

**Cairo University  
Faculty of Engineering**

**Department of Mining, Petroleum,**

**and Metallurgical 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:** | | | | | | **Metallurgical Engineering B.Sc.** | | | | | | | | | | | |
| **Date** | | | | | | **December, 2014** | | | | | | | | | | | |
| **Semester (based on final exam timing)** | | | | | | **Fall Spring** | | | | | | | | | | | |
| **A- Basic Information** | | | | | | | | | | | | | | | | | |
| **1. Title:** | **Iron and steel making** | | | | | | | | **Code:** | | | | **MET 404** | | | | |
| **2. Units/Credit hours per week:** | | **Lectures** | | | **3** | | **Tutorial** | | | **1** | **Practical** | | | **---** | **Total** | | **4** |
| **B- Professional Information** | | | | | | | | | | | | | | | | | |
| **1. Course description:** | | | | **The course provides a general overview of the standard process routes required to transform raw materials into steel and their respective history and evolution.**  **Outcomes:**   1. **1. Understand modern steel making concepts.** 2. **2. Define the routes through which plain carbon steels are produced.** 3. **3. Provide an overview of coke production & sinter and pellet production.** 4. **4. Study the principles and practice of iron making & the Blast furnace.** 5. **5. Describe the main processes for steel making, and understand the theoretical basis** 6. **of each process.** 7. **6. Carry out a heat and mass balance analysis for major iron and steel making** 8. **processes.** | | | | | | | | | | | | | |
| **2. Intended Learning**  **Outcomes of Course**  **(ILOs):** | | | | **a) Knowledge and Understanding** | | | | | | | | | | | | | |
| **1. Steel making concepts.**  **2. Difference between primary and secondary steel making processes.**  **3. Blast furnace design and process & material and heat balances.**  **Midrex direct reduction process and different products produced from**  **Midrex direct reduction process.**  **Difference among objective, equipment, source of energy, charging**  **materials, operation, and product characterizations in electric arc furnace**  **and steel making converter.**  **Difference among top, bottom, and mixed blown steel making converters.**  **Refining reactions and slag formation in blast oxygen furnace.**  **4. De-oxidation and degassing technologies.** | | | | | | | | | | | | | |
| **b) Intellectual Skills** | | | | | | | | | | | | | |
| **5. Solving problems.** | | | | | | | | | | | | | |
| **c) Professional and Practical Skills** | | | | | | | | | | | | | |
| **6. Applying mass and heat balances to calculate the weight of produced slag and the percentage volume compositions of exit gases.** | | | | | | | | | | | | | |
| **d) General and Transferable Skills** | | | | | | | | | | | | | |
| **7. Work as a member of team.** | | | | | | | | | | | | | |
| **3. Contents** | | | | | | | | | | | | | | | | | |
| **Topic** | | | | | | | | | | | | **Total hours** | | **Lectures hours** | | **Tutorial/ Practical hours** | |
| **1. Science base of steelmaking** | | | | | | | | | | | | **2** | | **2** | | **---** | |
| **2. Slag in steelmaking** | | | | | | | | | | | | **1** | | **1** | | **---** | |
| **3. Physico-chemical properties of slag** | | | | | | | | | | | | **1** | | **1** | | **---** | |
| **4. Steel making reactions** | | | | | | | | | | | | **1** | | **1** | | **---** | |
| **5. Sources of iron oxides** | | | | | | | | | | | | **1** | | **1** | | **---** | |
| **6. Ore preparation** | | | | | | | | | | | | **1** | | **1** | | **---** | |
| **7. Thermodynamics of oxide reductions** | | | | | | | | | | | | **1** | | **1** | | **---** | |
