UNIVERSITI TEKNOLOGI MARA

CMT352: MATERIAL SCIENCE

Course Name (English)	MATERIAL SCIENCE APPROVED
Course Code	CMT352
MQF Credit	3
Course Description	The course is designed to introduce students to the principal topics in materials science emphasizing the role of materials in the general context of everyday applications and demonstrating the importance of materials science in improving quality of life. Lecture sessions employ a mixture of lectures, tutorials and group work (self and peer discussions). The outcomes shall be assessed through a variety of tools which include the paper examination, quizzes and assignments.
Transferable Skills	Able to evaluate and measure the proficiency in solving problems and group working.
Teaching Methodologies	Lectures
CLO	CLO1 Identify the types and properties of materials and relate to their usage in modern world. CLO2 Describe the types, properties, engineering behavior and processing procedures of basic classes of materials. CLO3 Describe the scientific concepts of materials in relation to criteria of bonding, structures, crystal systems, phase transformation approaches. CLO4 Explain the concepts and techniques of materials processing related to material needs, usage and current demand.
Pre-Requisite Courses	No course recommendations

Topics
1. Introduction to Materials Science 1.1) 1.1 Historical Perspective. 1.2) 1.2 Types of materials and general applications.
2. Atomic Structure and Bonding 2.1) 2.1 Basic atomic calculations in molecular weight. 2.2) 2.2 Moles, density and quantity of atoms. 2.3) 2.3 Bonding: Ionic, metallic, covalent, Van de Waals and some examples. 2.4) 2.4 Coordination number and atomic radii relationship.
3. Crystal Structures -Perfections 3.1) 3.1 Seven crystal systems and fourteen Bravais lattices. 3.2) 3.2 Unit cells for metallic cubic systems: SC, BCC, FCC. 3.3) 3.3 Atomic packing factor for SC, BCC, FCC. 3.4) 3.4 Atomic positions, directions and planes: Miller indices for crystallographic planes in cubic unit cells. 3.5) 3.5 Linear and planar densities calculations. 3.6) 3.6 Polymorphism
4. Materials Characterization 4.1) 4.1 X-ray diffraction and calculation of d-spacing 4.2) 4.2 Brief Introduction to SEM and TEM.
5. Crystal Defects-Non Perfection 5.1) 5.1 Vacancies and self-interstitials 5.2) 5.2 Impurities in solids: substitutional and interstitial solid solution. 5.3) 5.3 Hume-Rothery Rules 5.4) 5.4 Point defect, linear defect, planar defect, bulk defect 5.5) 5.5 Solidification of metals and single crystals.

6. Phase Diagrams-Equilibrium Microstructural Development 6.1) 6.1 Solubility limit, phases 6.2) 6.2 Complete solid solubility and limited solubility. 6.3) 6.3 Eutectic. 6.4) 6.4 General binary phase diagrams. 6.5) 6.5 The Lever Rule: Compositions and quantities of phases. 6.6) 6.6 Microstructure development during cooling
7. Properties of Metals and Alloys 7.1) 7.1 Classification: Ferrous and Non-ferrous. 7.2) 7.2 Processing: Annealing, spheroidizing in high-carbon, precipitation hardening. 7.3) 7.3 Basic Mechanical properties: Stress and strain curve. Plastic and elastic deformation
8. Properties of Polymeric Materials 8.1) 8.1 Structures of polymers 8.2) 8.2 Types of polymer: Elastomers, thermoset and thermoplastic. 8.3) 8.3 Processing.
9. Properties of Ceramic Materials 9.1) 9.1 Types of ceramic: Traditional and engineering 9.2) 9.2 Processing: drying,sintering, firing, calcinations
10. Properties of Composite Materials 10.1) 10.1 Types of composite materials 10.2) 10.2 Processing
11. Corrosion of Metals 11.1) 11.1 Electrochemical corrosion 11.2) 11.2 Oxidation and reduction 11.3) 11.3 Galvanic couple-cathodic protection

Assessment Breakdown	%
Continuous Assessment	100.00%

Details of Continuous Assessment

Assessment Type	Assessment Description	% of Total Mark	CLO
Assignment	Assignment	20%	CLO4
Final Test	Final Test	50%	CLO3
Online Quiz	Quiz	10%	CLO2
Test	Test	20%	CLO1

Reading List

Reference Book Resources

- **William F. Smith 2006, *Foundations of Materials Science and Engineer*, 4 Ed., McGraw Hills**
- **William D. Callister, Jr. & David G. Rethwisc 2008, *Fundamentals of Materials Science and Enginee*, 3 Ed., John Wiley and Sons**
- **William D. Callister 2007, *Materials Science and Engineering: An Introdu*, 7 Ed., John Wiley and Sons**

Article/Paper List: This Course does not have any article/paper resources

Other References: This Course does not have any other resources