**METALLURGICAL AND MATERIAL ENGINEERING PhD PROGRAMME**

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| **First Year** | | | | | | |
| **I. Semester** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 501011101 | [THE SCIENTIFIC RESEARCH METHODS AND ITS ETHICS](#EN21) | 7.5 | 3+0 | 3 | **C** | Turkish |
| 503911607 | [Advanced Materials Thermodynamics and Kinetics](#EN26) | 7.5 | 3+0 | 3 | **C** | Turkish |
|  | Elective Course-1 | 7.5 | 3+0 | 3 | E | Turkish |
|  | Elective Course-2 | 7.5 | 3+0 | 3 | E | Turkish |
|  | Total of I. Semester | 30 |  | 12 |  |  |
| **II. Semester** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
|  | Elective Course-3 | 7.5 | 3+0 | 3 | E | Turkish |
|  | Elective Course-4 | 7.5 | 3+0 | 3 | E | Turkish |
|  | Elective Course-5 | 7.5 | 3+0 | 3 | E | Turkish |
| 503912001 | PhD Seminar | 7.5 | 0+1 | - | **C** | Turkish |
|  | Total of II. Semester | 30 |  | 9 |  |  |
|  | TOTAL OF FIRST YEAR | 60 |  | 21 |  |  |

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| **Second Year** | | | | | | |
| **III. Semester** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 503911801 | PhD PROFICIENCY | 30 | 0+1 | **-** | **C** | Turkish |
|  | Total of III. Semester | 30 |  |  |  |  |
| **IV. Semester** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 501011102 | THESIS PROPOSAL | 30 | 0+1 | **-** | **C** | Turkish |
|  | Total of IV. Semester | 30 |  |  |  |  |
|  | TOTAL OF SECOND YEAR | 60 |  |  |  |  |

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| **Third Year** | | | | | | |
| **Fall Semester** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 503911802 | PhD THESIS STUDY | 25 | 0+1 | **-** | **C** | Turkish |
| 503911803 | SPECIALIZATION FIELD COURSE | 5 | 3+0 | **-** | **C** | Turkish |
|  | Total of Fall Semester | 30 |  |  |  |  |
| **Spring Semester** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 503911802 | PhD THESIS STUDY | 25 | 0+1 | **-** | **C** | Turkish |
| 503911803 | SPECIALIZATION FIELD COURSE | 5 | 3+0 | - | **C** | Turkish |
|  | Total of Spring Semester | 30 |  |  |  |  |
|  | TOTAL OF THIRD YEAR | 60 |  |  |  |  |

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| **Fourth Year** | | | | | | |
| **Fall Semester** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 503911802 | PhD THESIS STUDY | 25 | 0+1 | **-** | **C** | Turkish |
| 503911803 | SPECIALIZATION FIELD COURSE | 5 | 3+0 | **-** | **C** | Turkish |
|  | Total of Fall Semester | 30 |  |  |  |  |
| **Spring Semester** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 503911802 | PhD THESIS STUDY | 25 | 0+1 | **-** | **C** | Turkish |
| 503911803 | SPECIALIZATION FIELD COURSE | 5 | 3+0 | - | **C** | Turkish |
|  | Total of Spring Semester | 30 |  |  |  |  |
|  | TOTAL OF FOURTH YEAR | 60 |  |  |  |  |

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| **Elective Courses** | | | | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | | C/E | | Language | |
| 503912601 | [ADVANCED ALLOYING DESIGN](#EN24) | 7.5 | 3+0 | 3 | | E | | Turkish | |
| 503911603 | [ADVANCED TECHNICAL CERAMIC MATERIALS](#EN3) | 7.5 | 3+0 | 3 | | E | | Turkish | |
| 503912602 | [Biomedical Materials](#EN27) | 7.5 | 3+0 | 3 | | E | | Turkish | |
| 503911601 | [DIFFUSION IN CRYSTAL STRUCTURES](#EN7) | 7.5 | 3+0 | 3 | | E | | Turkish | |
| 503911606 | [FIBER AND FIBER-BASED MATERIALS PROPERTIES AND USES](#EN9) | 7.5 | 3+0 | 3 | | E | | Turkish | |
| 503911602 | [PHASE TRANSFORMATIONS IN MATERIALS](#EN18) | 7.5 | 3+0 | | 3 | | E | | Turkish |
| 503911605 | [PRECIOUS METAL PRODUCTION](#EN13) | 7.5 | 3+0 | 3 | | E | | Turkish | |
| 503911604 | [PRODUCTION OF REFRACTORY METALS](#EN15) | 7.5 | 3+0 | 3 | | E | | Turkish | |

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**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Advanced Characterization Techniques |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | | x | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 25 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 25 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | Basic knowledge in materials engineering. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | After fulfilling the course the students will have achieved knowledge about some of the most important advanced materials characterization methods and choose the most suitable technique for a certain application. Techniques covered throughout the course are Advanced Diffraction Techniques, Advanced Surface Characterization Techniques, Advanced Spectroscopic Techniques, Advanced Microscopic Techniques. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to provide sufficiently detailed understanding of some of the most important advanced materials characterization techniques. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Graduate students taken this course improve their knowledge about the advanced characterization techniques that can be used in the characterization of materials. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | An understanding of the basic principles of the techniques and their advantages and limitations.  An understanding of the requirements for samples suitable each techniques.  The ability to decide in a selection of most suitable technique for a specific property.  The ability to analyze the data obtained by such techniques. | | | | | | | |
| **TEXTBOOK** | | | | | Malzeme Karakterizasyonu ve Temel İlkeleri, ERKMEN, Z.E. Yalın Yayıncılık, (2012) | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Materials Characterization Techniques Sam Zhang, Lin Li, Ashok Kumar;CRC press, (2008)2. Advanced Techniques for Materials Characterization, Materials Science Foundations (monograph series) A. K. Tyagi, Mainak Roy | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to the course |
| 2 | Advanced Diffraction Techniques:Introduction; X-Ray, their production&properties  Review of basic diffraction theory; |
| 3 | Quantitative analysis of phases: Rietveld Analysis |
| 4 | Quantitative analysis of phases: Rietveld Analysis |
| 5 | SAXS, SANS, LEED, RHEED, EXAFS. |
| 6 | Midterm Examination 1 |
| 7 | Advanced Surface Characterization Techniques: Introduction |
| 8 | XPS,AES, SIMS |
| 9 | Advanced Spectroscopic Techniques: Vis,UV,FTIR |
| 10 | Raman, STEM-EELS |
| 11 | Midterm Examination 2 |
| 12 | Advanced Microscopic Techniques: TEM: HR,HAADF,STEM,In-situ;  EBSD,AFM,STM, Laser Confocal Microscopy |
| 13 | Scanning Electron Microscopy (SEM) |
| 14 | Transmission electron microscopy (TEM) |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of engineering subjects related with mathematics, science and Metallurgical and Materials Engineering; an ability to apply theoretical and practical knowledge on solving and modeling of Metallurgical and Materials Engineering problems. |  |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications; ability to effective usage of information technologies. |  |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. |  |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. |  |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. |  |  |  |
| **LO 10** | Ability of effective usage of the information technologies. |  |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. |  |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. |  |  |  |

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| **Prepared by :** | Assoc. Prof.Hakan GASAN | **Date:** | 22.05.2015 |

**Signature**:

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**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503902501 | **TITLE** | Advanced Biomaterials and Applications |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | | x | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 15 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 15 |
| Project | | | | |  | |  |
| Report | | | | | 1 | | 30 |
| Seminar | | | | |  | |  |
| Other (Presentation) | | | | | 1 | | 10 |
| **Final Examination** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | After providing information about biocompatibility, cell-biomaterial interactions and biomaterials for biomedical applications, present and potential future use of metallic, ceramic and polymeric biomaterials will be discussed; information about tissue engineering and drug delivery with biosensor materials will be given. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Describe and discuss the properties, applications and production methods of some common and important biomaterials; the structure of the biomaterials in a very different and unique characteristics for the next generation technologies for current and future applications are some of the main objectives of the course. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | 1. Detail & general information about structure and properties of biomaterials with their production technologies.  2. Understand & discuss the relationships between the internal structure and the properties of biomaterials, applications and requirements. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | The main aim is to train and give a perspective to potential engineers & researchers for the structure, producing methods, requirements and using of current and next generation biomaterials. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Ratner, B. D. (Ed.). (2004). Biomaterials science: an introduction to materials in medicine. Academic press.2. Guelcher, S. A., & Hollinger, J. O. (Eds.). (2006). An introduction to biomaterials. CRC/Taylor & Francis. | | | | | | | |
| **OTHER REFERENCES** | | | | | Other books for biomaterials, articles, presentations and lecture notes. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to biomaterials/biocompatibility for biomedical applications |
| 2 | Cell-biomaterials interaction |
| 3 | Bulk and mechanical properties metals, ceramics |
| 4 | Metallic biomaterials |
| 5 | Metallic biomaterials |
| 6 | Midterm Examination 1 |
| 7 | Ceramic biomaterials |
| 8 | Ceramic biomaterials |
| 9 | Polymer biomaterials |
| 10 | Polymer biomaterials |
| 11 | Midterm Examination 2 |
| 12 | Drug delivery and biosensor materials |
| 13 | Tissue engineering |
| 14 | Presentations |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of engineering subjects related with mathematics, science and Metallurgical and Materials Engineering; an ability to apply theoretical and practical knowledge on solving and modeling of Metallurgical and Materials Engineering problems. |  |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications; ability to effective usage of information technologies. |  |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. |  |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. |  |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. |  |  |  |
| **LO 10** | Ability of effective usage of the information technologies. |  |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. |  |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. |  |  |  |

