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| **MENG286 – Material Science** | | | | | | | |
| **Eastern Mediterranean University**  **Faculty of Engineering** | | | | | | | |
| **Department:**MechanicalEngineering | | | | | | | |
| **ProgramCode:** 23 | | **Program:** Mechanical Engineering | | **Year/Semester:**2021-2022 Spring | | | |
| **Course Code:**  MENG286 | | **Course Title:**  Materials Science | | **Credit hours** | | | |
| **Lec.** | **Tut/Lab** | | **Total** |
| **3** | **1** | | **3** |
| **Categorization of Course:**  Engineering or Area Core  Engineering Course offered by other programs  Engineering Area Elective  Mathematics and Basic Sciences  General Education | | | | **Categorization of Credits:**   1. Mathematics & Basic Science: - 2. **Engineering Topics: 3** 3. General Education: - 4. Major Engineering Design: - | | | |
| **Instructor Name:** Asst. Prof. Dr. Mohammed Asmael | | | **Office no:** ME122 | | | **Office Tel:**6301279 | |
| **Course Web Page:**<https://staff.emu.edu.tr/mohammedasmael/en> | | | | | | | |
| **Textbook(s):** Materials Science and Engineering: An Introduction, W.D. Callister, Jr. and D.G. Rethwisch,8th edition, John Wiley and Sons, Inc. (2010).  **Indicative Basic Reading List:** Groover, M.P. (2013). Fundamentals of Modern Manufacturing: Materials, Processes And Systems, 5th edition, John Wiley & Sons Inc.. | | | | | | | |
| **Catalog Description:** Crystal structure and crystal geometry phase diagrams of alloy systems, heat treatments applied to metallic materials and plain-carbon steels. Mechanical properties of metals stress-strain in metals, tensile test, hardness and hardness testing, fatigue and fracture of metals, impact test, creep of metals and creep test. Strengthening and plastic deformation of metals. Mechanical properties of ceramics, glasses, polymers and composites. Corrosion of metals. Material selection based on mechanical properties. | | | | | | | |
| **Prerequisite(s)** | CHEM101 | | | | | | |
| **Type of Course** | Required  Selected Elective Elective | | | | | | |

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| **Student Outcomes** | |  |
| **1** | an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, andmathematics |  |
| **2** | an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety,and welfare, as well as global, cultural, social, environmental, and economic factors |  |
| **3** | an ability to communicate effectively with a range of audiences |  |
| **4** | an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, whichmust consider the impact of engineering solutions in global, economic, environmental, and societal contexts |  |
| **5** | an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusiveenvironment, establish goals, plan tasks, and meet objectives |  |
| **6** | an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment todraw conclusions |  |
| **7** | an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. |  |

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| **Course Learning Outcomes** | | **Student Outcomes** | | | | | | | **Assessments and**  **Percentages** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | Classify the solid materials, learning and understanding the atomic bonding in solids. Calculate the density of a material from  the knowledge of the crystal structure understanding and drawing the cubic crystal structures, Unit cell, Face-centred cubic, body-centre cubic .Understanding and calculating the Miller indices of a crystallographic planes | Χ |  |  |  |  |  |  | Online Midterm Exams 30%  Online Final Exam 40%  \* Labs Report submissions 30%,. |
| **2** | Understanding and describing the imperfections and dislocations in the solids and calculating the grain size of a crystalline material. | Χ |  |  |  |  |  |  |
| **3** | Understanding the diffusion mechanisms and using the Fick’s Laws to make calculations for the diffusion problems. | Χ |  |  |  |  |  |  |
| **4** | Understanding the mechanical properties of materials, the Hooke’s law, the stress and strain relations, Poisson’s ratio, ductility, hardness methods and conducting an experiment assign. | X |  |  |  |  |  |  |
| **5** | Understanding the phase diagrams for alloy systems, learning to make a correlation between microstructure and mechanical properties by carefully control of the heat treatment processes. | Χ |  |  |  |  |  |  |
| **6** | Understanding the importance of a heat treatment, and the effects on the microstructure of the iron-carbon alloys. To design a heat treatment process that will produce the desired microstructure. | X |  |  |  |  |  |  |
| **7** | Knowing the types of ferrous and nonferrous metals, and the applications area. | X |  |  |  |  |  |  |
| **8** | Understanding of the mechanisms and causes of corrosion and degradation of metals, learning the methods | Χ |  |  |  |  |  |  |
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|  | **Weight of Student Outcomes** | **H** |  |  |  |  | **M** |  |  |

