UNIVERSITI TEKNOLOGI MARA

CHM678: MATERIALS CHEMISTRY

Course Name (English)	MATERIALS CHEMISTRY APPROVED
Course Code	CHM678
MQF Credit	2
Course Description	The course covers the principal topics in materials chemistry emphasizing the role of materials in the general context of everyday applications and demonstrating the importance of materials in improving quality of life. Lecture sessions employ a mixture of lectures and active learning (self and peer discussions). The outcomes shall be assessed through a variety of tools which include the paper examination and classroom engagement.
Transferable Skills	learn new knowledge
Teaching Methodologies	Lectures, Discussion, Presentation
CLO	CLO1 Explain the concepts and theories in materials bonding, structure, properties, phase transformation and applications. CLO2 Verify the concepts and theories in materials bonding, structure, properties, phase transformation and applications. CLO3 Demonstrate managerial skills in case study related to new advanced materials in modern society
Pre-Requisite Courses	No course recommendations

Topics
1. Introduction to materials chemistry 1.1) 1.1 Historical perspective 1.2) 1.2 Classification of materials 1.3) 1.3 Importance of materials – case study
2. Composition of materials: Atomic Structure and Bonding 2.1) 2.1 Bondings: primary bondings - Ionic, metallic and covalent. Using Pauling's equation to calculate percentage ionic character. Secondary bondings. Types of bonding that explain materials properties. 2.2) 2.2 Bondings in metals, ceramics and polymers
3. Crystal structure and crystal systems 3.1) 3.1 Lattice, basis, unit cells and Bravais crystal systems 3.2) 3.2 Short-Range Order versus Long-Range Order of atoms arrangement in lattice. 3.3) 3.3 Amorphous materials: principles and examples 3.4) 3.4 Allotropic or polymorphic transformations 3.5) 3.5 Metallic crystal structure : BCC, FCC and HCP 3.6) 3.6 Crystallographic points, directions and planes in cubic and hexagonal unit cell 3.7) 3.7 Volume, Planar and linear density calculation for cubic unit cell 3.8) 3.8 Structure-mapping : X-ray diffraction and calculation of d-spacing
4. Imperfections in crystals 4.1) 4.1 Point defects 4.2) 4.2 Dislocations defects and significance of dislocation defects 4.3) 4.3 Planar defects : Stacking faults and Twin boundaries 4.4) 4.4 Bulk defects 4.5) 4.5 Importance of defects 4.6) 4.6 Experimental techniques for identification of microstructure and defects: Optical, transmission electron and scanning electron Microscopy

5. Mechanical properties of materials 5.1) 5.1 Stress and strain, Young elastic modulus 5.2) 5.2 Hardness of materials 5.3) 5.3 Fracture of metals-ductile fracture and brittle fracture
6. Properties of metals, ceramic and polymers 6.1) 6.1 Metals – its properties and applications 6.2) 6.2 Ceramics Materials – its properties and applications 6.3) 6.3 Polymers – its properties and applications
7. Phase diagrams - isomorphous, eutectic 7.1) 7.1 Solid solutions 7.2) 7.1.1 Hume-Rothery Rules 7.3) 7.1.2 Substitutional solid solutions 7.4) 7.1.3 Interstitial solid solutions 7.5) 7.2 Types of Phase Diagrams 7.6) 7.2.1 Complete solid solubility - Isomorphous 7.7) 7.2.2 Eutectic 7.8) 7.3 Understanding phase diagrams 7.9) 7.3.1 Chemical composition of phases 7.10) 7.3.2 The Lever Rule : Quantities of phases 7.11) 7.4 Microstructure development and phase transformation 7.12) 7.5 Cooling and heating curves
8. Presentations of assignments 8.1) Presentation theme: Materials for the future.

Assessment Breakdown	%
Continuous Assessment	60.00%
Final Assessment	40.00%

Details of Continuous Assessment

Assessment Type	Assessment Description	% of Total Mark	CLO
Presentation	Video Presentation	20%	CLO3
Test	Cumulative of 2 tests	40%	CLO1

Reading List

Recommended Text

- **William F. Smith and Javad Hashemi 2011, *Foundations of Materials Science and Engineering*, 5th Ed., Mc Graw Hill New york**

Article/Paper List

This Course does not have any article/paper resources

Other References

- **reference William D. Callister Jr., David G. Rethwisch 2018, *Materials Science and Engineering- An Introduction, 10th Edition* , John Wiley and Sons Inc., New York**
- **reference Donald R. Askeland and Pradeep P. Phule 2006, *The Science and Engineering of Materials* , Thompson, Canada**