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| **Prepared by :** | Yard. Doç. Dr. Hüseyin Avcı | **Date:** |  |

**Signature**:

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**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503911603 | **TITLE** | Advanced Technical Ceramic Materials |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | | x | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 10 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Definition and classification of advanced technical ceramics, comparison of other ceramic groups, design of technical ceramics, production and application of advanced technical ceramics, mechanical, electric, magnetic and optic properties, high temperature properties, corrosion and tribological properties. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Lecturing of structure and properties of advanced technical ceramics, sufficient knowledge of designing and production methods | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Analyzing of engineering problems with the knowledge of ad.tech.ceramics, Explanation of designing and production procedure of advanced technical ceramics, Approaching industrial problems with the knowledge of materials science to resolve. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.Comprehension of design and production processes of adv.tech. ceram.  2.Comprehension of properties of ad.tech.ceramics  3.Determining of technical applications  4.Signification the importance of adv.tech.cer. on economy and sector. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Richerson, D. W. (1992). Modern Ceramic Engineering, ABD, Marcel Dekker Inc.2. İleri Teknoloji Malzemeleri, Geçkinli, E., İTÜ Yayınları, 1992 | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Definition and classification of advanced technical ceramics, comparison of other ceram. |
| 2 | Investigation of industrial applications of advanced ceramics (Oxides, nitrides, carbides) such as; high temperature, aviation, defence, automotive, bioceramics, tribologic industries etc. |
| 3 | Compositional design and phase diagrams |
| 4 | Powder processes and shaping methods |
| 5 | Production procedure of advanced technical ceramics |
| 6 | Midterm Examination 1 |
| 7 | Sintering |
| 8 | Liquid-phase sintering, solid state sintering, sintering behaviour and mechanisms |
| 9 | Sol-gel |
| 10 | Characterization of advanced technical ceramics |
| 11 | Midterm Examination 2 |
| 12 | Mechanical properties |
| 13 | Physical and thermal properties,Corrosion and tribological properties |
| 14 | Electrical, magnetic and optic properties |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Developing the subjects related with Metallurgical and Materials engineering in the professional level; getting deep understanding and proposing original definitions. | | |  | |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications in professional level; ability of effective usage of information technologies. | | |  | |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | | |  | |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. | | |  | |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. | | |  | |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. | | |  | |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. | | |  | |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. | | |  | |  |  |
| **LO 10** | Ability of effective usage of the information technologies. | | |  | |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. | | |  | |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. | | |  | |  |  |
| **Prepared by :** | | | Assist.Prof.Dr.Bilge YAMAN | **Date:** | | 30.04.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| --- | --- | --- | --- |
| **DEPARTMENT** | **Metallurgical and Materials Engineering (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503901503 | **TITLE** | Ceramic Matrix Composites |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | | x | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 10 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Definition and classification of ceramic matrix composites (CMC), comparison of other composites, applications of CMCs, matrix and materials for the reinforcement, production processes of CMCs, chemical vapor infiltration processes, interface control, phase transformations, mechanical properties, nanocomposites, oxide and non-oxide ceramic matrix composites. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Lecturing of structure and properties of CMCs, developing of its properties, knowledge of designing and production methods. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Gaining the ability of compositional designing of CMC materials in intended properties, approaching industrial problems with the knowledge of CMC materials science principles to resolve and being accessible to new technologies and methodologies. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.Comprehension the importance of designing and production processes of CMCs.  2.Comprehension of properties of CMCs.  3.Determining of technical applications  4.Signification the importance of CMCs on economy and sector. | | | | | | | |
| **TEXTBOOK** | | | | | 1. N.Bansal, Handbook of ceramic composites, Springer, 2006, 564 pages2. R.Warren, Ceramic matrix composites, Springer, 1992, 276 pages | | | | | | | |
| **OTHER REFERENCES** | | | | | W.Krenkel, Ceramic matrix composites, John Wiley & Sons, 2008, 418 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Definition and classification of advanced technical ceramics, comparison of other composite materials |
| 2 | Industrial applications of CMCs |
| 3 | Material selection for matrix and the reinforcement |
| 4 | Fibers as reinforcement in ceramic materials |
| 5 | Production processes of CMC materials |
| 6 | Midterm Examination 1 |
| 7 | Production processes of CMC materials |
| 8 | Chemical Vapor Infiltration(CVI) processes for the ceramic matrix composites |
| 9 | Interfaces, interphases, phase transformations, residual stresses, microstructure-property relationship |
| 10 | Mechanical properties, fracture mechanism and toughness, thermal properties |
| 11 | Midterm Examination 2 |
| 12 | Nanocomposites; manufacturing, properties and applications |
| 13 | Non-oxide/non-oxide composites (CVI SiC/SiC, Carbon fiber reinforced SiC composites, SiC fiber reinforced Si3N4 composites, MoSi2 based composited, BN reinforced composites, Ultra high temperature composites) |
| 14 | Non-oxide/oxide composites (SiC whisker reinforced alümina, Mullite-ZrO2-SiC, Oxide/oxide; Al2O3- ZrO2 composites, etc.)Non-destructive testing techniques for CMC materials |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of engineering subjects related with mathematics, science and Metallurgical and Materials Engineering; an ability to apply theoretical and practical knowledge on solving and modeling of Metallurgical and Materials Engineering problems. |  |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications; ability to effective usage of information technologies. |  |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. |  |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. |  |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. |  |  |  |
| **LO 10** | Ability of effective usage of the information technologies. |  |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. |  |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. |  |  |  |

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| **Prepared by :** | Assist.Prof.Dr.Bilge YAMAN | **Date:** | 30.04.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503901506 | **TITLE** | Corrosion and Electrochemical Techniques |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | | X | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 2 | | 60 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Advanced understanding of the electrochemical aspects of the corrosion, understanding of the corrosion techniques, understanding of the analysis of the experimental results | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Advanced understanding of the principles of corrosion, designing of a research to determine corrosion types / prevention methods | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Identification of all types of corrosion  Developing a method to prevent corrosion  Designing an advanced experimental methods | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Uses the principles of corrosion in the solution of engineering problems Identifies the electrochemical processes  Analyses the material environment interaction in advanced level, Develops designs against material degradation | | | | | | | |
| **TEXTBOOK** | | | | | A. J. Bard and L. R. Faulkner, Electrochemical Methods, Wiley, New York (1980). | | | | | | | |
| **OTHER REFERENCES** | | | | | S. Üneri, Korozyon ve önlenmesi, Korozyon derneği yayınları, Ankara (1998). | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Electrochemical Thermodynamics |
| 2 | Electrochemical Thermodynamics |
| 3 | Electrochemical Kinetics |
| 4 | Electrochemical Kinetics |
| 5 | Passivation |
| 6 | Midterm Examination 1 |
| 7 | Passivation |
| 8 | Types of Corrosion |
| 9 | Types of Corrosion |
| 10 | Analysis of electrode-electrolyte interface |
| 11 | Midterm Examination 2 |
| 12 | DC Polarization techniques |
| 13 | Cyclic Voltametri |
| 14 | AC Electrochemical impedance spectroscopy |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Developing the subjects related with Metallurgical and Materials engineering in the professional level; getting deep understanding and proposing original definitions. | | |  | |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications in professional level; ability of effective usage of information technologies. | | |  | |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | | |  | |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. | | |  | |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. | | |  | |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. | | |  | |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. | | |  | |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. | | |  | |  |  |
| **LO 10** | Ability of effective usage of the information technologies. | | |  | |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. | | |  | |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. | | |  | |  |  |
| **Prepared by :** | | | Prof.Dr.Mustafa ANIK | **Date:** | | 13.05.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Seconday metallurgy |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | | 3 | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Definition basic principles and technology of the secondary metallurgical processes, metal-slag reactions, deoxidation and degassing, adjusting the chemical composition of steel, identification and control of the inclusions , new technologies and quality / cost analysis. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Information about the production of steel with secondary metallurgical methods. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To have knowledge about secondary metallurgical process of steel products. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | - To have information about the secondary metallurgical process,  - the understanding of production of quality steel,  - analyzing applications to increase steel quality and  - solving and evaluation the problems. | | | | | | | |
| **TEXTBOOK** | | | | | A Ghosh, "Secondary Steelmaking, Principles and Applications", CRC Press LLC, 2001,Florida. | | | | | | | |
| **OTHER REFERENCES** | | | | | Turkdoğan, E.T., “ Fundamentals of Steelmaking”, The Institute of Materials, 1996. Londra2. McGannon, H.E., “The Making Shaping and Treating of Steel” USS.3. Bodsworth, C and Bell, H.B.,” Physical Chemistry of Iron and Steel Manufacture”, Longman, 1972. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to Steelmaking |
| 2 | Chemistry of Steelmaking |
| 3 | Sulphur and phosphorus in steel |
| 4 | Metal - slag reactions |
| 5 | Deoxidation |
| 6 | Midterm Examination 1 |
| 7 | Sources and formation of inclusions in steel |
| 8 | Modification of Inclusions |
| 9 | Hydrogen and anitrogen in steel |
| 10 | Degassing |
| 11 | Midterm Examination 2 |
| 12 | Alloying and alloy steelmaking |
| 13 | Analysis and solution of fault in steeel |
| 14 | Quality/cost analysis |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of engineering subjects related with mathematics, science and Metallurgical and Materials Engineering; an ability to apply theoretical and practical knowledge on solving and modeling of Metallurgical and Materials Engineering problems. |  |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications; ability to effective usage of information technologies. |  |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. |  |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. |  |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. |  |  |  |
| **LO 10** | Ability of effective usage of the information technologies. |  |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. |  |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. |  |  |  |

