

**Department of Mining, Petroleum, and Metallurgical Engineering**

**Cairo University  
Faculty of Engineering**

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| **Course Specifications** | | | | | | | | | | | | | | | | | |
| **Program(s) on which this course is given:** | | | | | | | Mining, Petroleum and Metallurgical Engineering | | | | | | | | | | |
| **Department offering the program:** | | | | | | | Mining, Petroleum and Metallurgical Engineering | | | | | | | | | | |
| **Department offering the course:** | | | | | | | Metallurgical Engineering | | | | | | | | | | |
| **Academic Level:** | | | | | | | 1st year Mining, Petroleum and Metallurgy | | | | | | | | | | |
| **Date** | | | | | | | 2014 | | | | | | | | | | |
| **Semester (based on final exam timing)** | | | | | | | Fall Spring | | | | | | | | | | |
| **A- Basic Information** | | | | | | | | | | | | | | | | | |
| **1. Title:** | Materials Science | | | | | | | | | **Code:** | | | **MET 120** | | | | |
| **2. Units/Credit hours per week:** | | Lectures | | | 3 | | | Tutorial | | | 2 | Practical | | **-** | | Total | 5 |
| **B- Professional Information** | | | | | | | | | | | | | | | | | |
| **1. Course description:** | | | | The aims of this course are to provide first year Mining and Petroleum Engineering students with basic knowledge of materials science and engineering necessary for those working in relevant field in addition to selective topics of significance to major engineering specialisation. This module emphasises differences between material types, basic structure of material, and material properties of relevance to mining and petroleum engineering applications. The lab work is meant to train the student on some materials characterisation methods. | | | | | | | | | | | | | |
| **2. Intended Learning Outcomes of Course (ILOs):** | | | | **a) Knowledge and Understanding** | | | | | | | | | | | | | |
| 1. principles of basic structure of metals, ceramics and polymers; phase diagrams and mechanical properties of materials;  2. alloys: their microstructure and their heat treatment with emphasis on the Fe-C diagram; | | | | | | | | | | | | | |
| **b) Intellectual Skills** | | | | | | | | | | | | | |
| 3.identify the material type and structure-property (physical-chemical-mechanical) interrelationships in materials resulting from their structure and the relation with application requirements;  4.evaluate the material charactersitics (microstructure) based on appropriate testing methods and correlation with data from phase diagrams. | | | | | | | | | | | | | |
| **c) Professional and Practical Skills** | | | | | | | | | | | | | |
| 5. apply knowledge of materials science to analyse engineering problems;  6. interpret data from microstructure examination and mechanical tests. | | | | | | | | | | | | | |
| **d) General and Transferable Skills** | | | | | | | | | | | | | |
| 7.use current information technology sources to develop technical reports on materials engineering applications in the modern engineering life. | | | | | | | | | | | | | |
| **3. Contents** | | | | | | | | | | | | | | | | | |
| **Topic** | | | | | | **Total hours** | | | **Lectures hours** | | | | | | **Tutorial/ Practical hours** | | |
| Introduction: Course objectives and plan, why do we need to learn Materials Science, Plan for course | | | | | | 4 | | | 2 | | | | | | 2 | | |
| Crystal Structure | | | | | | 6 | | | 3 | | | | | | 3 | | |
| Diffusion in solids and applications related to discipline | | | | | | 4 | | | 2 | | | | | | 2 | | |
| Phase Diagrams: Solubility limit, components and phases, estimates of number and types of phases, phase composition, and weight fraction of phases. | | | | | | 6 | | | 3 | | | | | | 3 | | |
| Fe-C Phase Diagram | | | | | | 4 | | | 2 | | | | | | 2 | | |
| Types of steels | | | | | | 4 | | | 2 | | | | | | 2 | | |
| Mechanical properties and testing | | | | | | 6 | | | 3 | | | | | | 3 | | |
| Ceramics: structure and applications, composites | | | | | | 4 | | | 2 | | | | | | 2 | | |
| Polymers: structure and applications, composites | | | | | | 4 | | | 2 | | | | | | 2 | | |
| Concepts of failures and end of life for engineering materials considering price and availability of materials; relative cost of materials; optimization for properties. | | | | | | 3 | | | 3 | | | | | | - | | |
| **4. Teaching and Learning Methods** | | | | | | Lectures (\*) | | | Practical Training/ Laboratory ( ) | | | | | | Seminar/Workshop ( ) | | |
| Class Activity ( ) | | | Case Study (\*) | | | | | | Projects ( ) | | |
| E-learning (\*) | | | Assignments /Homework ( ) | | | | | | Other: | | |
| **5. Student Assessment Methods** | | | | | | | | | | | | | | | | | |
| * **.Assessment Schedule** | | | | | | | | | **Week** | | | | | | | | |
| -Assessment 1; Class test | | | | | | | | | 6 | | | | | | | | |
| -Assessment 2; Project Assignment | | | | | | | | | 12 | | | | | | | | |
| -Assessment 3; Lab report | | | | | | | | | 10 | | | | | | | | |
| -Assessment 3; Midterm Exam | | | | | | | | | 8 | | | | | | | | |
| -Assessment 4; Final Exam | | | | | | | | | Fifteenth week | | | | | | | | |
| * **Weighting of Assessments** | | | | | | | | | | | | | | | | | |
| -Mid-Term Examination | | | | | | | | | 15 points | | | | | | | | |
| -Final-term Examination | | | | | | | | | 85 points | | | | | | | | |
| -Project | | | | | | | | | 10 points | | | | | | | | |
| -Class Test | | | | | | | | | 5 points | | | | | | | | |
| -Lab report | | | | | | | | | 10 points | | | | | | | | |
| -Total | | | | | | | | | 125 points | | | | | | | | |
| **6. List of References** | | | | | | | | | | | | | | | | | |
| Course notes | | | | | | | | | | | | | | | | | |
| W.D. Callister, Jr., Materials Science and Engineering:  An Introduction (6th ed), Wiley and Sons, 2003. | | | | | | | | | | | | | | | | | |
| **7. Facilities Required for Teaching and Learning** | | | | | | | | | | | | | | | | | |
| Mechanical testing lab.  Microscopy lab.  Computer, Data show. | | | | | | | | | | | | | | | | | |
| **Course Coordinator:** | | | **Iman El-Mahallawi** | | | | | | | | | | | | | | |
| **Head of Department:** | | | Prof. Dr.E.M.Elbana | | | | | | | | | | | | | | |

