



UNIVERSITI TEKNOLOGI MARA

MEK452: MATERIALS SCIENCES & TECHNOLOGY

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| Course Name (English) | MATERIALS SCIENCES & TECHNOLOGY APPROVED |
| Course Code | MEK452 |
| MQF Credit | 3 |
| Course Description | This course introduces several advanced concepts and topics in the rapidly evolving field of material science, covering some fundamentals, which are necessary for the understanding of materials properties for their appropriate applications. Students are expected to develop comprehension of the subject and to gain scientific understanding regarding the choice and manipulation of materials for desired engineering technology applications. The major families of materials such as metals, ceramics, polymers, and composite are discussed for their structures, properties, and applications. |
| Transferable Skills | Practical skills (materials characterizations technique & instruments), thinking and scientific skills, basic knowledge (materials science 7 technology). |
| Teaching Methodologies | Lectures, Blended Learning, Lab Work, Tutorial |
| CLO | CLO1 Explain the basic concepts of structure, mechanical and physical properties of materials [PO1, PLO1, LO1] . CLO2 Identify the relationships between properties, structure and characterizations of materials in performing the materials selection process [PO2, PLO2, LO3]. CLO3 Construct experimental setup and interpret measurements and observations obtained from practical investigations relating to materials science and technology [PO4, PLO3, LO2]. |
| Pre-Requisite Courses | No course recommendations |
| Topics | |
| 1. Chapter 1: Introduction to Materials Science & Technology 1.1) 1.1 Historical Perspective 1.2) 1.2 Materials science, materials technology & engineering 1.3) 1.3 Type of materials 1.4) 1.4 Selection of materials 1.5) 1.5 Future trends of materials usage | |
| 2. Chapter 2: Basic structure of Materials 2.1) 2.1 Atomic structure 2.2) 2.2 Interatomic bonding amorphous and crystalline solid, crystal structures 2.3) 2.3 Efficiency of atomic packing, density computation, miller indices. 2.4) 2.4 Relationship between atomic structure, crystal structures and properties of material 2.5) 2.5 Crystalline Defects | |
| 3. Chapter 3: Properties and characterizations of materials 3.1) 3.1 Density 3.2) 3.2 Specific gravity 3.3) 3.3 Thermal properties 3.4) 3.4 Mechanical properties 3.5) 3.5 Electrical properties 3.6) 3.6 Magnetic properties 3.7) 3.7 Dielectric properties 3.8) 3.8 Optical properties | |
| 4. Chapter 4: Metallic Materials 4.1) 4.1 Introduction to Metallic Materials 4.2) 4.2 Phase diagram: Microstructure development, Microconstituent of phases. 4.3) 4.3 Fe-Fe ₃ C system: Microstructure development, Microconstituent of phases. 4.4) 4.4 Isothermal Transformation Diagram | |

5. Chapter 5: Thermal Treatment of Metallic Materials

- 5.1) 5.1 Strengthening Mechanisms
- 5.2) 5.2 Heat treatment of ferrous metals
- 5.3) 5.3 Hardenability
- 5.4) 5.4 Heat treatment of non-ferrous metals
- 5.5) 5.5 Surface heat treatment

6. Chapter 6: Overview of Engineering Materials

- 6.1) 6.1 Classification of engineering materials and nanomaterials
- 6.2) 6.2 Atomic bonding, properties, and applications of ceramics.
- 6.3) 6.3 Processing of ceramics
- 6.4) 6.4 Plastics and elastomer
- 6.5) 6.5 Composite Materials
- 6.6) 6.6 Materials suitability for Additive Manufacturing

| Assessment Breakdown | % |
|-----------------------|---------|
| Continuous Assessment | 100.00% |

| Details of Continuous Assessment | Assessment Type | Assessment Description | % of Total Mark | CLO |
|----------------------------------|---------------------|--|-----------------|------|
| | Assignment | Individual assignment | 5% | CLO1 |
| | Assignment | Group assignment | 5% | CLO1 |
| | Assignment | Individual assignment | 10% | CLO2 |
| | Assignment | Group assignment | 15% | CLO2 |
| | Practical | Lab report | 20% | CLO3 |
| | Quiz | Will be accessed at the end of each topic. | 5% | CLO1 |
| | Test | Final Test (Test 2) | 5% | CLO1 |
| | Test | Midterm test (Test 1) | 10% | CLO1 |
| | Test | Midterm test (Test 1) | 10% | CLO2 |
| Test | Final Test (Test 2) | 15% | CLO2 | |

| Reading List | Recommended Text | <ul style="list-style-type: none"> William D. Callister Jr, David G. Rethwisch 2018, <i>Materials Science and Engineering: An Introduction</i>, 10th Ed., John Wiley & Sons |
|--------------------|---|---|
| | Reference Book Resources | <ul style="list-style-type: none"> James F. Shackelford 2000, <i>Introduction to materials science for engineers</i>, Prentice Hall New Jersey William F. Smith 1996, <i>Principles of materials science and engineering</i>, McGraw-Hill Callister, William D 2013, <i>Fundamentals of material science and engineering : an interactive</i>, 4th Ed., John Wiley & Sons New York Kenneth G. Budinski, Michael K. Budinski 2010, <i>Engineering materials : properties and selection</i>, 9th Ed., Prentice Hall Serope Kalpakjian, Steven R. Schmid 2016, <i>Manufacturing processes for engineering materials</i>, 6th Ed., Prentice Hall |
| Article/Paper List | This Course does not have any article/paper resources | |
| Other References | This Course does not have any other resources | |