**Prepared by:** Dr. Abdi Aydoğdu **Date:**      

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503911601 | **TITLE** | Diffusion in Crystal Structures |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | | X | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 2 | | 60 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Diffusion equations, solutions for semi-infinite and finite systems, Boltzman-Matano solution, fast diffusion regions and solutions, atomistic mechanisms of diffusion | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Advanced understanding of the diffusion equations, solution of the equation with advanced mathematical methods, advanced understanding of the material properties and diffusivities. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Identification of the kinetics of the processes in materials science  Advanced understanding of the diffusion in materials science  Ability to find relation between process characteristics and material property | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Uses the advanced thermo-chemistry in the solutions of materials engineering problems  Designs processes by utilizing the kinetics  Analyses the relations between process kinetics and materials properties | | | | | | | |
| **TEXTBOOK** | | | | | R.W. Balluffi, S. M. Allen, W. C. Carter, Kinetics of Materials, WILEY, 2005. | | | | | | | |
| **OTHER REFERENCES** | | | | | P. Shewmon, Diffusion in solids, TMS, 1989. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction |
| 2 | Solutions and Applications of Ficks First Law |
| 3 | Solutions and Applications of Ficks Second Law, semi-infinite systems |
| 4 | Solutions and Applications of Ficks Second Law, finite systems |
| 5 | Diffusion in multi-phases |
| 6 | Midterm Examination 1 |
| 7 | Chemical Diffusion: Boltzman-Matano analyses |
| 8 | Fast Diffusion Regions |
| 9 | Ionic Diffusion |
| 10 | Electro-migration |
| 11 | Midterm Examination 2 |
| 12 | Atomistic Theory of Diffusion |
| 13 | Interstitial and substitional diffusion |
| 14 | Diffusion in amorphous solids |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Developing the subjects related with Metallurgical and Materials engineering in the professional level; getting deep understanding and proposing original definitions. | | |  | |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications in professional level; ability of effective usage of information technologies. | | |  | |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | | |  | |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. | | |  | |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. | | |  | |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. | | |  | |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. | | |  | |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. | | |  | |  |  |
| **LO 10** | Ability of effective usage of the information technologies. | | |  | |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. | | |  | |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. | | |  | |  |  |
| **Prepared by :** | | | Prof.Dr.Mustafa ANIK | **Date:** | | 13.05.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503902502 | **TITLE** | Electron microscopy and applications |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | | X | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 35 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 15 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Scanning electron microscope (SEM), transmission electron microscopy (TEM) | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Materials engineering and imaging is widely used in research techniques and applications in which these techniques are needed, the application forms and how to evaluate the data | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | In this course, the graduate student using SEM and TEM techniques on their samples will be able to get topography, morphology, shape, size, composition crystallographic information in laboratory studies | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | In this course, the graduate student using SEM and TEM techniques on their samples will be able to get topography, morphology, shape, size, composition crystallographic information in laboratory studies | | | | | | | |
| **TEXTBOOK** | | | | | -Abberation-Corrected Analytical Transmission Electron Microscopy, Rik Brydson, editor2011, 280pp, hardcover, ISBN 978-0-470-51851-9.-Electron Microscopy and Analysis, 3rd Edition, Peter J. Goodhew, John Humphreys, Richard Beanland, 2000, 272pp, softcover, ISBN 0-748-40968-8 | | | | | | | |
| **OTHER REFERENCES** | | | | | Course Notes | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction: SEM microscopy in materials analysis |
| 2 | Units and operating principle of the SEM |
| 3 | Sample preparation for SEM |
| 4 | SEM-EDS analysis |
| 5 | Practice metal sample analysis |
| 6 | Midterm Examination 1 |
| 7 | Practice plastic sample analysis |
| 8 | Practice-Metal and plastic sample EDS analysis |
| 9 | TEM microscopy in materials analysis |
| 10 | Units and operating principle of the TEM |
| 11 | Midterm Examination 2 |
| 12 | Sample preparation for TEM |
| 13 | TEM: Crystallography, composition, morphology analysis |
| 14 | Application: material analysis |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of engineering subjects related with mathematics, science and Metallurgical and Materials Engineering; an ability to apply theoretical and practical knowledge on solving and modeling of Metallurgical and Materials Engineering problems. | | |  | |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications; ability to effective usage of information technologies. | | |  | |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | | |  | |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. | | |  | |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. | | |  | |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. | | |  | |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. | | |  | |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. | | |  | |  |  |
| **LO 10** | Ability of effective usage of the information technologies. | | |  | |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. | | |  | |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. | | |  | |  |  |
| **Prepared by :** | | Yrd.Doç.Dr.Mustafa Özgür ÖTEYAKA | **Date:** | | 12.10.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Fiber and Fiber-Based Materials Properties and Uses |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| - | | x | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 20 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | | 1 | | 30 |
| Other (Presentation) | | | | | 1 | | 10 |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The explanation of the basic structure of natural and synthetic polymeric fibers with other type of fibers which do not have the basic polymeric structure, physical and chemical properties, manufacturing technologies; general information about the morphology of polymers and methods of studying the internal structure and properties, a brief information about nanofiber production technologies will be given. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Describe and discuss the properties, applications and production methods of some common fibers; the structure of the fibers in a very different and unique characteristics for the next generation technologies for current and future applications to industry and our daily lives. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | 1.Detail & general information about structure and properties of fiber and fiber-based materials with their production technologies.  2.Understand & discuss the relationships between the internal structure of fibrous materials and the properties. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | The main aim is to train potential engineers & researchers for the structure, producing methods and using of current and next generation fibers. | | | | | | | |
| **TEXTBOOK** | | | | | Zhang, X. (2014). Fundamentals of Fiber Science. DEStech Publications, Inc. | | | | | | | |
| **OTHER REFERENCES** | | | | | Other books for fiber and fiber-based materials, articles, presentations and lecture notes. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | An overview of the basic properties of fiber and fiber-based materials |
| 2 | Fiber structure and properties |
| 3 | Physical and chemical properties of natural fibers |
| 4 | Physical and chemical properties of synthetic fibers |
| 5 | Widely used non-polymeric fibers structures, properties and uses: Carbon and glass fibers |
| 6 | Midterm Examination 1 |
| 7 | Production technology and properties of synthetic polymer fibers |
| 8 | Mechanical behaviour of polymers |
| 9 | Polymer crystallization, melting and glass transition temperature |
| 10 | Fiber structure analysis methods |
| 11 | Midterm Examination 2 |
| 12 | Natural polymer fibers production technologies and properties |
| 13 | Nanofiber production technologies and fiber properties |
| 14 | Presentations |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Developing the subjects related with Metallurgical and Materials engineering in the professional level; getting deep understanding and proposing original definitions. | | |  | |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications in professional level; ability of effective usage of information technologies. | | |  | |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | | |  | |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. | | |  | |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. | | |  | |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. | | |  | |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. | | |  | |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. | | |  | |  |  |
| **LO 10** | Ability of effective usage of the information technologies. | | |  | |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. | | |  | |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. | | |  | |  |  |
| **Prepared by :** | | | Yard.Doç.Dr.Hüseyin AVCI | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503901501 | **TITLE** | Friction and Wear on the Materials |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 |  | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| x | | x | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 25 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | | 1 | | 25 |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The importance of tribology, adhesion, friction, wear, the determination of friction and wear. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The teaching of the basic mechanizms of the friction and wear, the friction and wear behaviours of the materials and the determination of friction and wear. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The students learn the basic mechanizms of friction and wear, the friction and wear behaviours of materials and determination of friction and wear. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Fundamentals of friction and wear materials behaviours, material development, measurement of friction and wear. | | | | | | | |
| **TEXTBOOK** | | | | | Principles and applications of tribology | | | | | | | |
| **OTHER REFERENCES** | | | | | Thesis, research atricles | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | The introduction and importance of tribology |
| 2 | Adhesion |
| 3 | Friction |
| 4 | Friction mechanisms |
| 5 | Friction of materials |
| 6 | Midterm Examination 1 |
| 7 | Wear |
| 8 | Wear mechanisms |
| 9 | Wear of materials |
| 10 | Determination of friction and wear |
| 11 | Midterm Examination 2 |
| 12 | Student presentations |
| 13 | Student presentations |
| 14 | Student presentations |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of engineering subjects related with mathematics, science and Metallurgical and Materials Engineering; an ability to apply theoretical and practical knowledge on solving and modeling of Metallurgical and Materials Engineering problems. | | |  | |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications; ability to effective usage of information technologies. | | |  | |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | | |  | |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. | | |  | |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. | | |  | |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. | | |  | |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. | | |  | |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. | | |  | |  |  |
| **LO 10** | Ability of effective usage of the information technologies. | | |  | |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. | | |  | |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. | | |  | |  |  |
| **Prepared by :** | | Assit. P. Dr. İbrahim ÇELİKYÜREK | **Date:** | | 08.05.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503901502 | **TITLE** | High Temperature Behaviour of Materials |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 0 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | | x | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Creep, fatigue and corrosion behaviour and deformation of materials at high temperatures, | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To research creep, hardness and fatigue behaviours of materials at high temperature and to compare materials microstructural and production characteristics for revealling ideal material’s structure. To learn about the methods used to measure and monitor the behavior of high-temperature creep, fatigue and corrosion tests. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To learn high-temperature behaviour metallic, ceramic and polymeric materials, and methods of determining these behaviors. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | • To make the definition of creep and to draw typical creep curve  • To explain relationship between creep strain - temperature - and the time and stress.  • To draw curves depending on the temperature and strain deformation  • To interpret the effects of microstructure and properties of the material (grain size, alloy, etc.) on creep behavior and creep resistance.  • To interpret the high-temperature corrosion behavior of material.  • To identify the relationship between the micro-structure and high temperature strength of materials.  • To explain how could increased the high-temperature strength of metallic, ceramic and polymeric materials | | | | | | | |
