

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

**Cairo University  
Faculty of Engineering**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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:** | | | | | | | Fifth year | | | | | | | | | | |
| **Date** | | | | | | | 2014 | | | | | | | | | | |
| **Semester (based on final exam timing)** | | | | | | | Fall Spring | | | | | | | | | | |
| **A- Basic Information** | | | | | | | | | | | | | | | | | |
| **1. Title:** | Casting | | | | | | | | | **Code:** | | | **MET 403** | | | | |
| **2. Units/Credit hours per week:** | | Lectures | | | 3 | | | Tutorial | | | 1 | Practical | | - | | Total | 4 |
| **B- Professional Information** | | | | | | | | | | | | | | | | | |
| **1. Course description:** | | | | The aims of this course are to provide the student with the necessary technological & theoretical concepts of the different casting methods and the relation between the cast materials and the casting process in addition to design of the process and its effect on the final product soundness and properties. | | | | | | | | | | | | | |
| **2. Intended Learning Outcomes of Course (ILOs):** | | | | **a) Knowledge and Understanding** | | | | | | | | | | | | | |
| 1. Understand fundamentals of solidification relevant to metals and alloys and casting parameters; (A3) | | | | | | | | | | | | | |
| 1. Identify melting and casting methods and their parameters and the relation to casting defects relevant to sources of error in process and implementation; (A4) | | | | | | | | | | | | | |
| **b) Intellectual Skills** | | | | | | | | | | | | | |
| 1. Design the appropriate material and manufacturing aspects related to charge calculations and feeding and gating systems; (B2) | | | | | | | | | | | | | |
| 1. Combine, exchange, and assess different ideas, views, and knowledge from a range of sources in topics related to manufacturing and development of cast parts; (B4) | | | | | | | | | | | | | |
| **c) Professional and Practical Skills** | | | | | | | | | | | | | |
| 1. Apply knowledge of mathematics, science, information technology, design, business context and engineering practice integrally to produce small castings and analyse the results; (C1) | | | | | | | | | | | | | |
| 1. Conduct planned steps to create and/or re-design the casting process, component or system, and carry out engineering designs considering quality procedures, management skills and environmental aspects and utilizing appropriate IT facilities; ( C3)   . | | | | | | | | | | | | | |
| **d) General and Transferable Skills** | | | | | | | | | | | | | |
| 1. Search for information and engage in life-long self learning discipline;(D3) 2. Develop students’ communication skills to present findings; 3. Work in a team to achieve a task. | | | | | | | | | | | | | |
| **3. Contents: Casting Methods And Technology (Sand, Permanent Mould, And Die Casting, Shell Mould And Investment Casting, Centrifugal And Continuous Casting Methods) – Patterns- Cores- Casting Defects- Design Of Gating And Feeding Systems –Melting Furnaces- Charge Calculations- Effect Of Different Melting And Casting Parameters On Cast Quality And Structure- Solidification Of Cast Structures- Refining And Modification Of Cast Structures- Some Examples Of Cast Alloys (Cast Iron- Al- Cu Alloys) – Casting Defects.** | | | | | | | | | | | | | | | | | |
| **Topic** | | | | | | **Total hours** | | | **Lectures hours** | | | | | | **Tutorial/ Practical hours** | | |
| 1. Introduction on manufacturing (forming – casting – powder metallurgy) methods and conditions when each method is selected. | | | | | | 4 | | | 2 | | | | | | 2 | | |
| 1. Metallurgical principles of solidification I: pure metals – alloys – eutectic. | | | | | | 4 | | | 2 | | | | | | 2 | | |
| 1. Heat transfer conditions affecting cooling and solidification. | | | | | | 4 | | | 2 | | | | | | 2 | | |
| 1. Casting technology I: casting methods general overview. | | | | | | 4 | | | 2 | | | | | | 2 | | |
| 1. Casting technology II: sand casting. | | | | | | 4 | | | 2 | | | | | | 2 | | |
| 1. Casting technology III: metal casting (die casting – pressure casting). | | | | | | 4 | | | 2 | | | | | | 2 | | |
| 1. Casting technology IV: centrifugal and continuous casting. | | | | | | 4 | | | 2 | | | | | | 2 | | |
| 1. Casting technology V: Advanced casting methods. | | | | | | 4 | | | 2 | | | | | | 2 | | |
| 1. Melting I: Furnaces. | | | | | | 4 | | | 2 | | | | | | 2 | | |
| 1. Melting II: Energy and charge selection and material balance. | | | | | | 4 | | | 2 | | | | | | 2 | | |
| 1. Cast alloys. | | | | | | 4 | | | 2 | | | | | | 2 | | |
| 1. Design of gating system. | | | | | | 4 | | | 2 | | | | | | 2 | | |
| 1. Design of feeding system. | | | | | | 4 | | | 2 | | | | | | 2 | | |
| 1. Casting defects. | | | | | | 4 | | | 2 | | | | | | 2 | | |
| **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 | | | | | | | | | 10 | | | | | | | | |
| -Assessment 3; Presentations | | | | | | | | | 10 | | | | | | | | |
| -Assessment 3; Midterm Exam | | | | | | | | |  | | | | | | | | |
| -Assessment 4; Final Exam | | | | | | | | | 15 | | | | | | | | |
| * **Weighting of Assessments** | | | | | | | | | | | | | | | | | |
| -Mid-Term Examination | | | | | | | | |  | | | | | | | | |
| -Final-term Examination | | | | | | | | | 70% | | | | | | | | |
| -Project | | | | | | | | | 10% | | | | | | | | |
| -Class Assignment including computational methods | | | | | | | | | 10% | | | | | | | | |
| -Presentation | | | | | | | | | 10% | | | | | | | | |
| -Total | | | | | | | | | 100% | | | | | | | | |
| **6. List of References** | | | | | | | | | | | | | | | | | |
| 1. **Fundementals of Metal Casting; R. A. Flinn, Addison-Wesley Publishing Company, 1963.** | | | | | | | | | | | | | | | | | |
| 1. **Principles of Foundry Technology; P. L. Jain, Tata Mc. Graw-Hill Publishing Company, 1999.** | | | | | | | | | | | | | | | | | |
| 1. **Foundry Technology; P. Beeley, Butterworth-Heinemann, 2001.** | | | | | | | | | | | | | | | | | |
| Course notes | | | | | | | | | | | | | | | | | |
| Prepared by the lecturers and e-learning facilities. | | | | | | | | | | | | | | | | | |
| **7. Facilities Required for Teaching and Learning** | | | | | | | | | | | | | | | | | |
| - Small group of students. | | | | | | | | | | | | | | | | | |
| - Up-to-date references in library. | | | | | | | | | | | | | | | | | |
| - Laboratory facilities. | | | | | | | | | | | | | | | | | |
| **Course Coordinator:** | | | **Prof. Iman Elmahallawi, Dr. Waleed Khalifa** | | | | | | | | | | | | | | |
| **Head of Department:** | | | **Dr. Said El-Banna** | | | | | | | | | | | | | | |