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| **Topics Covered and Class Schedule:** | |
| **Week 1** | Introduction ot Materials Science |
| **Week 2** | Classification of materials |
| **Week 3** | Classification of materials |
| **Week 4** | Crystallinity of solids, lattice structure, unit cells |
| **Week 5** | Crystal systems, crystallography, determination of crystal structure. |
| **Week 6** | Imperfections in solids, impurities & defects, |
| **Week 7** | Diffusion in solids, diffusion phenomena, |
| **Week 8** | **Midterm Examination** |
| **Week 9** | **Midterm Examination** |
| **Week 10** | Evaluation of mechanical properties of materials, tensile test, stress-strain diagrams, elastic & plastic deformation. |
| **Week 11** | Yield & tensile strength, ductility, resilience, toughness, hardness tests, fatigue test, creep test |
| **Week 12** | Phase diagrams for alloys |
| **Week 13** | Heat treatment of metals |
| **Week 14** | Heat treatment of metals |
| **Week 15** | Corrosion of metals |
| **Week 16** | **Final Examination** |

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| **Laboratory Experiments** | | | | |
| **No.** | **Experiment Title and Equipment Used** | **CLO** | **SO** | **Percentage** |
| **1** | **Title:** Tensile Test  **Equipment:** | **4** | **6** | 15% |
| **3** | **Title:** Hardness Test  **Equipment:** | **4** | **6** | 15% |

**Important Notes Regarding the Course:** University rules and regulations are applied to this course. For details, please see <http://mevzuat.emu.edu.tr>

**Exam and Quiz Policy:**

The midterm and final exams are OPEN book in Case of Online Teaching.

**Makeups:**

1. There is no make-up or resit for the Quiz and Labs.
2. A student who fails to sit for an examination for a valid reason is given a make-up exam. Within three working days after the examination, students who wish to take a make-up must submit a **written statement** to the course instructor explaining the reason(s) for his/her request.
3. Eligibility to take a **Make-Up Exam**:
   1. Student must contact the Instructor immediately within “**three working days**” after the examination when (s)he has missed the mid-term exam or final exam and to discuss with the faculty about the date and time to take the make-up exam.
   2. Student must secure a “**Make-Up Exam Form**” from the department Office or from instructor website & fill-out the Form. For each Make-Up Exam, please use separate Form.
   3. Student must secure the approval from the instructor for taking the Make-Up Exam.
   4. Failure to take the Make-Up Exam at the agreed date and time will lead to a “NG” Grade for the Make-Up Exam, midterm or final.

**NG Policy:**

1. **“NG” Nil Grade/ Failing from Absenteeism:** Students who do not comply with the required level attendance and/or not fulfilling the requirements for the evaluation of the course are given the “NG” grade by the Instructor of the Course based on the criteria determined by the Faculty/School Academic Council. Students are informed about the criteria for receiving the “NG” grade by the related course instructor at the beginning of the semester. “NG” grade is included in the computation of GPA and CGPA.
2. Student attendance is monitored and assessed by the course instructor. A student who fails to meet the requirements of a course or who is absent more than the limit specified by the Faculty is considered to be unsuccessful in that course.
3. Students who do not attend any of the above assessment activities (such as mid-term exam, final exam, lab exam, design project report etc.) will be given NG (Nil Grade).
4. Late Submissions of the Assignments, Lab Reports and Project will be graded as zero.

**Appeals:**

Any appeal against the marks of any assessment component must be made to the course instructor within one week following the announcement of the marks. Any appeal concerning a semester grade must be made to the course instructor no later than the end of the registration period of the following semester.