| **TEXTBOOK** | | | | | Ashby, M.F. & Jones, Davit R.H. (1996) "Engineering Materials 1: An Introduction to Their Properties & Applications" 2nd Edi., Oxford.Dieter, G.E. (1988) "Mechanical Metallurgy" SI Edi., ISBN:0 07 100406 8, London. | | | | | | | |
| **OTHER REFERENCES** | | | | | Jun-Shan Zhang. High temperature deformation and fracture of materials, Cambridge, UK : Woodhead Publishing : Science Press, 2010. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | The need for the use of materials at high temperature, creep (General Introduction, concepts and importance). |
| 2 | High-temperature deformation |
| 3 | Creep test and creep curves |
| 4 | The effect of temperature creep and stress. Creep activation energy. |
| 5 | Creep mechanisms |
| 6 | Midterm Examination 1 |
| 7 | Creep of ceramics. Creep of polymers. |
| 8 | Creep-resistant materials and designs |
| 9 | High-temperature fatigue and torsion tests. Stress relaxation test. |
| 10 | High-temperature fracture |
| 11 | Midterm Examination 2 |
| 12 | High-temperature corrosion |
| 13 | High-temperature materials |
| 14 | High-temperature protection |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of engineering subjects related with mathematics, science and Metallurgical and Materials Engineering; an ability to apply theoretical and practical knowledge on solving and modeling of Metallurgical and Materials Engineering problems. | | |  | |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications; ability to effective usage of information technologies. | | |  | |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | | |  | |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. | | |  | |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. | | |  | |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. | | |  | |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. | | |  | |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. | | |  | |  |  |
| **LO 10** | Ability of effective usage of the information technologies. | | |  | |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. | | |  | |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. | | |  | |  |  |
| **Prepared by :** | | Asist.Prof.Dr. Nese OZTURK KORPE | **Date:** | | 05.05.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| --- | --- | --- | --- |
| **DEPARTMENT** | **Metallurgical and Materials Engineering (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503901508 | **TITLE** | High Temperature Oxidation of Metals |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | | x | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Thermodynamics of high-temperature metals’ oxidation, oxidation of alloys, protective coatings. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To introduce the properties of metals’ high temperature oxidation, and briefly inform about the prevention of the oxidation to Metallurgical and Materials Engineering Department’s graduate students. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Determining the relationship between metals’ internal structure, properties, environment conditions and thermodynamic principles, development materials’ high-temperature oxidation resistance and selection of appropriate materials to make the usage environment and gain the skills to solve problems | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Define the properties of high-temperature oxidation of metal materials  2.To explain basics of the thermodynamic and the kinetic of high-temperature oxidation  3.To design and evaluate the outcomes of experimental studies examining high-temperature oxidation  4.To relate internal structure of high-temperature oxidation behavior of metals, properties and application environments  5.Determine the methods to increase the high-temperature oxidation resistance of metals  6.Determine the necessary materials and methods to avoid the high temperature oxidation of metals | | | | | | | |
| **TEXTBOOK** | | | | | 1. High-Temperature Oxidation of Metals, Per Kofstad, John Wiley&Sons, INC.2. Introduction to the HighTemperature Oxidation of Metals. Frederick S. Pettit, Gerald H. Meier, Neil Birks Cambridge University Press | | | | | | | |
| **OTHER REFERENCES** | | | | | Developments in high temperature corrosion and protection of materialsEdited by W Gao, University of Auckland, New ZealandHigh-Temperature Corrosion and Materials Applications, ASM Publication 1990. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | General Introduction |
| 2 | Adsorption and initial oxide formation |
| 3 | Defect structure in oxides |
| 4 | Diffusion in oxides |
| 5 | Formation of compact oxide scales at high temperatures |
| 6 | Midterm Examination 1 |
| 7 | Dissolution and diffusion of oxygen in metals |
| 8 | Oxide scale formation |
| 9 | Oxidation of alloys |
| 10 | Oxidation of alloys |
| 11 | Midterm Examination 2 |
| 12 | Oxidation in oxidant other than oxygen, Reaction of metals in mixed environments |
| 13 | Hot corrosion |
| 14 | Protective coatings |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of engineering subjects related with mathematics, science and Metallurgical and Materials Engineering; an ability to apply theoretical and practical knowledge on solving and modeling of Metallurgical and Materials Engineering problems. | | |  | |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications; ability to effective usage of information technologies. | | |  | |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | | |  | |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. | | |  | |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. | | |  | |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. | | |  | |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. | | |  | |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. | | |  | |  |  |
| **LO 10** | Ability of effective usage of the information technologies. | | |  | |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. | | |  | |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. | | |  | |  |  |
| **Prepared by :** | | Assist. Prof. Dr. Nese OZTURK KORPE | **Date:** | | 30.04.15 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **Metallurgical and Materials Engineering (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503911605 | **TITLE** | Precious Metal Production |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | | x | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Gold, silver and platinum and platinum group metals, the history of the group, properties, alloys, raw materials, world production and consumption, production technologies and environmental impacts. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Teaching basic knowledge, method, process and technologies for production and refining of precious metals which are important with respect to production and consumption. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | 1. To gain skills of evaluating data and conditions related to precious metal  plant, production and environmental impact.  2. To gain skills of defining and solving problems by making analysis | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Learns raw materials their properties and preparetion that are used in  precious metal production.  2. Learns the precious metal production technology  3. Apprehends the chemical reactions. Apprehends the chemical reactions. | | | | | | | |
| **TEXTBOOK** | | | | | F.Habasbi, Handbook of Extractive Metallurgy, Vol. III: Precious Metals, WILEY-VCH,1997.M.Grimwade, Introduction to Precious Metals, Newnes Tech. Books,1995. | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Overview of precious metals |
| 2 | Mineralogical structure-process relationship |
| 3 | Gold ores, alloys and consumption areas |
| 4 | Production of gold by cyanide |
| 5 | Production of gold by bacterial leaching |
| 6 | Midterm Examination 1 |
| 7 | The production of gold from the anode mud |
| 8 | Production of silver |
| 9 | Production of platinum and platinum group metals |
| 10 | Production of platinum and platinum group metals |
| 11 | Midterm Examination 2 |
| 12 | Using precious metals in plating industry |
| 13 | Student presantation |
| 14 | Student presantation |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Developing the subjects related with Metallurgical and Materials engineering in the professional level; getting deep understanding and proposing original definitions. | | |  | |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications in professional level; ability of effective usage of information technologies. | | |  | |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | | |  | |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. | | |  | |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. | | |  | |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. | | |  | |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. | | |  | |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. | | |  | |  |  |
| **LO 10** | Ability of effective usage of the information technologies. | | |  | |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. | | |  | |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. | | |  | |  |  |
| **Prepared by :** | | | Assist.Prof.Dr. Belgin TANIŞAN | **Date:** | | 05.05.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503901504 | **TITLE** | Refractory Materials and Applications |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | | x | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Classification and properties of refractory materials; asidic refractories,  alkaline refractories, neutral refractories, production of refractory materials, industrial use of refractory materials. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Identify basic raw materials used in refractory material production, learning production processes of refractory materials. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Learning basic knowledge and technologies on refractory materials and their industrial usage. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Learns raw materials, their properties and preparetion that are used in  refractory metal production  2. Learns the refractory metal production technology Learns the refractory metal production technology Learns raw materials, their properties and preparetion that are used in refractory metal production Learns raw materials, their properties and preparetion that are used in refractory metal productio Learns the refractory metal pr | | | | | | | |
| **TEXTBOOK** | | | | | J.H.CHESTERS, Refractories, production and properties, London 1973J.D.GILCHRIST, Fuels, Furnaces and Refractories, Pergamon Press, 1977. | | | | | | | |
| **OTHER REFERENCES** | | | | | F.H. NORTON, Refractories, McGrawHill, 1970. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Definition and properties of refractory materials |
| 2 | Classification of refractory materials |
| 3 | Alkaline refractories |
| 4 | Asidic refractories |
| 5 | Nötr refractories |
| 6 | Midterm Examination 1 |
| 7 | Refractory raw materials |
| 8 | Production of refractory materials |
| 9 | Production of refractory materials |
| 10 | The expected properties of refractory materials |
| 11 | Midterm Examination 2 |
| 12 | Industrial use of refractory |
| 13 | Test methods |
| 14 | Student presantation |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of engineering subjects related with mathematics, science and Metallurgical and Materials Engineering; an ability to apply theoretical and practical knowledge on solving and modeling of Metallurgical and Materials Engineering problems. | | |  | |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications; ability to effective usage of information technologies. | | |  | |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | | |  | |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. | | |  | |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. | | |  | |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. | | |  | |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. | | |  | |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. | | |  | |  |  |
| **LO 10** | Ability of effective usage of the information technologies. | | |  | |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. | | |  | |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. | | |  | |  |  |
| **Prepared by :** | | Assist.Prof.Dr. Belgin TANIŞAN | **Date:** | | 05.05.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503911604 | **TITLE** | Production of Refractory Metals |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Türkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| 1 | | 2 | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | | 20 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Chemical and physical principles of refractory elements production, Carbothermic and Metallothermic reduction reactions, | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To teach production methods of the most important refractory metals , To introduce the important refractory metals , to teach the usage field of these metals and to define basic principles of production methods of refractory metals | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To learn the chemical and physical principles of the refractory metals,  2. To learn the carbothermic and metallothermic reduction processes principles,  3. To recognize the apparatus and materials that use in the refractory metal processes, | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Ability to develop, select and use modern methods and tools required for production of refractory metals. | | | | | | | |
| **TEXTBOOK** | | | | | . Kumar, P., Ammon, R.L., 1989. Refractory Metals, State-of-the-art 1988, TMS. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Riss, M., Khodorovsky, Y., 1967. Production of Ferroalloys, Mir Publishers, Moscow. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Raw materials, Ores, Concentrates, Slag, Residue, Recycled materials, |
