

**Department 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, and Metallurgical Engineering | | | | | | | | | | |
| **Department offering the course:** | | | | | | | Mining, Petroleum, and Metallurgical Engineering | | | | | | | | | | |
| **Academic Level:** | | | | | | | 3rd Year | | | | | | | | | | |
| **Date** | | | | | | | 2014 | | | | | | | | | | |
| **Semester (based on final exam timing)** | | | | | | | Fall Spring | | | | | | | | | | |
| **A- Basic Information** | | | | | | | | | | | | | | | | | |
| **1. Title:** | Metallurgical Thermodynamics And Corrosion | | | | | | | | | **Code:** | | | **MET 302** | | | | |
| **2. Units/Credit hours per week:** | | Lectures | | | 4 | | | Tutorial | | | 1 | Practical | | 1 | | Total | 6 |
| **B- Professional Information** | | | | | | | | | | | | | | | | | |
| **1. Course description:** | | | | * Heat of chemical reactions. | | | | | | | | | | | | | |
| * Statistical interpretation of entropy. | | | | | | | | | | | | | |
| * Applications of second law of thermodynamics. | | | | | | | | | | | | | |
| * Change of entropy. Free energy. Chemical equilibria. | | | | | | | | | | | | | |
| * Equilibrium of gas-solid reactions. | | | | | | | | | | | | | |
| * Equilibrium of gas reactions. Behavior of solutions. | | | | | | | | | | | | | |
| * Electrochemistry of corrosion. Types of corrosion. Kinetics of corrosion and effect of various factors. Corrosion control. Corrosion testing. | | | | | | | | | | | | | |
| **2. Intended Learning Outcomes of Course (ILOs):** | | | | **a) Knowledge and Understanding** | | | | | | | | | | | | | |
| 1. Physical and electrochemistry and their relation to corrosion and extraction, purification and processing of metals and alloys. | | | | | | | | | | | | | |
| 2. Metallurgical thermodynamics and relation to metallurgical processes. | | | | | | | | | | | | | |
| **b) Intellectual Skills** | | | | | | | | | | | | | |
| 3. Combine, exchange, and assess different ideas, views, and knowledge from a range of sources in topics related to material processing, manufacturing, development and selection. | | | | | | | | | | | | | |
| **c) Professional and Practical Skills** | | | | | | | | | | | | | |
| 4. Apply knowledge of mathematics, science, information technology, design, business context and engineering practice integrally to solve metallurgical engineering problems. | | | | | | | | | | | | | |
| 5. Professionally merge the engineering knowledge, understanding, and feedback to improve design, products and/or services. | | | | | | | | | | | | | |
| 6. 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** | | | | | | | | | | | | | |
| 7. 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** | | |
| * Heat of chemical reactions. | | | | | | 6 | | | 4 | | | | | | 2 | | |
| * Statistical interpretation of entropy. | | | | | | 6 | | | 4 | | | | | | 2 | | |
| * Applications of second law of thermodynamics. | | | | | | 6 | | | 4 | | | | | | 2 | | |
| * Change of entropy. Free energy. Chemical equilibria. | | | | | | 6 | | | 4 | | | | | | 2 | | |
| * Equilibrium of gas-solid reactions. | | | | | | 6 | | | 4 | | | | | | 2 | | |
| * Equilibrium of gas reactions. Behaviour of solutions. | | | | | | 2 | | | 2 | | | | | |  | | |
| * Electrochemistry of corrosion. Types of corrosion. Kinetics of corrosion and effect of various factors. Corrosion control. Corrosion testing. | | | | | | 6 | | | 4 | | | | | | 2 | | |
| **4. Teaching and Learning Methods** | | | | | | Lectures (🗸) | | | Practical Training/ Laboratory (🗸) | | | | | | Seminar/Workshop ( ) | | |
| Class Activity ( ) | | | Case Study ( ) | | | | | | Projects ( ) | | |
| E-learning ( ) | | | Assignments /Homework (🗸) | | | | | | Other: Discussions | | |
| **5. Student Assessment Methods** | | | | | | | | | | | | | | | | | |
| * **.Assessment Schedule** | | | | | | | | | **Week** | | | | | | | | |
| -Assessment 1; Class test | | | | | | | | |  | | | | | | | | |
| -Assessment 2; Project Assignment | | | | | | | | |  | | | | | | | | |
| -Assessment 3; Presentations | | | | | | | | |  | | | | | | | | |
| -Assessment 3; Midterm Exam | | | | | | | | | Week 6, 10 | | | | | | | | |
| -Assessment 4; Final Exam | | | | | | | | |  | | | | | | | | |
| * **Weighting of Assessments** | | | | | | | | | | | | | | | | | |
| -Mid-Term Examination | | | | | | | | | 20 % | | | | | | | | |
| -Final-term Examination | | | | | | | | | 66 % | | | | | | | | |
| -Project | | | | | | | | |  | | | | | | | | |
| -Class Test | | | | | | | | |  | | | | | | | | |
| -Presentation | | | | | | | | |  | | | | | | | | |
| -Total | | | | | | | | | 100 % | | | | | | | | |
| **6. List of References** | | | | | | | | | | | | | | | | | |
| 6.1- Course Notes | | | | | | | | | | | | | | | | | |
| 6.2- Essential Books (Text Books) | | | | | | | | | | | | | | | | | |
| * Gaskel, D. Introduction to Metallurgical Thermodynamics. | | | | | | | | | | | | | | | | | |
| * Zemansky, Mark, and Richard Dittman. Heat and Thermodynamics. 7th ed. McGraw-Hill Publishers | | | | | | | | | | | | | | | | | |
| 6.3- Recommended Books | | | | | | | | | | | | | | | | | |
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| 6.4- Periodicals, Web Sites, … etc | | | | | | | | | | | | | | | | | |
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| **7. Facilities Required for Teaching and Learning** | | | | | | | | | | | | | | | | | |
| Board | | | | | | | | | | | | | | | | | |
| data show | | | | | | | | | | | | | | | | | |
| lab top | | | | | | | | | | | | | | | | | |
| **Course Coordinator:** | | | Prof. Dr. Hafez Abd El Azeem, Prof. Dr. Randa Abd El Kreem | | | | | | | | | | | | | | |
| **Head of Department:** | | | Prof. Dr. E.M. Elbanna | | | | | | | | | | | | | | |

