

**Cairo University
Faculty of Engineering**

**Department of Mining, Petroleum,**

**and Metallurgical 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:** | **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.**
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| **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** |