| 2 | Shaft furnace |
| 3 | Metallothermic reduction reactions, |
| 4 | Electrothermic processes and Electrolytic Processes |
| 5 | Vacuum processses |
| 6 | Midterm Examination 1 |
| 7 | Production of Chrome and its alloys |
| 8 | Production of Tungsten and its alloys |
| 9 | Production of Titanium and its alloys |
| 10 | Production of Zirconium and its alloys, |
| 11 | Midterm Examination 2 |
| 12 | Production of Molybdenum and its alloys |
| 13 | Vanadium and its alloys, |
| 14 | Presentation |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Developing the subjects related with Metallurgical and Materials engineering in the professional level; getting deep understanding and proposing original definitions. | | |  | |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications in professional level; ability of effective usage of information technologies. | | |  | |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | | |  | |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. | | |  | |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. | | |  | |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. | | |  | |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. | | |  | |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. | | |  | |  |  |
| **LO 10** | Ability of effective usage of the information technologies. | | |  | |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. | | |  | |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. | | |  | |  |  |
| **Prepared by :** | | | Yrd. Dr. Nurşen Koç | **Date:** | | 8-05-2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503901507 | **TITLE** | WELDING AND JOINING TECHNOLOGY |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TURKISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| 2 | | 3 | | | | 5 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Main target of this course is fundamental welding and joining processes within materials science and failures perspective, and selecting the optimum materilas for joining procedures. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Knowing about the welding and other joining techniques, selection of joining process for the right area, knowing the welding or joining failures relation with materials. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To introduce the student to understand the importance of analysing the welded or joined parts by other techniques | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Learning the relationship of materials science knowledge with joining techniques | | | | | | | |
| **TEXTBOOK** | | | | | 1. S.Kalpakjian, Manufacturing Processes for Engineering Materials, 5th ed., Prentice Hall, 20082. Metals Handbook, Welding and Brazinq, Vol. 6, 8th Edition, 1971, American Society for Metals, Materials Park, OH, 44073. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. David Brandon, Wayne D. Kaplan, Joining Processes: An Introduction, ohn Wiley&Sons 1997 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction and general descriptions |
| 2 | Joining |
| 3 | Joining strength and thermal diffusion |
| 4 | Forging and cold welding |
| 5 | Joining with adhesives and adhesive types |
| 6 | Midterm Examination 1 |
| 7 | Diffusion welding |
| 8 | Soldering and brazing |
| 9 | Fusion welding techniques |
| 10 | Flame cutting and welding |
| 11 | Midterm Examination 2 |
| 12 | Laser welding |
| 13 | Electron beam welding |
| 14 | Welding and joining failures |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of engineering subjects related with mathematics, science and Metallurgical and Materials Engineering; an ability to apply theoretical and practical knowledge on solving and modeling of Metallurgical and Materials Engineering problems. | | |  | |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications; ability to effective usage of information technologies. | | |  | |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | | |  | |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. | | |  | |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. | | |  | |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. | | |  | |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. | | |  | |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. | | |  | |  |  |
| **LO 10** | Ability of effective usage of the information technologies. | | |  | |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. | | |  | |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. | | |  | |  |  |
| **Prepared by :** | | Asst.Prof.Dr.Bedri BAKSAN | **Date:** | | 08.05.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503901505 | **TITLE** | Industrial Heat Treatments |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | | X | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Crystal structure of metals, Plastic deformation and mechanical properties, Effects of heating on deformed metals, Phase diagrams and phase transformation in alloys, Heat treatment of steel, Chemical heat treatment of steel | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main aim of the course is to obtain perfect heat treatment processes by applying the basic principles of applied heat treatment processes | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Learn basic principles of heat treatment and metallurgical applications of this knowledge  Evaluation and application of heat treatment technology data | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | To learn about effect of heat treatment on crystal structure,  To learn about mechanical properties,  To learn about phase diagrams,  To learn about phase transformations in alloys. | | | | | | | |
| **TEXTBOOK** | | | | | Metals Handbook, Volume 4, Heat Treating, 9th edition, ASM, 1991 | | | | | | | |
| **OTHER REFERENCES** | | | | | Komaç, O.Ş., Fiziksel Metalurji ve Isıl İşlem, çev. OGÜ, Eskişehir, 1994 Lakhtin Yu, Engineering Materials, Moscow, 1972 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Annealing of steel |
| 2 | Normalizing of steel |
| 3 | Austenitizing temperatures for hardening |
| 4 | Quenching of steel |
| 5 | Quenching of steel |
| 6 | Midterm Examination 1 |
| 7 | Martempering of steel |
| 8 | Tempering of steel |
| 9 | Austempering of steel |
| 10 | Heat treating of aluminum alloys |
| 11 | Midterm Examination 2 |
| 12 | Heat treating of copper alloys |
| 13 | Heat treating of magnesium alloys |
| 14 | Heat treating of titanium alloys |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of engineering subjects related with mathematics, science and Metallurgical and Materials Engineering; an ability to apply theoretical and practical knowledge on solving and modeling of Metallurgical and Materials Engineering problems. | | |  | |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications; ability to effective usage of information technologies. | | |  | |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | | |  | |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. | | |  | |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. | | |  | |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. | | |  | |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. | | |  | |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. | | |  | |  |  |
| **LO 10** | Ability of effective usage of the information technologies. | | |  | |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. | | |  | |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. | | |  | |  |  |
| **Prepared by :** | | Prof. Dr. Orhan Şerif KOMAÇ | **Date:** | | 05.10.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503911602 | **TITLE** | PHASE TRANSFORMATIONS IN MATERIALS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TURKISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| 3 | | 3 | | | | 4 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 25 |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 25 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Thermodynamics and phase diagrams. Kinetics of phase transformations. Atomistic diffusions mechanisms. Crystal growth kinetics, precipitations, interfaces. Diffusion and controlled growth from interface. Solidification of alloys. Diffusion based transformations in solids. Massive transformations, diffusionless phase transformations. Nucleation and growth of martensite. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | 1. Understanding the diffusion mechanism in atomic level, and assesment of the relationship between the diffusion and atoms mobility,  2. Knowing the formed crystal interfaces in materials' structure due to phase transformations and kinetics, and the parameter affecting the interfaces,  3. Solidification of alloys and diffusion and diffusionless phase transformations, | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | 1. Utilization and application of process thermodynamics and effects of kinetics on alloy design, | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Equilibrium in heterogenous systems, solutions thermodynamics and kinetics of phase transformations,  2. Diffusion mechanisms and transformations,  3. Nucleation mechanisms and alloy solidification,  4. Diffusionless transformations, nucleation and crystallography of martensite. | | | | | | | |
| **TEXTBOOK** | | | | | D.Porter, K.E. Easterling, M.Sherif, Phase Transformations in Metals and Alloys, Third Edition, CRC Press; 3 edition 2009G.Kostorz, Phase Transformations in Materials, WILEY-VCH Verlag GmbH, Weinheim, 2001 | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Thermodynamics of Materials and Phase Diagrams |
| 2 | Kinetics of Phase Transformations |
| 3 | Diffusion in Crystalline Materials |
| 4 | Vacancy Diffusion |
| 5 | Introduction to Crystal Interfaces |
| 6 | Midterm Examination 1 |
| 7 | Equilibrium in polycrystalline materials |
| 8 | Second phase precipitation |
| 9 | Introduction to nucleation, Homogenous and heterogenous nucleation |
| 10 | Diffusional transformations in solids |
| 11 | Midterm Examination 2 |
| 12 | Spinodal decompositon and aging |
| 13 | Eutectoid transformations and ordering |
| 14 | Diffusionless transformations and martensite |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Developing the subjects related with Metallurgical and Materials engineering in the professional level; getting deep understanding and proposing original definitions. | | |  | |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications in professional level; ability of effective usage of information technologies. | | |  | |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | | |  | |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. | | |  | |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. | | |  | |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. | | |  | |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. | | |  | |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. | | |  | |  |  |
| **LO 10** | Ability of effective usage of the information technologies. | | |  | |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. | | |  | |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. | | |  | |  |  |
| **Prepared by :** | | | Asst.Prof.Dr.Bedri BAKSAN | **Date:** | | 08.05.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503901509 | **TITLE** | ADVANCED CASTING TECHNOLOGIES |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | | X | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Models, molds, molds sands, cores, molding methods, investment casting, shell molding, permanent mold casting, pressure casting, centrifugal casting, continuous casting, melting and furnaces, cast irons, tempered cast iron, nodular cast irons, plaster molding | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main aim of the course is to obtain perfect casting processes by applying the basic principles of casting technology | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | By the end of this module students will be able to:  Learning the basic principles of casting technology and metallurgical applications of this knowledge  Evaluation and application of casting technology data | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Learn casting process, models, mould cores, molding process and  different casting processes and decide selection procedures.  Understand principles of steels and cast irons casting technology.  Gain knowledge about the melting process furnaces. | | | | | | | |
| **TEXTBOOK** | | | | | Metals Handbook, Volume 15, Casting, 9th edition, ASM, 1984 | | | | | | | |
| **OTHER REFERENCES** | | | | | Çavuşoğlu, E., Döküm Teknolojisi I, 2.Baskı, İTÜ, İstanbul, 1992Butts, A., Metallurgical Problems, McGraw Hill Book Co. Inc. NewYork, 1943 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Sand molding |
| 2 | Carbon dioxide molding |
| 3 | Plaster mold casting, ceramic mold casting |
| 4 | Shell molding, investment casting |
| 5 | Permanent mold casting, Die casting |
| 6 | Midterm Examination 1 |
| 7 | Production of grey cast iron |
| 8 | Production of grey cast iron |
| 9 | Production of steel casting |
| 10 | Production of steel casting |
| 11 | Midterm Examination 2 |
| 12 | Production of non-ferrous metals castings |
| 13 | Production of non-ferrous metals castings |
| 14 | Production of non-ferrous metals castings |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of engineering subjects related with mathematics, science and Metallurgical and Materials Engineering; an ability to apply theoretical and practical knowledge on solving and modeling of Metallurgical and Materials Engineering problems. |  |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications; ability to effective usage of information technologies. |  |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. |  |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. |  |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. |  |  |  |
| **LO 10** | Ability of effective usage of the information technologies. |  |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. |  |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. |  |  |  |

