

**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:** | | | | | | | Metallurgical Engineering | | | | | | | | | | |
| **Department offering the program:** | | | | | | | **Mining Petroleum & Metallurgy** | | | | | | | | | | |
| **Department offering the course:** | | | | | | | **Mining Petroleum & Metallurgy** | | | | | | | | | | |
| **Academic Level:** | | | | | | | 2nd year | | | | | | | | | | |
| **Date** | | | | | | | 2014 | | | | | | | | | | |
| **Semester (based on final exam timing)** | | | | | | | Fall ● Spring | | | | | | | | | | |
| **A- Basic Information** | | | | | | | | | | | | | | | | | |
| **1. Title:** | Optical Metallurgy | | | | | | | | | **Code:** | | | **MET 203** | | | | |
| **2. Units/Credit hours per week:** | | Lectures | | | 3 | | | Tutorial | | |  | Practical | | **3** | | Total | 6 |
| **B- Professional Information** | | | | | | | | | | | | | | | | | |
| **1. Course description:** | | | | Metallography, the study of microstructure has been an invaluable to the progress of science and industry over the past three centuries. Metallography is one major valuable tool can be a precise aid for:   1. Provide practice in techniques of micro specimens' selection, polishing and etching (macro examination and microscopic examination). 2. Provide initial training in the use of metallurgical microscope. 3. Study the constituents present in microstructure of metals and alloys. 4. Study types of the metallurgical light optical microscopy and their applications.   Apply the planometric method of volume fraction, grain size, particle size, and shape factor, measurement and control. | | | | | | | | | | | | | |
| **2. Intended Learning Outcomes of Course (ILOs):** | | | | **a) Knowledge and Understanding** | | | | | | | | | | | | | |
| 1. Concepts and theories of mathematics and sciences, appropriate to the discipline. | | | | | | | | | | | | | |
| 2. Fundamentals of materials science and physical metallurgy their relation to metallurgical and materials related topics. | | | | | | | | | | | | | |
| 3. The relation between the microstructure and the mechanical properties and their relationship to shaping and manufacturing methods and failures. | | | | | | | | | | | | | |
| **b) Intellectual Skills** | | | | | | | | | | | | | |
| 4. Select appropriate mathematical and computer-based methods for modeling and analyzing metallurgical problems. | | | | | | | | | | | | | |
| 5. Assess and evaluate the characteristics, performance and failure of components, systems and processes. | | | | | | | | | | | | | |
| **c) Professional and Practical Skills** | | | | | | | | | | | | | |
| 6. Apply knowledge of mathematics, science, information technology, design, business context and engineering practice integrally to solve metallurgical engineering problems. | | | | | | | | | | | | | |
| 7. Use appropriate mechanical testing, corrosion testing, optical, X-ray, and electron metallographic, and chemical analysis methods for metals and alloys. | | | | | | | | | | | | | |
| **d) General and Transferable Skills** | | | | | | | | | | | | | |
| 8. Search for information and engage in life-long self learning discipline to learn ccurrent engineering technologies and contemporary metallurgical engineering topics related to metallurgical engineering. | | | | | | | | | | | | | |
| **3. Contents** | | | | | | | | | | | | | | | | | |
| **Topic** | | | | | | **Total hours** | | | **Lectures hours** | | | | | | **Tutorial/ Practical hours** | | |
| The optical microscope | | | | | | 12 | | | 3 | | | | | |  | | |
| Preparations of specimens for light Metallography | | | | | |  | | |  | | | | | | 9 | | |
| Optical examination of standard macro and microstructures covering grains structures, solidification structures, wrought structures, phase distribution, eutectics, peritectic and solid state transformations products | | | | | |  | | |  | | | | | | 21 | | |
| Lenses and lens aberrations | | | | | | 22.5 | | | 1.5 | | | | | |  | | |
| Resolution and depth of focus | | | | | | 7.5 | | | 1.5 | | | | | | 6 | | |
| Illumination systems | | | | | | 3 | | | 3 | | | | | |  | | |
| Polarizing microscopy | | | | | | 3 | | | 3 | | | | | |  | | |
| High temperature microscopy | | | | | | 3 | | | 3 | | | | | |  | | |
| Phase contrast and interferometry | | | | | | 3 | | | 3 | | | | | |  | | |
| Mid-Term | | | | | | 3 | | | 3 | | | | | |  | | |
| Elements of quantitative metallography | | | | | | 15 | | | 15 | | | | | |  | | |
| Metallographic Measurements | | | | | |  | | |  | | | | | | 3 | | |
| Elements of photography | | | | | |  | | |  | | | | | | 3 | | |
| Oral and Prcticle Exam | | | | | | 6 | | | 3 | | | | | | 3 | | |
| * **Teaching and learning Methods** | | | | | | 6 | | | 3 | | | | | | 3 | | |
| Class Activity (● ) | | | Case Study (● ) | | | | | | Projects ( ) | | |
| E-learning ( ) | | | Assignments /Homework (● ) | | | | | | Other: practice work in lab | | |
| * **.Assessment Schedule** | | | | | | | | | **Week** | | | | | | | | |
| -Assessment 1; Class test | | | | | | | | | Week on a weekly basis | | | | | | | | |
| -Assessment 2; Project Assignment | | | | | | | | | Week 5 | | | | | | | | |
| -Assessment 3; Presentations | | | | | | | | | Week 13 | | | | | | | | |
| -Assessment 3; Midterm Exam | | | | | | | | | Week 8 | | | | | | | | |
| -Assessment 4; Final Exam | | | | | | | | | End of the term | | | | | | | | |
| * **Weighting of Assessments** | | | | | | | | | | | | | | | | | |
| -Mid-Term Examination | | | | | | | | | 15% | | | | | | | | |
| -Final-term Examination | | | | | | | | | 60% | | | | | | | | |
| -Project | | | | | | | | | 10% | | | | | | | | |
| -Class Test | | | | | | | | | 5% | | | | | | | | |
| -Presentation | | | | | | | | | 10% | | | | | | | | |
| -Total | | | | | | | | | 100% | | | | | | | | |
| **6. List of References** | | | | | | | | | | | | | | | | | |
| 6.1 ASM Handbook vol. 1, 2, and 9, ASM international 10th edition (1990). | | | | | | | | | | | | | | | | | |
| 6.2 Metallography- Principles and practice, Co. F. Vander Voort 1st edition, Mc Graw-Hill publisher (1984) | | | | | | | | | | | | | | | | | |
| 6.3 Metallographic Polishing by Mechanical Methods, L. E. Samules 4th edition, ASM international publisher (2003) | | | | | | | | | | | | | | | | | |
| 6.4 Metallographic Etching G. Pet3ow, 2nd edition, ASM International publisher (1999) | | | | | | | | | | | | | | | | | |
| 6.5 Metallography and Microstructure of Ancient and Historic Metals by David A. Scott (1991) | | | | | | | | | | | | | | | | | |
| 6.6 Metallographic Handbook by Donald c. Zipperian (2011) | | | | | | | | | | | | | | | | | |
| **7. Facilities Required for Teaching and Learning** | | | | | | | | | | | | | | | | | |
| * . **Board, Overhead projector and Data show** * **Tools in optical metallography lab** | | | | | | | | | | | | | | | | | |
| **Course Coordinator:** | | | **Prof. Dr. E. M. Elbana** | | | | | | | | | | | | | | |
| **Head of Department:** | | | **Prof. Dr. E. M. Elbana** | | | | | | | | | | | | | | |

