

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:** | | | | | | | Materials and Metallurgical Engineering | | | | | | | | | | |
| **Department offering the program:** | | | | | | | Department of Mining, Petroleum and Metallurgical Engineering | | | | | | | | | | |
| **Department offering the course:** | | | | | | | Department of Mining, Petroleum and Metallurgical Engineering | | | | | | | | | | |
| **Academic Level:** | | | | | | | 4th year B.Sc students | | | | | | | | | | |
| **Date** | | | | | | | 2014 | | | | | | | | | | |
| **Semester (based on final exam timing)** | | | | | | | Fall Spring | | | | | | | | | | |
| **A- Basic Information** | | | | | | | | | | | | | | | | | |
| **1. Title:** | **Structure and Design of Alloys** | | | | | | | | | **Code:** | | | **MET 401 B** | | | | |
| **2. Units/Credit hours per week:** | | Lectures | | | 4 | | | Tutorial | | | 1 | Practical | | 1 | | Total | 6 |
| **B- Professional Information** | | | | | | | | | | | | | | | | | |
| **1. Course description:** | | | | Upon completion of the course the student should be able to:   1. Microstructure-property-chemistry correlations in industrial non- ferrous alloys (Al, Cu, Ti and Super alloys) 2. Concepts and relevant problems in fracture mechanics. Strength vs. Toughness in material selection 3. Designing against fatigue 4. Designing against creep and high temperature considerations in materials selection 5. Low temperature considerations in materials selection 6. Formalization of materials selection 7. Case studies | | | | | | | | | | | | | |
| **2. Intended Learning Outcomes of Course (ILOs):** | | | | **a) Knowledge and Understanding** | | | | | | | | | | | | | |
| 1. Engineering principles and Basic topics related with engineering generally and metals and alloys particularly are including information and computer technology. | | | | | | | | | | | | | | |
| 2. Fundamentals of materials science and physical metallurgy their relation to metallurgical and materials related topics. | | | | | | | | | | | | | | |
| 3. Microstructure-Property correlations in engineering applications and considerations of materials selection and failure prevention. | | | | | | | | | | | | | | |
| **b) Intellectual Skills** | | | | | | | | | | | | | |
| 4. Select and identify the appropriate material and manufacturing aspects of design of a component. | | | | | | | | | | | | | |
| 5. Combine, exchange, and assess different ideas, views, and knowledge from a range of sources in topics related to material processing, manufacturing, development and selection. | | | | | | | | | | | | | |
| 6. Assess and evaluate the characteristics, performance and failure of components, systems and processes. | | | | | | | | | | | | | |
| 7. Solve engineering problems, often on the basis of limited and possibly contradicting information appreciating the role of information technology in providing support for metallurgical engineers. | | | | | | | | | | | | | |
| **c) Professional and Practical Skills** | | | | | | | | | | | | | |
| 8. Professionally merge the engineering knowledge, understanding, and feedback to improve design, products and/or services. | | | | | | | | | | | | | |
| 9. Create and/or re-design a process, component or system, and carry out specialized engineering designs considering safety, quality assurance procedures, management skills and environmental aspects. | | | | | | | | | | | | | |
| **d) General and Transferable Skills** | | | | | | | | | | | | | |
| 10. Collaborate effectively within multidisciplinary team in stressful environment and within constraints and effectively manage tasks, time, and resources. | | | | | | | | | | | | | |
| 11. Communicate and collaborate effectively within a multidisciplinary team. | | | | | | | | | | | | | |
| **3. Contents** | | | | | | | | | | | | | | | | | |
| **Topic** | | | | | | **Total hours** | | | **Lectures hours** | | | | | | **Tutorial/ Practical hours** | | |
| - Non ferrous alloys | | | | | | 6 | | | 12 | | | | | | 4 | | |
| - Fracture mechanics | | | | | | 6 | | | 12 | | | | | | 4 | | |
| - Design against Fatigue | | | | | | 4 | | | 8 | | | | | | 4 | | |
| - Design against Creep | | | | | | 4 | | | 8 | | | | | |  | | |
| - High and low temperature considerations | | | | | | 2 | | | 4 | | | | | | 3 | | |
| - Formalization of selection procedures | | | | | | 4 | | | 8 | | | | | | 3 | | |
| - Case studies | | | | | | 6 | | | 12 | | | | | |  | | |
| **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 | | | | | | | | | To assess problem solving abilities. | | | | | | | | |
| -Assessment 2; Project Assignment | | | | | | | | | 3 | | | | | | | | |
| -Assessment 3; Midterm Exam | | | | | | | | | To assess understanding and versatility. | | | | | | | | |
| - Assessment 4; Oral exam/ presentation | | | | | | | | | To assess understanding and ability to present data. | | | | | | | | |
| -Assessment 5; Final Exam | | | | | | | | | At the end of term | | | | | | | | |
| * **Weighting of Assessments** | | | | | | | | | | | | | | | | | |
| - Lab Section | | | | | | | | | 15% | | | | | | | | |
| -Mid-Term Examination | | | | | | | | | 15% | | | | | | | | |
| -Presentation/ Oral exam | | | | | | | | | 5% | | | | | | | | |
| -Pop Quizzes | | | | | | | | | 5% | | | | | | | | |
| -Final-term Examination | | | | | | | | | 60% | | | | | | | | |
| -Total | | | | | | | | | 100% | | | | | | | | |
| **6. List of References** | | | | | | | | | | | | | | | | | |
| 6.a. Course Notes | | | | | | | | | | | | | | | | | |
| 6. b. Essential Books (Text Books)   * Suggested by the Academic Advisor  1. Notes prepared by the lecturer. 2. Structure and properties of Engineering alloys, Smith, Pense and Gordon, McGraw Hill. 3. Steel and its heat treatment, Thelning, Butterworths; 4. The Science and Design of Engineering Materials, Schaffer, Saxena, Antolovich, Sanders and warner, Irwin. 5. Physical Metallurgy of Steels, William C.Leslie, McGraw- Hill. 6. Internet web sites, 2002-2006. | | | | | | | | | | | | | | | | | |
| 6.c. Recommended Books.   * Suggested by the Academic Advistor | | | | | | | | | | | | | | | | | |
| 6.d. Periodicals, Web Sites, … etc: N/A | | | | | | | | | | | | | | | | | |
| **7. Facilities Required for Teaching and Learning** | | | | | | | | | | | | | | | | | |
| Computer , data show ,projector and blackboard | | | | | | | | | | | | | | | | | |
| **Course Coordinator:** | | | **Prof. Dr. Abdel-Hamid Ahmed Hussein** | | | | | | | | | | | | | | |
| **Head of Department:** | | | **Prof. Dr. El-sayed Mahmoud El-Banaa** | | | | | | | | | | | | | | |

