>Intended Learning Outcomes</b>	<p>Upon completion of the subject, students will be able to:</p> <ul style="list-style-type: none"> <li>(a) apply the knowledge in bonding and crystal structure to the interpretation of properties of metals and ceramics;</li> <li>(b) use the phase diagram to obtain information such as solubility, presence of different phases, solidification, etc.;</li> <li>(c) describe and explain different strengthening mechanisms for metals and toughening mechanisms for ceramics;</li> <li>(d) outline the important properties of common engineering alloys, including the ferrous and the non-ferrous alloys;</li> <li>(e) explain the effect of heat treatment of alloys based on the temperature-time-transformation curves;</li> <li>(f) describe the mechanical and electrical properties of common ceramic materials;</li> <li>(g) describe the typical processing and applications of ceramic materials; and</li> <li>(h) select appropriate metals and/or ceramics to meet specific requirements in practice.</li> </ul>
<b>Subject Synopsis/ Indicative Syllabus</b>	<p><b>Metals:</b> iron and steel; structures of plain carbon steels; nonferrous metals and alloys; corrosion; metal processing; strengthening mechanisms.</p> <p><b>Ceramics:</b> ceramic structures; oxides, carbides and nitrides; glass; processing of ceramics; strengthening and toughening mechanisms; electrical properties of ceramics.</p>
<b>Teaching/Learning Methodology</b>	<p><b>Lecture:</b> The concepts related to metallurgy and ceramics science will be explained. Examples will be used to illustrate the concepts and ideas in the lecture. Students are free to request help. Assignment sets will be given to assess the learning progress of students.</p> <p><b>Tutorial:</b> Various teaching and learning activities will be conducted in tutorial sessions to consolidate the teaching in lectures. Students will work on problem sets in the tutorials, which provide them opportunities to apply the knowledge gained in lectures.</p> <p><b>Laboratory:</b> Three experiments will be conducted, covering selected topics highlighted in intended learning outcomes. Students will work in groups and conduct the experiments under the guidance of the teaching staff. They are required to analyze their experimental results and complete lab reports during the laboratory sessions.</p>

<b>Assessment Methods in Alignment with Intended Learning Outcomes</b>	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)							
			a	b	c	d	e	f	g	h
	(1) Continuous assessment	40	✓	✓	✓	✓	✓	✓	✓	✓
	(2) Examination	60	✓	✓	✓	✓	✓	✓	✓	✓
	Total	100								
<p>Continuous assessment consists of assignments, laboratory reports and mid-term test. The continuous assessment will assess the students' understanding of basic concepts and principles in materials science. Examination will be conducted to make a comprehensive assessment of students' intended learning outcomes as stated above.</p>										
<b>Student Study Effort Expected</b>	Class contact:									
	• Lecture		26 h							
	• Tutorial		6 h							
	• Laboratory		9 h							
	Other student study effort:									
	• Self-study		79 h							
	Total student study effort		120 h							
<b>Reading List and References</b>	<p>Materials Science and Engineering: an Introduction (W.D. Callister, John Wiley &amp; Sons (Asia) Pte Ltd.), 8<sup>th</sup> Edition, 2009.</p> <p>Foundations of Materials Science and Engineering (W.F. Smith and J. Hashemi, McGraw Hill), 5<sup>th</sup> Edition, 2009.</p> <p>The Science and Engineering of Materials (D.R. Askeland and P.P. Phule, Thomson, Brooks/Cole), 6<sup>th</sup> Edition, 2010.</p> <p>Introduction to Ceramics (W.D. Kingery, H.K. Bowen and D.R. Uhlmann, Wiley Blackwell), 2<sup>nd</sup> Edition, 1976.</p>									