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| **Prepared by :** | Prof.Dr.Orhan Şerif KOMAÇ | **Date:** | 06.04.2016 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503901505 | **TITLE** | INDUSTRIAL HEAT TREATMENTS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | | X | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Crystal structure of metals, Plastic deformation and mechanical properties, Effects of heating on deformed metals, Phase diagrams and phase transformation in alloys, Heat treatment of steel, Chemical heat treatment of steel | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main aim of the course is to obtain perfect heat treatment processes by applying the basic principles of applied heat treatment processes | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | By the end of this module students will be able to:  Learn basic principles of heat treatment and metallurgical applications of this knowledge  Evaluation and application of heat treatment technology data | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Learn & understand crystal structure of metals and plastic deformation related to mechanical properties of materials  Identifies the effects of heat treatment on alloys  comprehends the phase transformation of alloys related to heat treatment | | | | | | | |
| **TEXTBOOK** | | | | | Metals Handbook, Volume 4, Heat Treating, 9th edition, ASM, 1991 | | | | | | | |
| **OTHER REFERENCES** | | | | | Komaç, O.Ş., Fiziksel Metalurji ve Isıl İşlem, çev. OGÜ, Eskişehir, 1994Lakhtin Yu, Engineering Materials, Moscow, 1972 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Annealing of steel |
| 2 | Normalizing of steel |
| 3 | Austenitizing temperatures for hardening |
| 4 | Quenching of steel |
| 5 | Quenching of steel |
| 6 | Midterm Examination 1 |
| 7 | Martempering of steel |
| 8 | Tempering of steel |
| 9 | Austempering of steel |
| 10 | Heat treating of aluminum alloys |
| 11 | Midterm Examination 2 |
| 12 | Heat treating of copper alloys |
| 13 | Heat treating of magnesium alloys |
| 14 | Heat treating of titanium alloys |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of engineering subjects related with mathematics, science and Metallurgical and Materials Engineering; an ability to apply theoretical and practical knowledge on solving and modeling of Metallurgical and Materials Engineering problems. |  |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications; ability to effective usage of information technologies. |  |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. |  |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. |  |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. |  |  |  |
| **LO 10** | Ability of effective usage of the information technologies. |  |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. |  |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. |  |  |  |