| **8. Blast furnace design and process & material and heat balances** | | | | | | | | | | | | **14** | | **6** | | **8** | |
| **9. Midrex direct reduction process** | | | | | | | | | | | | **2** | | **2** | | **---** | |
| **10. Converter steelmaking Practice & combined blowing** | | | | | | | | | | | | **7** | | **4** | | **3** | |
| **11. Fundamentals of converter steelmaking technology** | | | | | | | | | | | | **4** | | **4** | | **---** | |
| **12. Modern trends in BOF steelmaking** | | | | | | | | | | | | **2** | | **2** | | **---** | |
| **13. Electric furnace steelmaking** | | | | | | | | | | | | **8** | | **6** | | **2** | |
| **14. Development in EAF steelmaking** | | | | | | | | | | | | **2** | | **2** | | **---** | |
| **15. Stainless steel making technology** | | | | | | | | | | | | **1** | | **1** | | **---** | |
| **16. Evolution of ladle treatments and requirements** | | | | | | | | | | | | **1** | | **1** | | **---** | |
| **17. Injection ladle metallurgy** | | | | | | | | | | | | **1** | | **1** | | **---** | |
| **18. Principles of de-oxidation and degassing** | | | | | | | | | | | | **1** | | **1** | | **---** | |
| **19. Inclusion sources and control** | | | | | | | | | | | | **1** | | **1** | | **---** | |
| **Total** | | | | | | | | | | | | **52** | | **39** | | **13** | |
| **4. Teaching and Learning Methods** | | | | | | | | | | | | **Lectures**  **(** √ **)** | | **Practical Training/ Laboratory ( )** | | **Seminar/**  **Workshop**  **( )** | |
| **Class Activity ( )** | | **Case**  **Study**  **( √ )** | | **Projects**  **( )** | |
| **E-learning ( )** | | **Assignments /Homework ( √ )** | | **Other:** | |
| **5. Student Assessment** | | | | | | | | | | | | | | | | | |
| * **Method** | | | | | | | | **To assess (with reference to the ILOs)** | | | | | | | | | |
| **- Assessment 1; Assignments and presentations** | | | | | | | | **b6, d1** | | | | | | | | | |
| **- Assessment 2; Quizzes** | | | | | | | | **a1, a2, b6** | | | | | | | | | |
| **- Assessment 3; Mid-term exam** | | | | | | | | **a1, a2, a3, b6, c1** | | | | | | | | | |
| **- Assessment 4; Final Exam** | | | | | | | | **a1, a2, a3, a5, b6, c1** | | | | | | | | | |
| * **Assessment Schedule** | | | | | | | | **Week** | | | | | | | | | |
| **- Assessment 1; Assignments and presentations** | | | | | | | | **3, 5, 8** | | | | | | | | | |
| **- Assessment 2; Quizzes** | | | | | | | | **4, 9** | | | | | | | | | |
| **- Assessment 3; Mid-term exam** | | | | | | | | **7** | | | | | | | | | |
| **- Assessment 4; Final Exam** | | | | | | | | **End of Term** | | | | | | | | | |
| * **Weighting of Assessments** | | | | | | | | | | | | | | | | | |
| **- Assessment 1; Assignments and presentations** | | | | | | | | **5%** | | | | | | | | | |
| **- Assessment 2; Quizzes** | | | | | | | | **10%** | | | | | | | | | |
| **- Assessment 3; Mid-term exam** | | | | | | | | **15%** | | | | | | | | | |
| **- Assessment 4; Final Exam** | | | | | | | | **70%** | | | | | | | | | |
| **- Total** | | | | | | | | **100%** | | | | | | | | | |
| **6. List of References** | | | | | | | | | | | | | | | | | |
| **-Ghosh, A. and Chatterjee, A., Principles and Practices in Iron and Steel making, Prentice Hall of India, New**  **Delhi, 2008.**  **-Making, Shaping and Treating of Steel (Steelmaking and Refining), 10th Edition, 1985, AISE, Pittsburgh.** | | | | | | | | | | | | | | | | | |
| **7. Facilities Required for Teaching and Learning** | | | | | | | | | | | | | | | | | |
| **Board, and datashow.** | | | | | | | | | | | | | | | | | |
| **Course Coordinator:** | | | **Dr. Moetaz Mohamed Nabil Mohamed Mohamed Ahmed** | | | | | | | | | | | | | | |
| **Head of Department:** | | | **Prof. Dr. El-Sayed Mahmoud El-Banna** | | | | | | | | | | | | | | |