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| **Prepared by :** | Prof. Dr. Orhan Şerif Komaç | **Date:** | 06.04.2016 |

**Signature**

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | Joint Course for the Institute | **SEMESTER** | Fall-Spring |

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| **COURSE** | | | |
| **CODE** | 501011101 | **TITLE** | The Scientific Research Methods and Its Ethics |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| MSc-  Ph.D | 3 | | 0 | 0 | | | 3+0 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| 1,5 | | 1,5 | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Science, the scientific thought and other fundamental concepts, the scientific research process and its techniques, Methodology: Data Collecting-Analysis-Interpretation, Reporting the scientific research (Preparation of a thesis, oral presentation, article, project), Ethics, Ethics of scientific research and publication. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main objectives are: To examine the foundations of scientific research and the scientific research methods, to teach the principles of both the methodology and the ethics, to realize the process on a scientific research and to evaluate the results of research, to teach reporting the results of research (on a thesis, presentation, article). | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Applying the scientific research methods and the ethical rules in their professional life. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Gaining awareness on ethical principles at basic research methods, becoming skillful at analyzing and reporting the data obtained in scientific researches, being able to have researcher qualification with occupational sense of responsibility, having the scientific and vocational ethics’ understanding and being able to defend this understanding in every medium. | | | | | | | |
| **TEXTBOOK (Turkish)** | | | | | Karasar, N. (2015). Bilimsel Araştırma Yöntemi. Nobel Akademi Yayıncılık, Ankara. | | | | | | | |
| **OTHER REFERENCES** | | | | | **1-**Büyüköztürk, Ş., Çakmak, E. K., Akgün, Ö. E., Karadeniz, Ş., Demirel, F. (2012). Bilimsel Araştırma Yöntemleri. Pegem Akademi Yayınevi, Ankara.  **2-**Tanrıöğen, A. (Editör). (2014). Bilimsel Araştırma Yöntemleri. Anı Yayıncılık, Ankara.  **3-**Türkiye Bilimler Akademisi Bilim Etiği Komitesi. Bilimsel Araştırmada Etik ve Sorunları, Ankara: TÜBA Yayınları, (2002).  **4-**Ekiz, D. (2009). Bilimsel Araştırma Yöntemleri: Yaklaşım, Yöntem ve Teknikler. Anı Yayıncılık, Ankara.  **5-**Day, Robert A. (Çeviri: G. Aşkay Altay). (1996). Bilimsel Makale Nasıl Yazılır ve Nasıl Yayımlanır?, TÜBİTAK Yayınları, Ankara.  **6-**Özdamar, K. (2003). Modern Bilimsel Araştırma Yöntemleri. Kaan Kitabevi, Eskişehir.  **7-**Cebeci, S. (1997). Bilimsel Araştırma ve Yazma Teknikleri. Alfa Basım Yayım Dağıtım, İstanbul.  **8-**Wilson, E. B. (1990). An Introduction to Scientific Research. Dover Pub. Inc., New York.  **9-**Çömlekçi, N. (2001). Bilimsel Araştırma Yöntemi ve İstatistiksel Anlamlılık Sınamaları. Bilim Teknik Kitabevi, Eskişehir. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Science, scientific thought and other basic concepts (University, history of university, higher education, science, scientific thought and other related concepts) |
| 2 | Science, scientific thought and other basic concepts (University, history of university, higher education, science, scientific thought and other related concepts) |
| 3 | The scientific research and its types (Importance of the scientific research, types of science, scientific approach) |
| 4 | The scientific research process and its techniques (Access to the scientific knowledge, literature search, determining the research issue, definition of the problem, planning) |
| 5 | The scientific research process and its techniques (Access to the scientific knowledge, literature search, determining the research issue, definition of the problem, planning) |
| 6 | The scientific research process and its techniques (Access to the scientific knowledge, literature search, determining the research issue, definition of the problem, planning) |
| 7 | The method and the approach: Collecting, analysis and interpretation of the data (Data, data types, measurement and measurement tools, collecting data, organizing data, summarizing data, analysis and the interpretation of data) |
| 8 | The method and the approach: Collecting, analysis and interpretation of the data (Data, data types, measurement and measurement tools, collecting data, organizing data, summarizing data, analysis and the interpretation of data) |
| 9 | Finalizing the scientific research (Reporting, preparing the thesis, oral presentation, preparing an article and a project) |
| 10 | Finalizing the scientific research (Reporting, preparing the thesis, oral presentation, preparing an article and a project) |
| 11 | Finalizing the scientific research (Reporting, preparing the thesis, oral presentation, preparing an article and a project) |
| 12 | Ethics, scientific research and publication ethics (Ethics, rules of ethics, occupational ethics, non-ethical behaviors) |
| 13 | Ethics, scientific research and publication ethics (Ethics, rules of ethics, occupational ethics, non-ethical behaviors) |
| 14 | Ethics, scientific research and publication ethics (Ethics, rules of ethics, occupational ethics, non-ethical behaviors) |
| 15,16 | Mid-term exam, Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INSTITUTE’S GRADUATE PROGRAMME’S LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (M.Sc.-Ph.D.)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Having the scientific and vocational ethics’ understanding and being able to defend this understanding in every medium. | | |  | |  |  |
| **LO 2** | Being able to have researcher qualification with occupational sense of responsibility. | | |  | |  |  |
| **LO 3** | Becoming skillful at analyzing and reporting the data obtained in scientific researches. | | |  | |  |  |
| **LO 4** | Gaining awareness on ethical principles at basic research methods. | | |  | |  |  |
| **Prepared by :** | | |  | **Date:** | | 14.06.2016 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Advenced Non-Ferrous extractive metallurgy |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | | 3 | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Copper minerals, copper production by hydrometallurgical methods, pyrometallurgical copper production, aluminum minerals, aluminum production, electrolysis of aluminum, production methods of gold, silver, zinc, lead, nickel and ferro-metal | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The course provides students with types of nonferrous metals and their properties; production methods of metals such as copper, aluminum, gold, silver, zinc, lead, nickel and ferro-metal production process. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To have knowledge about production of non-ferrous metals. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1)Comprehend the types of non-ferrous metals  2) Comprehend the production processes from ores to metals  3) Comprehend the production and purification methods of metals.  4) Evaluate the contribution of precious metals to the economy.  5) Comprehend the production steps of copper, aluminum, gold, silver, zinc, lead, nickel and ferro-metal  6) Investigate of the production of some other metals and comprehend | | | | | | | |
| **TEXTBOOK** | | | | | • Principles of Extractive Metallurgy, F. Habashi, Volume 2-4, Wiley-VCH, 1997. | | | | | | | |
| **OTHER REFERENCES** | | | | | A.K. Biswas, W.G. Davenport, Extractive Metallurgy of Copper, Pergamon Pres, 1976. • Demirden Gayrı Metaller Metalurjisi I-II, Çev:Erman Tulgar, İTÜ Matbaası, 1987. • Elektrometalurji,Çev: Erman Tulgar, İTÜ Matbaası, 1968. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Non-ferrous metals and their properties and applications, and their economic potential  Pretreatment ( drying, calcination, agglomeration, roasting) |
| 2 | Kinetcs of roasting and Kellog diagrams |
| 3 | Reduction processes (gaseous reduction, metallothermic reduction,carbon reduction) |
| 4 | Metal production processes |
| 5 | Magnesium production and its production processes, |
| 6 | Midterm Examination 1 |
| 7 | Zinc production and its production processes |
| 8 | Copper production and its production processes (pyrometallurgical copper production, roasting of copper ores, matte production, hydrometallugical Cu production, Blister copper production, fire and electrolytical refining of blister copper) |
| 9 | Aluminum production and its production processes |
| 10 | Nickel production and production processes |
| 11 | Midterm Examination 2 |
| 12 | Refining processes and their applications |
| 13 | Hydormetallurgy |
| 14 | Electrochemistry |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of engineering subjects related with mathematics, science and Metallurgical and Materials Engineering; an ability to apply theoretical and practical knowledge on solving and modeling of Metallurgical and Materials Engineering problems. |  |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications; ability to effective usage of information technologies. |  |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. |  |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. |  |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. |  |  |  |
| **LO 10** | Ability of effective usage of the information technologies. |  |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. |  |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. |  |  |  |

**Prepared by:** Dr. Abdi Aydoğdu **Date:**      

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Medical Materials |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 6 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| 1 | | 1 | | | | 1 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | | 20 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | | 30 |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Description of medical materials, their application areas, types and properties of medical materials, biocompatibility, development of novel medical materials. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Learning about the types and propertirs of the materials used in the medical field, understanding the concept of biocompatibility,learning about the currently used medical materials and their applications as well as newly developed medical materials. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Understanding the materials selection procedures for medical applications.  Being informed about advaces in the medical materials field; development of novel medical materials and their applications.  Learning about the methods for biocompatibility improvement of materials. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Learning about the engineering applications in medical field and the types of materials used in these applications.  Understanding the critical material properties for medical applications and the concept of biocompatibility.  Evaluating the applicability of currently used mateials in the medical field.  Conducting research and analysis on the development of novel medical materials and their applications. | | | | | | | |
| **TEXTBOOK** | | | | | Biomaterials: An Introduction; Joon Park, R.S. Lakes; Springer (2010) | | | | | | | |
| **OTHER REFERENCES** | | | | | Electronic data bases | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to medical materials |
| 2 | Application areas of medical materials |
| 3 | Hard tissue applications |
| 4 | Soft tissue applications |
| 5 | Biocompatibility concept |
| 6 | Midterm Examination 1 |
| 7 | Metallic medical materials |
| 8 | Ceramic medical materials |
| 9 | Polymeric medical materials |
| 10 | Composite medical materials |
| 11 | Midterm Examination 2 |
| 12 | Biomimetic materials |
| 13 | Advanced medical materials, tissue engineering |
| 14 | Biocompatibility improvement and development of novel medical materials |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of engineering subjects related with mathematics, science and Metallurgical and Materials Engineering; an ability to apply theoretical and practical knowledge on solving and modeling of Metallurgical and Materials Engineering problems. |  |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications; ability to effective usage of information technologies. |  |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. |  |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. |  |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. |  |  |  |
| **LO 10** | Ability of effective usage of the information technologies. |  |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. |  |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. |  |  |  |

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| **Prepared by :** |  | **Date:** |  |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Advanced Alloying Design |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Türkçe |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | | x | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 2 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | |  | | | | | | | |
| **COURSE OBJECTIVES** | | | | | It is aimed to teach the effects of alloying elements on mechanical, physical and chemical properties of alloys for different metallic material groups. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The student learns the effects of the alloying elements, and has an ability to develop new alloys. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | It is obtained an understanding on content-property relation by learning of the effects of the alloying elements. | | | | | | | |
| **TEXTBOOK** | | | | | Alloying, Understanding the basics. ASM international | | | | | | | |
| **OTHER REFERENCES** | | | | | Metallurgical design of steels, İTÜ | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Principles of alloying, alloying for mechanical properties and service propertiesAlloying techniques |
| 2 | Alloying techniques |
| 3 | Gray irons |
| 4 | Ductile irons |
| 5 | Carbon and alloy steels |
| 6 | Midterm Examination 1 |
| 7 | Carbon and alloy steels |
| 8 | High-strength low-alloy steels |
| 9 | Tool steels |
| 10 | Maraging steels, manganese steels |
| 11 | Midterm Examination 2 |
| 12 | Stainless steels |
| 13 | Light metals and alloys, Al alloys |
| 14 | Light metals and alloys, Mg alloys |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Developing the subjects related with Metallurgical and Materials engineering in the professional level; getting deep understanding and proposing original definitions. | | |  | |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications in professional level; ability of effective usage of information technologies. | | |  | |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | | |  | |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. | | |  | |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. | | |  | |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. | | |  | |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. | | |  | |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | | |  | |  |  |
| **Prepared by :** | | | Doç. Dr. Osman TORUN | **Date:** | | 09.11.2017 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Heat Resistant Materials |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 0 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | | x | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 15 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 45 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | High temperature mechanical and corrosion properties, Iron-Based High Temperature Materials, Super Alloys, Non-Ferrous High-Temperature Materials, Intermetallic Compounds, Ceramics, Composites, Coatings | | | | | | | |
| **COURSE OBJECTIVES** | | | | | High temperature technology is of great importance in many industries, such as primary metal and non-nonmetal production, material processing, chemical engineering, transportation and energy production. In most of these industries the fuel price is an important component of overall operating costs. The materials that enable high temperature operation are important for industrial competitiveness because the efficiency of fuel conversion and use is related to the operating temperature. Classes and materials will be introduced. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Recognition of high temperature materials will eliminate the need for information related to academic and related sectors. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Recognition of High Temperature Materials  Defining the Properties of High Temperature Materials  Use of High Temperature Materials Depending on Their Properties  Appropriate Material Selection by Knowing Material Properties | | | | | | | |
| **TEXTBOOK** | | | | | ASM SPECIALTY HANDBOOK\_HEAT RESISTANT MATERIALS | | | | | | | |
| **OTHER REFERENCES** | | | | | HIGH TEMPERATURE MATERIALS AND MECHANISMS-YOSEPH BAR-COHENHIGH TEMPERATURE STRUCTURAL MATERIALS-R.W.CHAN-A.G.EVANS | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | 1. Introduction  1.1 High Temperature Characteristics of Engineering Materials  1.2.High Temperature Mechanical Properties  1.3. High Temperature Corrosion Properties |
| 2 | 2. High Temperature Iron Alloys and Properties  2.1.Steels  2.1.1 Ferritic Heat Resistant Materials  2.1.2 Creep Resistant Materials  2.1.3 Austenitic Steels  2.1.3.1 Corrosion Resistant Austenitic Steels  2.1.3.2 High Strength Austenitic Steels |
| 3 | 2.2. Cast Iron  2.2.1. Gray Cast Iron  2.2.2. Spheroidal Graphite Irons  2.2.3. Austenitic Irons  2.3.Carbon and Alloy Steels  2.4.Stainless Steel  2.5. Cast Iron Alloys |
| 4 | 3.Superalloys  3.1. Iron Superalloys  3.2. Nickel Superalloys  3.3. Cobalt Süperalloys |
| 5 | 4. High Temperature Non- Ferrous Materials and Properties  4.1. Titanium and Titanium Alloys  4.2. Magnesium Alloys and Aluminum Alloys |
| 6 | Midterm Examination 1 |
| 7 | 5. Refractories and Insulating Materials |
| 8 | 6. Intermetallics  6.1. Titanium Aluminides  6.2. Nickel Aluminides |
| 9 | 6.3. Iron Aluminides  6.4. Other Intermetallics |
| 10 | 7. Ceramics |
| 11 | Midterm Examination 2 |
| 12 | 8.Composites |
| 13 | 9. High temperature Coatings |
| 14 | 10.High temperature Coatings |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of engineering subjects related with mathematics, science and Metallurgical and Materials Engineering; an ability to apply theoretical and practical knowledge on solving and modeling of Metallurgical and Materials Engineering problems. | | |  | |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications; ability to effective usage of information technologies. | | |  | |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | | |  | |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. | | |  | |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. | | |  | |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. | | |  | |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. | | |  | |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. | | |  | |  |  |
| **LO 10** | Ability of effective usage of the information technologies. | | |  | |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. | | |  | |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. | | |  | |  |  |
| **Prepared by :** | | Asist.Prof.Dr. Nese OZTURK KORPE | **Date:** | | 12.11.2018 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **Metallurgical and Materials Engineering (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Biomedical Materials |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 6 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Turkish2 |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| 1 | | 2 | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | | 20 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | | 10 |
| Project | | | | |  | | 30 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Description of biomedical materials, their application areas, types and properties of biomedical materials, biocompatibility, development of novel biomedical materials. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Learning about the types and properties of the materials used in the biomedical field, understanding the concept of biocompatibility,learning about the currently used biomedical materials and their applications as well as newly developed biomedical materials. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Understanding the materials selection procedures for biomedical applications.  Being informed about advaces in the biomedical materials field; development of novel medical materials and their applications.  Learning about the methods for biocompatibility improvement of materials. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Learning about the engineering applications in biomedical field and the types of materials used in these applications.  Understanding the critical material properties for biomedical applications and the concept of biocompatibility.  Evaluating the applicability of currently used materials in the biomedical field.  Conducting research and analysis on the development of novel biomedical materials and their applications. | | | | | | | |
| **TEXTBOOK** | | | | | Biomaterials: An Introduction; Joon Park, R.S. Lakes; Springer (2010) | | | | | | | |
| **OTHER REFERENCES** | | | | | Electronic data bases | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to biomedical materials |
| 2 | Application areas of biomedical materials |
| 3 | Hard tissue applications |
| 4 | Soft tissue applications |
| 5 | Biocompatibility concept |
| 6 | Midterm Examination 1 |
| 7 | Metallic biomedical materials |
| 8 | Ceramic biomedical materials |
| 9 | Polymeric biomedical materials |
| 10 | Composite biomedical materials |
| 11 | Midterm Examination 2 |
| 12 | Biomimetic materials |
| 13 | Advanced biomedical materials, tissue engineering |
| 14 | Biocompatibility improvement and development of novel biomedical materials |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Developing the subjects related with Metallurgical and Materials engineering in the professional level; getting deep understanding and proposing original definitions. | | |  | |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications in professional level; ability of effective usage of information technologies. | | |  | |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | | |  | |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. | | |  | |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. | | |  | |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. | | |  | |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. | | |  | |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms in Turkish/English; proficiency in at least one foreign language. | | |  | |  |  |
| **LO 10** | Ability of effective usage of the information technologies. | | |  | |  |  |
| **LO 11** | Understanding of professional and ethical issues and taking responsibility. | | |  | |  |  |
| **LO 12** | Ability to have strategy, politics and applications plans in the professional subjects and ability to evaluate obtained results in the framework of the quality processes. | | |  | |  |  |
| **Prepared by :** | | |  | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
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| **DEPARTMENT** | **Metallurgical and Materials Engineering (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Advanced Materials Thermodynamics and Kinetics |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | | X | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Materials engineering applications of First and Second law of thermodynamics, thermodynamics of gases, phase stability at single and multi-component systems, solution thermodynamics, phase diagrams, activity, steady state and non-steady state diffusion, diffusion in semi finite and finite systems, diffusion in multi component systems, chemical diffusion | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Reviewing of the laws of thermodynamics and understanding of their materials science applications, advanced understanding of the open and closed systems, reviewing of the diffusion equations and solution of them at different boundary conditions | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The main contribution of the course is to gain the ability to examine the thermodynamic and kinetic basics of material properties at the PhD level with an advanced understanding of the thermodynamics and kinetics of the material, and to be able to use this skill in materials engineering applications. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Advanced understanding of material thermodynamics, advanced understanding of material kinetics, analysis of thermodynamic and kinetic basis of material properties, use of thermodynamic and kinetic principles in materials engineering applications | | | | | | | |
| **TEXTBOOK** | | | | | 1) Chemical Thermodynamics of Materials, C.H.P. Lupis, Elsevier, 1983.2) Kinetics of Materials, R.W.Balluffi, S.M. Allen, W.C.Carter, Wiley, 2005. | | | | | | | |
| **OTHER REFERENCES** | | | | | Intorduction to the Thermodynamics of Materials, D.R. Gaskell, Taylor&Francis, 1995. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | First law of Thermodynamic - Application to Materials engineering |
| 2 | Second law of Thermodynamic - Application to Materials engineering |
| 3 | Thermodynamics of gasses |
| 4 | Phase Equilibria in Single Component Systems |
| 5 | Phase Equilibria in Multi Component Systems |
| 6 | Midterm Examination 1 |
| 7 | Ideal, Regular and Real Solutions |
| 8 | Phase Diagrams |
| 9 | Activity |
| 10 | Steady - State and non Steady State Diffusion |
| 11 | Midterm Examination 2 |
| 12 | Diffusion in Semifinite Systems |
| 13 | Diffusion in Finite Systems |
| 14 | Fast Diffusion Regions |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE Metallurgical and Materials Engineering PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Developing the subjects related with Metallurgical and Materials engineering in the professional level; getting deep understanding and proposing original definitions. | | |  | |  |  |
| **LO 2** | Ability to develop, select and use modern methods and tools required for Metallurgical and Materials Engineering applications in professional level; ability of effective usage of information technologies. | | |  | |  |  |
| **LO 3** | Ability to determine, define, formulate and solve complex Metallurgical and Materials Engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | | |  | |  |  |
| **LO 4** | Ability to work effectively and professionally in inner or multi-disciplinary teams; proficiency of interdependence. | | |  | |  |  |
| **LO 5** | Designing ability of the complex system, process, equipment or product under the realistic constraints and conditions by developing the novel strategic approaches. | | |  | |  |  |
| **LO 6** | Self-confidence in dealing with the problems encountered in the engineering applications. | | |  | |  |  |
| **LO 7** | Ability of criticizing and proposing alternatives in the professional subjects. | | |  | |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | | |  | |  |  |
| **Prepared by :** | | | Prof.Dr. Mustafa ANIK | **Date:** | | 13.04.2022 | | | |

**Signature**: