**MECHANICAL ENGINEERING MSc PROGRAMME**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **First Year** | | | | | | | | |
| **I. Semester** | | | | | | | | |
| Code | | Course Title | ECTS | T+P | Credit | C/E | Language | |
| 501011101 | [THE SCIENTIFIC RESEARCH METHODS AND ITS ETHICS](#EN34) | | 7.5 | 3+0 | 3 | **C** | Turkish |
| 503701518 | | [ENGINEERING NUMERICAL ANALYSIS WITH MATHEMATICA](#EN32) | 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 | |
| 503702001 | | Seminar | 7.5 | 0+1 | - | **C** | Turkish | |
|  | | Total of II. Semester | 30 |  | 9 |  |  | |
|  | | TOTAL OF FIRST YEAR | 60 |  | 21 |  |  | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Second Year** | | | | | | | | |
| **III. Semester** | | | | | | | | | |
| Code | Course Title | | ECTS | | T+P | Credit | C/E | Language |
| 503701702 | MSc THESIS STUDY | | 25 | | 0+1 | - | **C** | Turkish |
| 503701703 | SPECIALIZATION FIELD COURSE | | 5 | | 3+0 | - | **C** | Turkish |
|  | | Total of III. Semester | 30 |  | |  |  |  | |
| **IV. Semester** | | | | | | | | | |
| Code | | Course Title | ECTS | T+P | | Credit | C/E | Language | |
| 503701702 | | MSc THESIS STUDY | 25 | 0+1 | | - | **C** | Turkish | |
| 503701703 | | SPECIALIZATION FIELD COURSE | 5 | 3+0 | | - | **C** | Turkish | |
|  | | Total of IV. Semester | 30 |  | |  |  |  | |
|  | | TOTAL OF SECOND YEAR | 60 |  | |  |  |  | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Elective Courses** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 503702501 | [ADAPTIVE CONTROL](#EN10) | 7.5 | 3+0 | 3 | E | Turkish |
| 503701523 | [Advanced Engineering Design](#EN37) | 7.5 | 3+0 | 3 | E | Turkish |
| 503701508 | [AVIATIONS MATERIALS I](#EN21) | 7.5 | 3+0 | 3 | E | Turkish |
| 503702509 | [AVIATIONS MATERIALS II](#EN20) | 7.5 | 3+0 | 3 | E | Turkish |
| 503702516 | [BIODIESEL](#EN7) | 7.5 | 3+0 | 3 | E | Turkish |
| 503701517 | [BOILING AND CONDENSATION HEAT TRANSFER](#EN33) | 7.5 | 3+0 | 3 | E | Turkish |
| 503702511 | [COGENERATION SYSTEMS](#EN26) | 7.5 | 3+0 | 3 | E | Turkish |
| 503701514 | [COMPRESSORS AND VACUUM TECHNOLOGY](#EN31) | 7.5 | 3+0 | 3 | E | Turkish |
| 503702522 | [CONDUCTION HEAT TRANSFER](#EN23) | 7.5 | 3+0 | 3 | E | Turkish |
| 503702512 | [CONTROL OF ROBOT MANIPULATORS](#EN6) | 7.5 | 3+0 | 3 | E | Turkish |
| 503702521 | [CONVECTIVE HEAT TRANSFER](#EN9) | 7.5 | 3+0 | 3 | E | Turkish |
| 5037015022 | [Energy Management and Sustainable Environment](#EN41) | 7.5 | 3+0 | 3 | E | Turkish |
| 503702526 | [Failure Analysis](#EN40) | 7.5 | 3+0 | 3 | E | Turkish |
| 503702520 | [FUELS AND FUNDAMENTALS OF COMBUSTION](#EN8) | 7.5 | 3+0 | 3 | E | Turkish |
| 503701513 | [FUSELAGES](#EN30) | 7.5 | 3+0 | 3 | E | Turkish |
| 503701515 | [HEAT CONDUCTION](#EN22) | 7.5 | 3+0 | 3 | E | Turkish |
| 503701505 | MECHANICAL VIBRATIONS | 7.5 | 3+0 | 3 | E | Turkish |
| 503702525 | [MECHANICS OF COMPOSITE MATERIALS](#EN38) | 7.5 | 3+0 | 3 | E | Turkish |
| 503701608 | [MODELLING OF SOLAR RADIATION CALCULATION](#EN27) | 7.5 | 3+0 | 3 | E | Turkish |
| 503701509 | [MODERN CONTROL SYSTEMS](#EN2) | 7.5 | 3+0 | 3 | E | Turkish |
| 503702518 | [NONLINEAR CONTROL](#EN11) | 7.5 | 3+0 | 3 | E | Turkish |
| 503702502 | [PNEUMATICS](#EN18) | 7.5 | 3+0 | 3 | E | Turkish |
| 503701521 | [Steels and Heat Treatments](#EN42) | 7.5 | 3+0 | 3 | E | Turkish |
| 503702514 | [SYNTHESIS OF MECHANISMS](#EN25) | 7.5 | 3+0 | 3 | E | Turkish |
| 503701512 | [THERMOHYDRAULIC DESIGN I](#EN13) | 7.5 | 3+0 | 3 | E | Turkish |
| 503702503 | [THERMOHYDRAULIC DESIGN II](#EN5) | 7.5 | 3+0 | 3 | E | Turkish |
| 503702524 | [Tool and Die Design](#EN39) | 7.5 | 3+0 | 3 | E | Turkish |
| 503702517 | [TRIBOLOGY](#EN35) | 7.5 | 3+0 | 3 | E | Turkish |
| 503701524 | [Viscous Flow](#EN36) | 7.5 | 3+0 | 3 | E | Turkish |

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503701516 | **TITLE** | Scientific Research Techniques |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 (√)]** | | | | | | |
|  | | 3 | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Introduction and Basic Concepts;Scientific Research and Research Methods; Citations and Scientific Ethics; Report Preparation and Presentation Techniques; Introduction to Design of Experiments and Data Analysis | | | | | | | |
| **COURSE OBJECTIVES** | | | | | All Master's students will be taught how to conduct scientific research of reference resourcses of knowledge, report and present an academical work and while reflecting the knowledge, the students will gain the ability of pursuing the ethical rules. Another objective of the course is to teach the introduction to design of experiments and data analyses of the subjects. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain the ability of preparation, reporting, and presentation, and design of experiments and analyses of experimental data. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students will be able to  1. reflect the knowledge by learning the scientific ethical subjects  2. apply the techniques of scientific research of reference resources  3. conduct analysis of statistical calculations on computer  4. evaluate the experimental data and results | | | | | | | |
| **TEXTBOOK** | | | | | 1. Bilimsel Araştırma Kılavuzu , 2004, Üstdal et al., Pelikan Press, Ankara 2. Kalite için Deney Tasarımı "Taguçi Yaklaşımı",1997, Şirvancı, M., Literatür Press, İstanbul | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Mühendisler için Excel Uygulamaları, 2013, Bakioğlu and Çelik, Nobel Press, Ankara 2. Araştırmalarda Rapor Hazırlama, 2005, Karasar N., Nobel Press, Ankara 3. İstatiksel Deney Tasarımı, 2014, Şenoğlu and Acıtaş, Nobel Press, Ankara | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction and Basic Concepts |
| 2 | Scientific Research and Research Methods |
| 3 | Scientific Research and Research Methods |
| 4 | Citations and Scientific Ethics |
| 5 | Citations and Scientific Ethics |
| 6 | Midterm Examination 1 |
| 7 | Report Preparation and Presentation Techniques |
| 8 | Report Preparation and Presentation Techniques |
| 9 | Introduction to Design of Experiments and Data Analysis |
| 10 | Introduction to Design of Experiments and Data Analysis |
| 11 | Midterm Examination 2 |
| 12 | Introduction to Design of Experiments and Data Analysis |
| 13 | Homework Presentations |
| 14 | Homework Presentations |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assist.Prof.Dr. Ümit ER | **Date:** | 05.10.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503701509 | **TITLE** | MODERN CONTROL SYSTEMS |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | State variable and input-output descriptions of linear continuous-time and discrete-time systems. Solution of linear system dynamical equations. Controllability and observability. Canonical descriptions of linear equations. Irreducible realizations of rational transfer function matrices. Canonical form dynamical equations. State feedback and state estimators. Decoupling by state feedback. Stability of linear dynamical systems and Lyapunov theorem. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To learn fundamentals of linear control theory and its implications into the applied engineering | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To earn skills required for design and control of linear systems | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | By the end of this module students will be able to:  1) gain the knowledge of how to investigate the system behaviour of input-output systems  2) understand and analyze the effects of different inputs to the output signal of the system,  3) learn how to synthesise a controller that results in specific prescribed system behaviour  4) design Lyapunov stable control system implementations | | | | | | | |
| **TEXTBOOK** | | | | | Chen C.T. Linear System Theory and Design, Oxford University Press | | | | | | | |
| **OTHER REFERENCES** | | | | | Lecture Notes | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction : Linear State Space Equations, Linearization |
| 2 | Mathematical Descriptions Of Systems: Input-Output Description, State Variable Description |
| 3 | Comparisons Of Input-Output Description And The State Variable Description |
| 4 | Interconnections Of Linear Systems, Interconnections Of Linear Time Invariant Systems |
| 5 | Linear Dynamical Equations And Impulse-Response Matrices, Solutions Of Dynamical Equations  Eigenvalues, Eigenvectors, Jordan Form, Functions Of A Square Matrix Model Decomposition |
| 6 | Midterm Examination 1 |
| 7 | Equivalent Dynamical Equations, Impulse-Response Matrices And Dynamical Equations |
| 8 | Controllability And Observability Of State Space Systems |
| 9 | Duality Of Controllability And Observability |
| 10 | Canonical Decomposition Of Linear Time Invariant Dynamical Equation, Irreducibility (Minimal State Space Realization), Directional Variations (Degree Of Controllability And Observability) |
| 11 | Midterm Examination 2 |
| 12 | State Feedback And State Estimation |
| 13 | Stability Of Linear Systems In Terms Of Input-Output Description & State-Space Description |
| 14 | Lyapunov Theorem |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assoc. Prof. Dr. Naci Zafer | **Date:** | 15 May 2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503701610 | **TITLE** | VIBRATION ANALYSIS & CONTROL IN MECHANICAL SYSTEMS |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The course aims to teach modeling, detection, elimination and control of noise & vibrations in machines. It provides comprehensive analysis of the tools in vibrational analysis, modeling/measurement and control. The specific topics addressed are: dynamic modeling & analysis, isolation techniques, vibration sources, vibration measurement and data analysis, vibration transducers, modal analysis, FFT, filtering, windowing, control of vibrations. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | 1) to provide practical knowledge on mechanical vibrations,  2) to teach how to analyze vibration behavior characteristics,  3) to study approches used in preventing and controlling vibrations | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students learn, by taking this course, how to model, eliminate and control machine vibrations. The course also aims to make them understand in detail the techniques of elimination and control of noise and vibrations. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | By the end of this module students will be able to:  1) model and analyze vibrations in machinery,  2) learn how to determine vibration and noise sources,  3) gain insight into vibration isolation and elimination techniques,  4) learn practical aspects of vibration analysis & control techniques,  5) understand the importance of condition monitoring. | | | | | | | |
| **TEXTBOOK** | | | | | Vibration of Discrete and Continuous Systems, A.A. Shabana, Springer | | | | | | | |
| **OTHER REFERENCES** | | | | | Lecture Notes | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction: Mechanical Vibrations Review |
| 2 | Vibration Sources, Directions, Detection, Effects, Isolation and Prevention; Noise |
| 3 | Vibration Analysis: Spectrum: FFT, Interpretation, Periodic Measurements |
| 4 | Vibration Analysis: Data Collection and Processing, Test Conditions , Vib Pattern, Waveform (RMS, Peak-to-Peak), Vib Standards, Demodulation; Practical Applications |
| 5 | Waveform Analysis: Signal Conditioning, Modulation, Beating, Clipped Vibs etc.; Commonly Faced Issues (Impacting, Unbalance, Misalignment, Looseness, Damaged Parts, Cavities etc.) |
| 6 | Midterm Examination 1 |
| 7 | Frequency Domain Analysis (Fourier Transform & FFT) |
| 8 | Matlab: Signals and FFT, Convolution, Sampling |
| 9 | Matlab: Signals with Noise, Filtering (Bandpass) |
| 10 | Nyquist-Shannon theorem, Anti-Aliasing filter, Frequency leakage |
| 11 | Midterm Examination 2 |
| 12 | Filter Types (Butterworth, Chebyshev, Bessel, Elliptical), Frequency Responses |
| 13 | Signal Parameters for a Random Signal, Windowing (Hanning and Rectangular) |
| 14 | Control of Vibrations (Passive, Semi-Active & Active) |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assoc. Prof. Dr. Naci Zafer | **Date:** | 15 May 2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503702503 | **TITLE** | THERMOHYDRAULIC DESIGN II |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 2 | | 30 |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Thermohydraulic Analysis of cooling channels, Coolants, one and two phase Flows, Steam Generators Used In Nuclear Plants, Thermal – Hydraulics of Pressurized Water Reactors, Boiling Water Reactors, High Temperature Gas-Cooled Reactor, Liquid Metal Fast Breeder Reactors. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Teaching heat removal fundamentals and specifically the cooling systems of advance energy systems: nuclear reactors. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Designing coolant channels and effective cooling systems for advance energy plants. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Designing coolant channels and effective cooling systems for advance energy plants. | | | | | | | |
| **TEXTBOOK** | | | | | M.M.El-Wakil, Nuclear Heat Transport, American Nuclear Society, 0-89448-014-6, 1978. | | | | | | | |
| **OTHER REFERENCES** | | | | | Samuel Glastone ve Alexander Sesonske, Nuclear Reactor Engineering, Von Nostrand Reinhold Company, 1967. | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction |
| 2 | Thermohydraulic Analysis of cooling channels |
| 3 | Coolants, one and two phase Flows |
| 4 | Steam Generators |
| 5 | Steam Generators Used In Nuclear Plants |
| 6 | Midterm Examination 1 |
| 7 | Pressurized Water Reactors and Water Reactor Thermal – Hydraulics |
| 8 | BWR-Boiling Water Reactors and Reactor Cooling channels and Thermal – Hydraulics |
| 9 | High Temperature Gas-Cooled Reactors |
| 10 | High Temperature Gas-Cooled Reactor Thermal – Hydraulics |
| 11 | Midterm Examination 2 |
| 12 | Liquid Metal Fast Breeder Reactors |
| 13 | Liquid Metal Fast Breeder Reactor Thermal – Hydraulics |
| 14 | Problems in Heat Removal and examles |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Prof. Dr. L. Berrin ERBAY | **Date:** |  |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503702512 | **TITLE** | CONTROL OF ROBOT MANIPULATORS |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The course teaches how to mathematically model industrial robots and how to control them. The specific topics addressed are: characterization of various types of robots, kinematics (rotation, translation, and the homogeneous transformation, forward kinematics and the Denavit-Hertenberg parameters inverse kinematics), motion kinematics (forward and inverse velocity and acceleration kinematics, singularities and jacobian matrices), propagation of static forces/moments and torque (effect of forces/moments at the tool on the robot's joints, effect of forces/moments at the robot's joints on the tool), trajectory generation and planning various interpolation techniques, dynamics, control of robots (PID type controllers, more advanced control schemes such as the computed torque method). | | | | | | | |
| **COURSE OBJECTIVES** | | | | | It is the aim of this course to provide an introductory understanding of the multi-disciplinary field of robotics. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Learning how to model and control robotic manipulators while providing an appreciation of the importance of sensing to robotic applications. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | By the end of this module students will be able to:  1) gain a general appreciation of the field of robotics,  2) obtain and analyze dynamical models of mechanical manipulators,  3) syntesize forces and moments causing a prescribed motion,  4) understand how to design and implement manipulator controllers. | | | | | | | |
| **TEXTBOOK** | | | | | J. J. Craig, Introduction to Robotics Mechanics and Control, Addison Wesley | | | | | | | |
| **OTHER REFERENCES** | | | | | Lecture Notes | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction: Characterization of Various Types of Robots, Some Fundamental Problems In The Field of Robotics, Sensors |
| 2 | Kinematics: Rotation, Translation, and The Homogeneous Transformation |
| 3 | Forward Kinematics and The Denavit-Hartenburg Parameters |
| 4 | Inverse Kinematics |
| 5 | Motion Kinematics: Forward and Inverse Velocity and Acceleration Kinematics |
| 6 | Midterm Examination 1 |
| 7 | Singularities and Jacobian Matrices |
| 8 | Propagation of Static Forces/Moments and Torque: Effect of Forces/Moments At The Tool On The Robot's Joints, Effect of Forces/Moments At The Robot's Joints On The Tool |
| 9 | Trajectory Generation and Planning: Various Interpolation Techniques |
| 10 | Dynamics: Kinetic/Potential Energy and The Equations of Motion |
| 11 | Midterm Examination 2 |
| 12 | The Euler-Lagrange Approach, A Structured Dynamic Model For Rigid Robots |
| 13 | Control of Robots : PID Type Controllers |
| 14 | Advanced Control Schemes (Computed Torque) |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assoc. Prof. Dr. Naci Zafer | **Date:** | 15 May 2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503702516 | **TITLE** | BIODIESEL |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 40 |
| Project | | | | |  | |  |
| Report | | | | | 1 | | 60 |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | |  |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Definition, advantages and disadvantages of biodiesel fuel as an alternative Diesel engine fuel. Fuel standards (TS EN 14214 and ASTM 6751) and standard fuel tests. Organic chemistry and basic fuel compounds. Combustion in Diesel Engines and Heat Release analysis. Comparison of standard Diesel fuel and biodiesel combustion. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The objective of the course is to give and discuss knowledge about definition, advantages and disadvantages, standards, standard test techniques and combustion of biodiesel as an alternative Diesel engine fuel obtained from animal fats and vegetable oils. The aim of the course is also to teach fundamentals of organic chemistry and fuel compounds and basics of Diesel engine combustion. Beside these; to improve ones proficiency of research, report and presentation abilities. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Who will take the course shall define and recognize biodiesel as an alternative Diesel engine fuel obtained from biological renewable resources. Also he/she develops a proficiency of understand, analyze, compare, search, interpret, report and present knowledge about biodiesel’s benefits, shortcomings, standards, standard test techniques and combustion characteristics. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Defines biodiesel as an alternative Diesel engine fuel and realizes its advantages and disadvantages. 2. Knows standards of biodiesel and standard fuel test techniques. 3. Recognize basic hydrocarbon compounds. 4. Understands Diesel engine combustion characteristics and effecting parameters. 5. Knows the difference between biodiesel and standard diesel fuel combustions characteristics. 6. Conducts and follows up-to-date review studies about biodiesel. 7. Reports and presents up-to-date review studies about biodiesel | | | | | | | |
| **TEXTBOOK** | | | | | Scientific research papers and study reports etc. | | | | | | | |
| **OTHER REFERENCES** | | | | | The Biodiesel Handbook, Editors: Gerhard Knothe, Jürgen Krahl and Jon Van Gerpen, AOCS PRESS, 2005. Automotive Fuels Reference Book, Keith Owen and Trevor Coley, Society | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to Alternative fuels and fuel properties |
| 2 | What is Biodiesel and What is not, renewable resources Biodiesel driven. |
| 3 | Fuel properties of biodiesel and standards. |
| 4 | Biodiesel standards and fuel standard test techniques |
| 5 | Biodiesel standards and fuel standard test techniques |
| 6 | Midterm Examination 1 |
| 7 | Fundamentals of Organic Chemistry Alkane /Alkanes (Prafins), Alkene / Alkenes (Olefins / Ethylene), Alkines (Acetylenes) |
| 8 | Combustion characteristics of Diesel engine (Heat Release Analysis) |
| 9 | Conduction Heat Release analysis on Diesel engine combustion |
| 10 | Comparison of combustion characteristics of Biodiesel and standard Diesel fuel |
| 11 | Midterm Examination 2 |
| 12 | Research, discussion and presentation |
| 13 | Research, discussion and presentation |
| 14 | Research, discussion and presentation |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | DOÇ. DR. MUSTAFA ERTUNÇ TAT | **Date:** | 15/05/2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503702520 | **TITLE** | FUELS AND FUNDAMENTALS OF COMBUSTION |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 40 |
| Project | | | | |  | |  |
| Report | | | | | 1 | | 60 |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | |  |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | First and the second laws of thermodynamics, gas mixtures, fuels, theoretical and real combustion process, enthalpy of formation, first law analysis of reacting systems and adiabatic flame temperature, second law analysis and entropy change of reacting systems, chemical equilibrium, equilibrium constant for ideal gas mixtures, chemical equilibrium for simultaneous reactions and phase equilibrium. Moreover scientific search, report, oral presentation and discussion at the field of fuels and combustion. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The objective of the course is to teach about thermodynamic laws, properties of gas mixtures, combustion process, to conduct first and second law analysis of chemical reacting systems, to define chemical equilibrium and equilibrium constant, to teach about equilibrium of simultaneous combustion reactions and equilibrium of different phases. . Beside these; to improve one’s proficiency of research, report and presentation abilities. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students taken the course shall know the first and the second laws of thermodynamics, rules of gas mixtures, hydrocarbon fuels and theoretical and practical combustion process. He/she can calculates enthalpy of formation and adiabatic flame temperature, and can conduct analysis of the first and the second laws on chemically reacting systems, and can understands equilibrium concept, defines equilibrium constants of ideal gas mixtures. One can calculate equilibrium constants of simultaneous reactions and different phases. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Defines laws of thermodynamics. 2. Calculates properties of gas mixtures. 3. Understands concept of fuel and recognizes hydrocarbon types. 4. Balances theoretical and practical combustion process. 5. Calculates formation of enthalpy and adiabatic flame temperature. 6. Conducts analyzes of the first and second laws of thermodynamics on chemically reacting systems. 7. Defines equilibrium constant. 8. Calculates equilibrium constants for ideal gas mixtures, simultaneous reactions and for different phases. 9. Develops proficiency of doing research, report, present and discuss on combustion related subject. | | | | | | | |
| **TEXTBOOK** | | | | | Yunus Ali Çengel and Michael A. Boles, “ Thermodynamics: An Engineering Approach ”, McGraw-Hill Book Company, 1989.F. El-Mahallawy and S. El-Din Habik, Fundamentals and Technology of Combustion, Elsevier 2002 | | | | | | | |
| **OTHER REFERENCES** | | | | | Turns, S.R. An Introduction to Combustion. McGraw Hill, 2011Kuo, K.K. (2005). Principles of Combustion. Wiley-Interscience, 2005 | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | First and Second Laws of Thermodynamics |
| 2 | Ideal Gas Mixtures |
| 3 | Hydrocarbon Fuels |
| 4 | Theoretical and Practical Combustion Process |
| 5 | Enthalpy of Formation and Combustion Enthalpy |
| 6 | Midterm Examination 1 |
| 7 | First law analysis of reacting systems and Adiabatic Flame Temperature |
| 8 | Second Law Analysis of Reacting Systems and Entropy Change |
| 9 | Chemical Equilibrium |
| 10 | Equilibrium Constant for Ideal Gas Mixtures |
| 11 | Midterm Examination 2 |
| 12 | Chemical Equilibrium of Simultaneous Reactions and Phase Equilibrium |
| 13 | Scientific search, report and presentation |
| 14 | Scientific search, report and presentation |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | DOÇ. DR. MUSTAFA ERTUNÇ TAT | **Date:** | 15/05/2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503702521 | **TITLE** | Convective Heat Transfer |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Basic concepts, Differantial Formulation of the basic laws, exact one dimensional solutions, boundary layer flow: application to external flow, appraximate solutions: integral method, heat transfer in channel flow,free convection, correlation equations: forcedand free convection, convection in microchannels | | | | | | | |
| **COURSE OBJECTIVES** | | | | | This course is designed to give graduate students detailed knowledge of convective heat transfer and the use of this knowledge in the solution of engineering problems of convective heat transfer | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Give an ability to apply knowledge of convective heat transfer problems. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. A sound understanding of the governing equations in free and forced convection and their physical  aspects.  2. Ability to identify dimensionless numbers in convection flows  3. Ability to derive differential and integral formulations of boundary layer equations  4. Ability to solve integral boundary layer equations approximately  5. Ability to solve forced convection problems in pipes and ducts  6. Ability to solve natural convection problems. | | | | | | | |
| **TEXTBOOK** | | | | | Latif M. Jiji, Heat Convection, Springer 2006 | | | | | | | |
| **OTHER REFERENCES** | | | | | Bejan, A, 1995. Convection Heat Transfer, John Wiley & Sons Inc. New York. | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Basic concepts |
| 2 | Differantial Formulation of the basic laws |
| 3 | Eexact one dimensional solutions |
| 4 | Boundary layer flow: application to external flow, |
| 5 | Aappraximate solutions: integral method |
| 6 | Midterm Examination 1 |
| 7 | Aappraximate solutions: integral method |
| 8 | Heat transfer in channel flow |
| 9 | Heat transfer in channel flow |
| 10 | Free convection |
| 11 | Midterm Examination 2 |
| 12 | Free convection |
| 13 | Correlation equations: forced and free convection |
| 14 | Convection in microchannels |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assoc. Prof. Dr. Mesut TEKKALMAZ | **Date:** | 15.05.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503702607 | **TITLE** | ADAPTIVE CONTROL |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Real-time parameter estimation, self-tuning regulators, MRAS, stability, convergence and robustness, auto-tuning and gain scheduling | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To provide a review of theory and methodology of adaptive systems  To teach adaptive controller design and implementation methods & alternatives | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To bring awareness about the practical implications of adaptive control. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1) To develop a general understanding of nonlinear systems  2) To understand and analyze various stability types  3) To design and test adaptive controllers (MRAC);  4) To design tunable controllers to improve performance and achieve robustness. | | | | | | | |
| **TEXTBOOK** | | | | | Adaptive control, Karl J. Åstrom ve Bjorn Wittenmark, Addison-Wesley | | | | | | | |
| **OTHER REFERENCES** | | | | | Lecture Notes; J.-J. E. Slotine and W. Li, Applied Nonlinear Control. | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction |
| 2 | Real-Time Parameter Estimation |
| 3 | Self-Tuning Regulators: Deterministic and Stochastic Approaches |
| 4 | Model-Reference Adaptive Systems (MRAS) |
| 5 | Lyapunov Theory and Design of MRAS |
| 6 | Midterm Examination 1 |
| 7 | Input-Output Stability |
| 8 | Analysis of Adaptive Control Systems |
| 9 | Averaging Methods |
| 10 | Robustness and Convergence Rates |
| 11 | Midterm Examination 2 |
| 12 | Automatic Tuning and Gain Scheduling |
| 13 | Perspectives on Adaptive Control |
| 14 | Applications and Case Studies |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assoc. Prof. Dr. Naci Zafer | **Date:** | 15 May 2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503702608 | **TITLE** | NONLINEAR CONTROL |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Mathematical modeling and analysis techniques of nonlinear systems, stability, limit cycles, describing function method, Lyapunov method based approaches, sliding mode control | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To teach analysis of & controller design methods for nonlinear systems. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The scientific and practical importance of analysis and design methods for nonlinear control systems is emphasized by calling attention to the fact that all natural and engineering systems are nonlinear. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | By the end of this module students will  1) get familiar with basic aspects of nonlinear systems and control, from both an analysis and a design point of view,  2) gain knowledge on nonlinear system control techniques,  3) comprehend the importance of feedback control in nonlinear systems,  4) learn various definitions of stability and the value of Lyapunov theorem. | | | | | | | |
| **TEXTBOOK** | | | | | H Khalil, Nonlinear Systems (Prentice Hall) | | | | | | | |
| **OTHER REFERENCES** | | | | | Lecture Notes | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction: Some Nonlinear Systems, General Perspective |
| 2 | Equilibrium Points, Limit Cycles, Adaptive Control |
| 3 | Euclidean Space, Mean Value And İmplicit Function Theorems |
| 4 | Gronwall-Bellman Inequality, Contraction Mapping, Existence-Uniqueness |
| 5 | Continuous Dependence on Initial Conditions And Parameters (Differentiability of Solutions And Sensitivity, Comparison Principle) |
| 6 | Midterm Examination 1 |
| 7 | Periodic Orbits (2nd Order Systems, Stability) |
| 8 | Feedback Kontrol (Linearization, Stability, Regulation Via Integral Control, Gain Scheduling |
| 9 | Analysis of Feedback Systems: Absolute Stability (Circle-Popov Criterions, Simultaneous Lyapunov Functions) |
| 10 | Small Gain Theorem, Passivity, Describing Function Method |
| 11 | Midterm Examination 2 |
| 12 | Stability (Lyapunov ,L-L2, Input/Output, Input/State) |
| 13 | Center Manifold Theorem (Region of Attraction, Invariance Theorems) |
| 14 | Lyapunov Based Design (Robust Stabilization, Backstepping, Sliding Mode Control, Adaptive Control) |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assoc. Prof. Dr. Naci Zafer | **Date:** | 15 May 2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503702509 | **TITLE** | AVIATIONS MATERIALS II |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 (√)]** | | | | | | |
|  | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 10 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 60 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | NDI in aviation, maintanencein aviation , RAM, armour materials, Pytotechnics and application of aviation , Frames of Aeroplanes | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Materials and technologies in today's aviation sector as a locomotive in mind that the Space and Aeronautics,  • Introduction of newly developed materials  •"Defense Sector In Practice" of these materials  • These applications, reflected technological developments in the civilian sector to recognize  • As an engineer, in the light of these developments, new designs and be able to interpret the current developments  • identify the sector of industrial facilities and opportunities to learn about the issues so that the lesson learned in the sector and establish the relationship between the tractor industry issues. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | |  | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Please write minimum four learning outcomes for the course. | | | | | | | |
| **TEXTBOOK** | | | | |  | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 | Midterm Examination 1 |
| 7 |  |
| 8 |  |
| 9 |  |
| 10 |  |
| 11 | Midterm Examination 2 |
| 12 |  |
| 13 |  |
| 14 |  |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

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

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503702509 | **TITLE** | AVIATIONS MATERIALS I |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 (√)]** | | | | | | |
|  | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 10 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 60 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | NDI in aviation, maintanencein aviation , RAM, armour materials, Pytotechnics and application of aviation , Frames of Aeroplanes | | | | | | | |
| **COURSE OBJECTIVES** | | | | | • Introductio to fuselage  •"Aviation Sector In Practice" of these fuselages  • These applications, reflected technological developments in the civilian sector to recognize  • As an engineer, in the light of these developments, new designs and be able to interpret the current developments  • identify the sector of industrial facilities and opportunities to learn about the issues so that the lesson learned in the sector and establish the relationship between the tractor industry issues. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | |  | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Please write minimum four learning outcomes for the course. | | | | | | | |
| **TEXTBOOK** | | | | |  | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 | Midterm Examination 1 |
| 7 |  |
| 8 |  |
| 9 |  |
| 10 |  |
| 11 | Midterm Examination 2 |
| 12 |  |
| 13 |  |
| 14 |  |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

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

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** |  | **TITLE** | Heat Conduction |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 |  | | | 3 |  | 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 | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | In this course, the one and two-dimensional steady heat conduction in cartesian, cylindrical and spherical coordinates, transient heat conduction, porous media and experimental methods used to measure the thermal conductivities are explained. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | In this course, aimed to teach can be approximated under the which condition the transient and multi-dimensionality of the heat transfer problems, to develop differential equation of heat conduction in various coordinate systems, to determine the thermal conditions on the surface, and can be expressed as a mathematical boundary and initial conditions of these conditions. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Provide students to analyze and solve complex engineering applications including conduction heat transfer. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Derivation of Heat transfer equation,  Learning the usage of these equations,  Application of heat transfer equations at cartesian, cylindirical, and spherical coordinates,  Learning of thermal conductivity measurement methods. | | | | | | | |
| **TEXTBOOK** | | | | | Latif M.J., (2009), Heat Conduction, Springer Verlag-Berlin Heidelberg | | | | | | | |
| **OTHER REFERENCES** | | | | | Kakaç S., Yener Y., (1993), Heat Conduction | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction |
| 2 | General Heat Conduction Equation |
| 3 | One-Dimensional Steady-State Conduction |
| 4 | One-Dimensional Steady-State Conduction |
| 5 | Procedure for the Application of Separation of Variables Method Two-Dimensional Steady-State Conduction |
| 6 | Midterm Examination 1 |
| 7 | Procedure for the Application of Separation of Variables Method Two-Dimensional Steady-State Conduction |
| 8 | Procedure for the Application of Separation of Variables Method Transient Heat Conduction |
| 9 | Procedure for the Application of Separation of Variables Method Transient Heat Conduction |
| 10 | Transient Heat Conduction: solution with Integral Transform |
| 11 | Midterm Examination 2 |
| 12 | Transient Heat Conduction: solution with Laplace Transform |
| 13 | Porous media |
| 14 | Thermal conductivity measurement methods. |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assist. Prof.Dr. Özge Altun | **Date:** |  |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503702522 | **TITLE** | Conduction Heat Transfer |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Basic contens, one-two dimensional steady state conduction, transient conduction, porous media | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To understand the concepts of heat transfer by conduction,  To gain the ability to solve the steady state and transient heat conduction problems | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Gain skills to solving the problem of heat transfer by conduction | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Recognizes the importance of the concepts of heat conduction.  2. Analyze the one and two-dimensional heat conduction problems.  3. Analyze the time-dependent heat conduction problems  4. Understand the heat transfer in porous media | | | | | | | |
| **TEXTBOOK** | | | | | Latif M. Jiji, Heat Conduction, Third Edition Springer, 2009 | | | | | | | |
| **OTHER REFERENCES** | | | | | Arpacı, V.S. “Conduction Heat Transfer”, Addison-Wesley Publ.Kakaç, S. “Isı İletimi”, ODTÜ | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Basic concepts |
| 2 | One dimensional steady state conduction |
| 3 | One dimensional steady state conduction |
| 4 | One dimensional steady state conduction |
| 5 | Two dimensional steady state conduction |
| 6 | Midterm Examination 1 |
| 7 | Two dimensional steady state conduction |
| 8 | Two dimensional steady state conduction |
| 9 | Transient conduction |
| 10 | Transient conduction |
| 11 | Midterm Examination 2 |
| 12 | Transient conduction |
| 13 | Porous Media |
| 14 | Porous Media |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assoc. Prof. Dr. Mesut TEKKALMAZ | **Date:** | 15.05.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (PhD)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503712602 | **TITLE** | Materials and Surface Engineering in Tribology |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 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 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Importance of tribology, theories of tribology and wear mechanisms, contact surfaces and its interaction, friction and wear of elements, methodology and technique of tribological testing, selection of materials for tribology, surface design for tribology. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Introduction of materials and surface engineering in tribology.  Understand the experimental approaches and theories used in the tribology.  Material selection and surface design according to the needs of different tribological systems. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students gain skills about the tribological system solution and design subjects. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | After completing the course students should obtain the knowledge of theoretical fundamentals and practical methods for decisions making according tribological problems in design and maintenance of machines and develop the ability to apply them to practical situations:  • have a clear overall picture about the basics of tribology and related sciences, theoretical background about processes in tribological system, mechanisms and forms of interaction of friction surfaces;  • have enough knowledge about the surface and materials applied for different tribological systems;  • understand the principles and know the methodology of performing the tribological testing;  • have good knowledge about the technologies and methods to increase the tribological reliability of machinery elements and friction joints. | | | | | | | |
| **TEXTBOOK** | | | | | Materials and Surface Engineering in Tribology, Jamal Takadoum, Wiley, 2008 | | | | | | | |
| **OTHER REFERENCES** | | | | | Friction, wear, lubrication : a textbook in tribology, K.C Ludema, CRC Press,1996Wear –Materials,Mechanism and Practice, Gwidon W. Stachowiak, Wiley, 2005. | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction of Tribology |
| 2 | Introduction of tribological applications |
| 3 | Materials and surface treatments |
| 4 | Tribological properties of coatings |
| 5 | Tribological properties of coatings |
| 6 | Midterm Examination 1 |
| 7 | Coating characterization and evaluation |
| 8 | Coating selection |
| 9 | Tribological applications and coatings |
| 10 | Tribological applications and coatings |
| 11 | Midterm Examination 2 |
| 12 | Tribological system design–coating selection |
| 13 | Tribological system design–coating selection |
| 14 | Tribological system design–coating selection |
| 15,16 | Final Examination |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | | **CONTRIBUTION LEVEL** | | |
| **NO** | | **LEARNING OUTCOMES (PhD)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. | |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. | |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. | |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. | |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. | |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. | |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility | |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. | |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. | |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assist.Prof.Dr. Mustafa Ulutan | **Date:** | 07.05.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503702514 | **TITLE** | Synthesis of Mechanisms |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Cam types, displacement diyagrams, cam profile, cam production, Four-bar linkage, Crank and rocker | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Student can be designed the cam mechanismsand four bar linkage | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Design of mechanisms, teaching how to obtain cam profiles and four bar linkage | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Be able to gecognize and identify the mechanisms, calculate and analyze | | | | | | | |
| **TEXTBOOK** | | | | | Mekanizmalar, Prof. Dr. Eres Söylemez | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Cam types, displacement diagrams |
| 2 | Simple harmonic motion |
| 3 | Cycloidal motion |
| 4 | Constant acceleration |
| 5 | Modified Constant acceleration |
| 6 | Midterm Examination 1 |
| 7 | Cam profile |
| 8 | Roller follower |
| 9 | Pressure angle |
| 10 | Disk cam |
| 11 | Midterm Examination 2 |
| 12 | Cam production |
| 13 | Four-bar linkage |
| 14 | Crank and rocker |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Asist Prof. Dr. Sezan ORAK | **Date:** | 24.08.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (PhD)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503702511 | **TITLE** | COGENERATION SYSTEMS |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | ------ | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The definition of cogeneration, cogeneration systems, cogeneration system type selection criteria and thermodynamic cycles used in cogeneration systems, trigeneration applications, Energy and exergy analysis of cogeneration and trigeneration systems | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Nowadays, efficient use of energy is very important. For these reason, cogeneration and trigeneration system to use more energy efficient techniques to gain knowledge and skills required for the project to be analyzed. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The ability to set up and operation of cogeneration facility | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Have knowledge about cogeneration and trigeneration systems, Ability to design elements of cogeneration system, Gain ability and knowledge to make energy and exergy analysis of cogeneration and trigeneration systems | | | | | | | |
| **TEXTBOOK** | | | | | N.V. Khartchenko, Advanced Energy Systems, Taylor and Francis, 1998. | | | | | | | |
| **OTHER REFERENCES** | | | | | Acıkkalp E., Balli Ö., Yamik H., Aras H., Energy and Exergy Analysis of a Trigeneration Facility with Natural Gas Engine., Progress in Sustainable Energy Technologies Vol II, CHAPTER 41.p:621-635, Springer 2014. | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to cogeneration |
| 2 | Cogeneration systems |
| 3 | Selection criteria of cogeneration system type |
| 4 | Classification of Cogeneration Systems |
| 5 | Factors Influencing Cogeneration Choice |
| 6 | Midterm Examination 1 |
| 7 | Thermodynamics cycles which used in cogeneration systems |
| 8 | Energy and exergy analysis of cogeneration and trigeneration systems |
| 9 | Energy and exergy analysis of cogeneration and trigeneration systems |
| 10 | Applications |
| 11 | Midterm Examination 2 |
| 12 | Topping and Bottoming cycles |
| 13 | Investment models for Cogeneration |
| 14 | Investment models for Cogeneration |
| 15,16 | Final Examination |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | | **CONTRIBUTION LEVEL** | | |
| **NO** | | **LEARNING OUTCOMES (PhD)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. | |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. | |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. | |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. | |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. | |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. | |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility | |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. | |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. | |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Prof.Dr.Haydar ARAS | **Date:** | 26.08.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (PhD)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503701608 | **TITLE** | MODELLING OF SOLAR RADIATION CALCULATION |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | ------- | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Basic concepts and definitions, Solar angles, angles inclined surface, radiation coming from the atmosphere. Radiation from the earth's surface measurements of solar radiation, all solar radiation, direct and diffuse solar radiation, solar radiation on inclined surface, solar radiation in the open air. Provinces selected for the modeling studies based on geographic region in our country | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The design of solar energy systems, the accuracy of solar radiation is extremely important. From the existing studies in the literature that measures the solar radiation and sunshine duration expensive due to the establishment and maintenance of the systems, the region closest to the measured values of the selected region using empirical formulas are developed for the region is work to be done. The best known and widely used of these formulas Angstrom formula. Instant from the earth, hourly and daily solar radiation values measured by meteorological stations with solar radiation measuring devices or it can be calculated with the aid of empirical or atmospheric correlations developed for the area.  In this course, in our country, all of the daily solar radiation per unit area of the horizontal plane equations used to calculate and analysis of the results obtained from these relations will be discussed. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Be able to MODELLING OF SOLAR RADIATION CALCULATION | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | PlHaving information about the Renewable Energy Resources Solar Energy Basics,  Learning knowledge and skills to calculate solar radiation,  To-date information about literature on the subject  The model developed to understand the results to be obtained to access the Knowledge Levelease write minimum four learning outcomes for the course. | | | | | | | |
| **TEXTBOOK** | | | | | 1) Güneş Enerjisi, Abdurrahman KILIÇ, Aksel ÖZTÜRK, Kipaş Dağıtımcılık, İstanbul, 1983. | | | | | | | |
| **OTHER REFERENCES** | | | | | 2) Güneş Enerjisi ve Uygulamaları, Ali Yücel UYAREL, Etem Sait ÖZ, Emel Matbaacılık Ankara, 1987. 3) Güneş Enerjili Su Isıtma Sistemler TÜBİTAK MAM, Kocaeli, 1997. | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Basic Concepts and Definitions |
| 2 | Solar Angles |
| 3 | Angular Surface Angles |
| 4 | Extraterrestirial Radiation |
| 5 |  |
| 6 | Midterm Examination 1 |
| 7 | Global Solar Radiation |
| 8 | Direct and Diffuse Solar Radiation |
| 9 | Angular Plane Incoming Solar Radiation |
| 10 | Introduction the Modelling |
| 11 | Midterm Examination 2 |
| 12 | Model Studies for Different Provincies in Turkey |
| 13 | Model Studies for Different Provincies in Turkey |
| 14 | Model Studies for Different Provincies in Turkey |
| 15,16 | Final Examination |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | | **CONTRIBUTION LEVEL** | | |
| **NO** | | **LEARNING OUTCOMES (PhD)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. | |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. | |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. | |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. | |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. | |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. | |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility | |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. | |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. | |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Prof.Dr.Haydar ARAS | **Date:** | 26.08.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (PhD)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503711605 | **TITLE** | Boundary Layer Theory |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 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 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Conservation of mass, momentum, energy equations, kinematics, viscous flow, unsteady parallel flow, Stokes problems, similarity solution, aproximate methods for the solution of two dimensional steady boundary layer equations, stability of steady flows. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Derivation of mass, momentumand energy equations, application of these equations to parallel flow and boundary layer flows | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Student gain the skills to apply the basic equations about the boundary layer to real, complex flows. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Apply Navier Sokes equations to sove the flow broblems such as parallel flow, flow betwee two cocentric cylinders  apply the basic equations to boundary layer flows  Analyse the boundary layer flows | | | | | | | |
| **TEXTBOOK** | | | | | Schlichting, H. Boundary-Layer Theory, McGraw-Hill Book Company, 1979, USA | | | | | | | |
| **OTHER REFERENCES** | | | | | White, M. W. Viscous Fluid Flow, McGraw-Hill, Inc. 1991, SingapureRosenhad, L. Laminar Boundary Layers, Dover Publications 1988, USA | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Kinematic |
| 2 | Conservation of mass, momentum, energy equations |
| 3 | Conservation of mass, momentum, energy equations |
| 4 | Exact solution of Navier Stokes equations, unsteady paralel flows |
| 5 | Very slow motion, Stokes problems |
| 6 | Midterm Examination 1 |
| 7 | Laminar boundary layer |
| 8 | Laminar boundary layer |
| 9 | Similarity solution |
| 10 | Approximate methods for the solution of two dimensional steady boundary layer equations |
| 11 | Midterm Examination 2 |
| 12 | Approximate methods for the solution of two dimensional steady boundary layer equations |
| 13 | Stability of steady flows |
| 14 | Stability of steady flows |
| 15,16 | Final Examination |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | | **CONTRIBUTION LEVEL** | | |
| **NO** | | **LEARNING OUTCOMES (PhD)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. | |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. | |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. | |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. | |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. | |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. | |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility | |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. | |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. | |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assoc.Prof.Dr. Necati MAHİR | **Date:** | 07.05.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (PhD)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503711607 | **TITLE** | Surface Modification |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 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 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Surface modification techniques of metals. General and special processes. Diffusion techniques, chemical and physical vapour deposition techniques, and thermally assisted coatings. Surface properties that improved by these techniques. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Introduction of surface modification techniques of metal materials.  Understand the importance of different properties and applications of the surface modification.  Introduction of some advanced techniques of surface treatment of metals.  Developing and decision-making according to needs of surface properties of manufactured parts. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Student gain the skills to advanced design and selection of the surface properties of different work materials. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Design a system, component, or process to meet desired needs.  Get a recognition of the need for, and an ability to engage in life-long learning.  Gain a knowledge of contemporary issues. Identify, formulate, and solve engineering problems.  Improving knowledge about material selection for industrial applications. | | | | | | | |
| **TEXTBOOK** | | | | |  | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. ASM Handbook Volume 5, “Surface Modification”2. Coating Materials and Surface Coating, Arthur A. Tracton.3. Advanced Thermally Assisted Surface Engineering Processess, Ramnarayan Chattopadhyay4. Modern Surface Technology, Friedrich-Wilhelm Bach, Andreas | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Surfaces |
| 2 | Surface energy |
| 3 | Tribological properties of surfaces |
| 4 | Mechanical state of surfaces |
| 5 | Mechanical state of surfaces |
| 6 | Midterm Examination 1 |
| 7 | Chemical state of surfaces |
| 8 | Chemical state of surfaces |
| 9 | Surface treatments and coatings |
| 10 | Surface treatments and coatings |
| 11 | Midterm Examination 2 |
| 12 | Selection and design of surface modification |
| 13 | Selection and design of surface modification |
| 14 | Selection and design of surface modification |
| 15,16 | Final Examination |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | | **CONTRIBUTION LEVEL** | | |
| **NO** | | **LEARNING OUTCOMES (PhD)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. | |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. | |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. | |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. | |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. | |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. | |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. | |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility | |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. | |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. | |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assist.Prof.Dr. Mustafa ULUTAN | **Date:** | 07.05.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503702509 | **TITLE** | FUSELAGES |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 (√)]** | | | | | | |
|  | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 10 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 60 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | All the details to the design of aircraft. Presentation all the elements of the body, including on the plane. For example an aircraft design | | | | | | | |
| **COURSE OBJECTIVES** | | | | | • Introductio to fuselage  •"Aviation Sector In Practice" of these fuselages  • These applications, reflected technological developments in the civilian sector to recognize  • As an engineer, in the light of these developments, new designs and be able to interpret the current developments  • identify the sector of industrial facilities and opportunities to learn about the issues so that the lesson learned in the sector and establish the relationship between the tractor industry issues. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Through this course, because it is the fastest growing technology, aerospace, professional literature, is considered to be updated very often. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | A graduate student completing this course, on the fuselage of the aircraft's other structural parts of the motor on the minimum level of knowledge about the design of an adequate level, and becomes the owner of an aircraft.  In addition, in the event of work in the sector both in terms of business meetings as well as its knowledge in the workplace becomes more advantageous than other mechanical engineers | | | | | | | |
| **TEXTBOOK** | | | | | Uçak Tasarım Projeleri, LLYOD R., JENKINSON | | | | | | | |
| **OTHER REFERENCES** | | | | | • A’dan Z’ye Dünya Uçakları ve Helikopterleri, KUŞHAN M.C.• Recent Advantages in Aircraft Technology, AGARWAL K.• Uçaklar ve Helikopterler, ŞAHİN K.• Uçak Ana Elemanları, ÖZŞAHİN E. | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | The principle of the general structure of the aircraft and flight |
| 2 | Aircraft recognition |
| 3 | Aircraft wing and ailerons |
| 4 | Landing gear |
| 5 | Airframes |
| 6 | Midterm Examination 1 |
| 7 | Aircraft Design |
| 8 | Aircraft Design |
| 9 | Aircraft Design |
| 10 | Aircraft Design |
| 11 | Midterm Examination 2 |
| 12 | Presentation of Homeworks |
| 13 | Presentation of Homeworks |
| 14 | Presentation of Homeworks |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assoc.Prof.Dr. Melih Cemaş Kuşhan | **Date:** |  |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503701514 | **TITLE** | Compressors and Vacuum Technology |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Compressor theory and research of application areas. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Applications of compressors in machinery production industry, design and gainning an experiences for solutions of problems. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To prepare the students with trainning and gaining experience for industrial applications. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Understanding of compressed air systems used in industry, application and appreciation of applications in automation. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Compressors: Selection and Sizing, 3rd edition, by Royce N. Brown, ISBN: 0750675454 Pub. Date: June 2005, Publisher: Elsevier Science & Technology Books.2. Compressors:Selection %Sizing/Royce N.Brown-2nd edition, ISBN:0-88415-164-6, Library of Congress Cataloging-in Publication Data.3. Compressors and Applications, Prof.Dr.Yaşar Pancar ve Assist.Prof.Dr.H.Sevil Ergür, Eskişehir, pp. 325, In Press. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1.Vacuum and Presssure Systems Handbook, Gast Manufacturing Inc, A Unit of IDEX Corporation.2. Vacuum Technology and Elements, Prof.Dr.Yaşar Pancar ve Assist.Prof.Dr. H.Sevil Ergür, Eskişehir, pp. 74. In press. | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Compressor Theory |
| 2 | Compressor Theory and Applications |
| 3 | Compressor Types, Cooling and Energy Economics |
| 4 | Vacuum Theory |
| 5 | Applications of Vacuum Technology |
| 6 | Midterm Examination 1 |
| 7 | Calculations and Control of Compressed Air |
| 8 | Calculations and Control of compressed Air |
| 9 | Calculations and Control of Vacuum Technology |
| 10 | Calculations and Control of Vacuum Technology |
| 11 | Midterm Examination 2 |
| 12 | Compressed Air Problems and Solutions |
| 13 | Troubleshooting in Compressor Systems and Air Lines |
| 14 | Discussion of Compressed Air And Vacuum Pumps |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assist. Prof. Dr. H. Sevil ERGÜR | **Date:** | 26.08.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** |  | **TITLE** | Eng Numerical Analyses with Mathematica |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 |  | | | 3 |  | 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 | | | | | 2 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | | 6 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Introduction to Mathematica. Coordinate systems, matrices and vectors. Differentiation and integration with Mathematica. Plotting graphs with Mathematica, Numerical differentiation methods and calculations, Numerical integration methods and calculations, Numerical solution of ordinary differential equations, Numerical solutions of the partial differential equations, Solutions of Laplace and Poissons equations with Mathematica, Applications for steady equations, Applications in wave mechanics, Applications in fluid dynamics. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To teach at least one of the programs that are used to solve numerical problems computer aid | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain the ability of analysis of data in Master's level experimental and theoretical works.  To understand the compulsoriness of computer aided analyses of numerical approaches to real physical applications  The course is designed to compensate the lack of knowledge of students | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | To learn at least one numerical computational program  To the knowledge of numerical analyses methods  To use computer aided numerical analysis methods  To gain the ability of using a powerful symbolic software for solution of engineering numerical problems such as Mathematica | | | | | | | |
| **TEXTBOOK** | | | | | "An Introduction to Programming with Mathematica" by Paul Wellin, Sam Kamin, and Richard Gaylord,"Differential equations with Mathematica" by Martha L. Abell and James P. Braselton" | | | | | | | |
| **OTHER REFERENCES** | | | | | A Physicists Guide to Mathematica" by Patrick T. Tam, Academic Press | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to Mathematica: introducing of notebook interface, preparation of input, on-line help |
| 2 | Nand symbolic calculations, Creating 2D and 3D graphics |
| 3 | Arithmatic operations: Matrices, some mathematical functions, solution of polinomial equations |
| 4 | Numerical integration, solution of differential equations |
| 5 | Solution of equations, derivatives, integral, summation |
| 6 | Midterm Examination 1 |
| 7 | Power series, limits |
| 8 | Solution methods for partial differential equations |
| 9 | Fourier transform |
| 10 | Graphical capabilities: 2D and 3D graphics, animations, exercises |
| 11 | Midterm Examination 2 |
| 12 | Mechanics: Solutions of falling bodies problems and |
| 13 | Ss of pendulum problems with Mathematica |
| 14 | Solution of the wave equaitons in Mathematica |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assist. Prof. Tuncay Kamaş | **Date:** | 20th of June, 2016 |

**Signature**

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** |  | **TITLE** | Boiling and condensation heat transfer |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 4 | | 25 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | |  |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Condensation heat transfer phenomena, droplet condensation , condensation number of film condensation over the horizontal pipes, boiling heat transfer , pool boiling , flow boiling , simplified correlations for boiling heat transfer with water, heat pipe, non-boiling two-phase flow heat transfer. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | understanding of boiling and condensation phenomena for heating and cooling design | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | It was usually occured boiling and condensation in fluids used in power and cooling cycles . Engineers interested in this subject must understand the relevant processes to design the appropriate heat transfer device. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | understanding of condensation,understanding of boiling,understanding of film condensation in pipe, understanding the importance of heat pipe used to take advantage of the phase change heat transfer | | | | | | | |
| **TEXTBOOK** | | | | | Isı transferi, J. P. Holman | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. ısı ve kütle transferi Yunus A. çengel, Afshin J. Ghajar2. Lahey,R.T.,Jr. Boiling Heat Transfer Elsevier Science Publishers,1992.3. Delhaye,J.M.,M.Giot,M.L.Riethmuller; Thermohydraulics of Two-Phase Systems for Industrial Design, Series in Thermal and Fluids Engineering, Hemisphere Publ. Cor., 1981. | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | boiling heat transfer |
| 2 | pool boiling |
| 3 | flow boiling |
| 4 | simplified correlations for boiling heat transfer with water |
| 5 | heat pipe |
| 6 | Midterm Examination 1 |
| 7 | condensation heat transfer |
| 8 | condensation coefficient |
| 9 | film condensation in horizontal pipes |
| 10 | dropwise condensaiton |
| 11 | Midterm Examination 2 |
| 12 | film condensaiton |
| 13 | film condensation |
| 14 | non-boiling two phase boiling heat transfer |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assist. Prof. Dr. Nihal Uğurlubilek | **Date:** | 18.04.2016 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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. | | | | | | | |

|  |  |
| --- | --- |
| **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 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **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**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503702517 | **TITLE** | Tribology |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 40 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Theoretical and / or practical studies on friction, wear, lubrication and coating technologies. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Gains the ability to identify, research, find a solutions and development about the tribology problems. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The ability of the mechanical engineer to gain the necessary research, investigation, calculation and solution skills in tribological systems. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Ability to apply knowledge of basic sciences (Mathematics, Physics, Chemistry)  2. Ability to analyze and evaluate data  3. Ability to select, design and develop one tribological system, desired qualities (friction, wear, etc.)  4. Ability to identify, formulate and solve problems in the branch  5.Establishment of oral and written communication skills  6. Ability to understand the national and global effects of engineering solutions  7.The ability to following current topics. | | | | | | | |
| **TEXTBOOK** | | | | | Industrial Tribology, Theo Mang, Kirsten Bobzin and Thorsten Bartels, Wiley VCH, 2011. | | | | | | | |
| **OTHER REFERENCES** | | | | | Coating Tribology Properties, Mechanisms, Techniques and Applications in Surface Engineering, Kenneth Holmberg and Allan MAtthews, Elsevier, 2009 | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | General Information |
| 2 | Tribological Systems |
| 3 | Surface Engineering in Tribology |
| 4 | Friction |
| 5 | Friction Tests |
| 6 | Midterm Examination 1 |
| 7 | Wear |
| 8 | Wear Mechanisms |
| 9 | Lubricants |
| 10 | Lubrication Systems |
| 11 | Midterm Examination 2 |
| 12 | Tribological Materials |
| 13 | Tribology of Coatings |
| 14 | Tribology of Coatings |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assist.Prof.Dr. Koray KILIÇAY | **Date:** |  |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** |  | **TITLE** | COMPOSITE MATERIALS |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 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 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | This course investigates general structure of composite materials, production techniques, mechanical behavior and failure criteria of laminated composite materials. In order to teach the classical lamination theory better, anisotropic elasticity is also covered within this course. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Composite materials are among advance materials which are effectively utilized in aerospace and automotive industry. This course leads students in learning about composite materials and designing parts by using such materials. Moreover, this course provides students with sufficient knowledge in solid mechanics. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Examination of mechanical behavior of composite materials requires special approaches and theories. By learning such theories, students gain ability to design parts composed of composite materials. Additionally, they know about various production techniques. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students who succeed in this class,  1) Get information about constituents and production techniques of composite materials.  2) Have ability to design a components using laminated composites.  3) Get fundamental knowledge in Elasticity.  4) Develop ability to think analytically. | | | | | | | |
| **TEXTBOOK** | | | | | Robert M. Jones, Mechanics of Composite Materials, Taylor and Francis, 1999. | | | | | | | |
| **OTHER REFERENCES** | | | | | Course Notes | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Constituents of composite materials |
| 2 | Production Techniques |
| 3 | Production Techniques |
| 4 | Anisotropic Elasticity |
| 5 | Anisotropic Elasticity |
| 6 | Midterm Examination 1 |
| 7 | Macro-mechanical behavior of a lamina |
| 8 | Micro-mechanical behavior of a lamina |
| 9 | Micromechanical behavior of a lamina |
| 10 | Macro-mechanical behavior of a laminate |
| 11 | Midterm Examination 2 |
| 12 | Macro-mechanical behavior of a laminate |
| 13 | Strength of laminates and Failure criteria |
| 14 | Strength of laminates and Failure criteria |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assist.Prof.Dr. Onur Arslan | **Date:** | 23.03.2018 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** |  | **TITLE** | Computational Fluid Dynamics by Finite Volume Method |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | | X | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Numerical solution of convection problems by using finite volume method | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To teach numerical solution techniques of finite-volume methods of convection problems | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain the ability to solve flow and heat transfer problems. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Compass the finite volume method.  Applies the finite volume method in diffusion problems.  Applies the finite volume method for convection-diffusion problems.  Evaluates basic numerical methods used in heat-flow systems. | | | | | | | |
| **TEXTBOOK** | | | | | An introduction to computational Fluid Dynamics, The Finite volume Method. H.K. Versteeg and W. Malalasekera | | | | | | | |
| **OTHER REFERENCES** | | | | | Hoffman K.A., Chiang S.T., 2000, Computational Fluid Dynamics, Engineering Education System. | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Basic concepts |
| 2 | Fundamental equations in fluid mechanics and heat transfer |
| 3 | Classification of mathematical physics equations |
| 4 | Boundary conditions |
| 5 | Numerical solution approaches: Finite difference, finite volume and finite element methods |
| 6 | Midterm Examination 1 |
| 7 | Numerical solution approaches: Finite difference, finite volume and finite element methods |
| 8 | Basics of finite volume techniques |
| 9 | Solution of algebraic equations by iterative methods |
| 10 | Finite volume method in diffusion problems |
| 11 | Midterm Examination 2 |
| 12 | Finite volume method in convection-diffusion problems |
| 13 | Non-orthogonal meshes |
| 14 | Non-orthogonal meshes |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Dr. Öğr. Üyesi Zerrin SERT | **Date:** | 05.04.2018 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** |  | **TITLE** | ELASTICITY |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 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 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | This course contributes theories of solid mechanics in graduate level. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main objective of this course is to make students gain a vision in the physics of the stress and strain phenomena occuring in elastic materials under various types of loading conditions. A therotical knowledge is given and ability to perform mathematical operations in elasticity problems are developped in this course. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Elasticity is the prominent theoretical course in mechanics field of science. Especially the students who are interested in solid mechanics benefit from this course in understaning and evaluation of solid mechanics problems. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students who succeed in this class,  1) Learn theories in deformation, strain and stress phenomena occuring in elastic isotropic/anisotropic materials .  2) Increase ablility to handle theoretical problems.  3) Learn performing mathemetical operations using Einstein's notation which is effectively utilized in every engineering dicipline.  4) Develop analytical thinking ability. | | | | | | | |
| **TEXTBOOK** | | | | | Richard G. Budynas, Advance strength and Applied stress analysis, Mc Graw Hill, 1999. | | | | | | | |
| **OTHER REFERENCES** | | | | | Course Notes | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Basic concepts and Einstein's Notation |
| 2 | Basic concepts and Einstein's Notation |
| 3 | Analysis of strain, Strain transformation, Strain compatibility |
| 4 | Analysis of strain, Strain transformation, Strain compatibility |
| 5 | Analysis of stress, Stress transformation, Equilibrium equations |
| 6 | Midterm Examination 1 |
| 7 | Analysis of stress, Stress transformation, Equilibrium equations |
| 8 | Constitutive relations, Anisotropic materials |
| 9 | Constitutive relations, Anisotropic materials |
| 10 | Stress Functions |
| 11 | Midterm Examination 2 |
| 12 | Two-Dimensional Elasticity |
| 13 | Two-Dimensional Elasticity |
| 14 | Thermo-elastic problems |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assist.Prof.Dr. Onur Arslan | **Date:** | 23.03.2018 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503701501 | **TITLE** | THERMAL DESIGN OF REFRIGERATION SYSTEMS |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 2 | | 30 |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | General aspects of thermodynamics, fluid flow and heat transfer, Refrigerants, Basic components of refrigeration cycle, Design and analysis of the refrigeration systems with the 1st and 2nd law of thermodynamics point of view. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Learning of advantages and disadvantages of the refrigerants, having knowledge of basic components of refrigeration cycle such as compressor, condenser, and evaporator, and analyze the refrigeration systems by the view of 1st and 2nd law of thermodynamics. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Having knowledge about cooling devices, analyzing them in terms of energy conservation, improving their quality and efficiency, sizing and designing | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To learn about thermodynamics, fluid mechanics and heat transfer  2. Applications of I. and II. law of Thermodynamics for cooling devices  3. Analysis of efficiency and avaliability of cooling devices  4. Sizing of cooling devices, evaluate it to the practise | | | | | | | |
| **TEXTBOOK** | | | | | Dinçer İ, Kanoğlu M, Refrigeration Systems and Applications, 2nd edition, John Wiley and Sons, 2010. | | | | | | | |
| **OTHER REFERENCES** | | | | | Yamankaradeniz R, Horuz M, Kaynaklı Ö, Çoşkun S, Yamankaradeniz N, Soğutma Tekniği ve Isı Pompası Uygulamaları, 3. basım, Dora Yayınları, 2013. | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | General aspects of thermodynamics, fluid flow and heat transfer |
| 2 | General aspects of thermodynamics, fluid flow and heat transfer |
| 3 | Refrigerants |
| 4 | Refrigeration system components |
| 5 | Refrigeration system components |
| 6 | Midterm Examination 1 |
| 7 | Refrigeration cycles and systems |
| 8 | Refrigeration cycles and systems |
| 9 | Advanced refrigeration cycles and systems |
| 10 | Advanced Refrigeration cycles and systems |
| 11 | Midterm Examination 2 |
| 12 | Exergy analysis of refrigeration systems |
| 13 | Exergy analysis of refrigeration systems |
| 14 | Exergy analysis of refrigeration systems |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Asst. Prof. Dr. Bahadır DOĞAN | **Date:** | 04.04.2018 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** |  | **TITLE** | Air-conditioning system design |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Basic concepts of air conditioning and psychometric diagram, basic of psychometric processes, psychometric examination of air conditioning appliances, calculation of heating and cooling loads, heat recovery systems | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Basic concepts of air conditioning and the psychrometric diagram, calculation of ,heating and cooling loads, to gain the ability to calculate the subject of air conditioning systems and air-conditioning elements. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Air conditioning is one of the most important branches of Mechanical Engineering. This course will form the basis for graduates who need to work in this branch. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Having knowledge about the properties of moist air thermodynamics  Analysis of climate conditioning cycles  Design of air conditioning systems for different applications  Having knowledge about heat recovery systems | | | | | | | |
| **TEXTBOOK** | | | | | ASHRAE Handbook: Fundamentals, 2001 | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Klima Tesisatı, MMO Yayını2. İklimlendirme Esasları, Çeviren Prof.Dr.Osman F.Gence3. Heating Ventilating, And Air Conditioning Face, C. McQuiston, Jerald, D. Parker,4. Howell, R.H., Sauer, H.J., Coad W.J.: Principles of Heating, Ventilating and Air Conditioning, ASHRAE, 1998. | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Psychrometry definition |
| 2 | thermodynamic features of dry and moist air |
| 3 | Psychometric terms |
| 4 | psychrometric chart |
| 5 | Heating of air |
| 6 | Midterm Examination 1 |
| 7 | Cooling of air |
| 8 | Humidifying of air |
| 9 | Psychometric examination of the air conditioning applications |
| 10 | Heat recovery |
| 11 | Midterm Examination 2 |
| 12 | Heat recovery |
| 13 | Receiving of air humidity |
| 14 | Receiving of air humidity |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assist. Prof. Nihal UĞUĞRLUBİLEK | **Date:** | 20/11/17 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 503702517 | **TITLE** | Tribology |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 40 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Theoretical and / or practical studies on friction, wear, lubrication and coating technologies. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Gains the ability to identify, research, find a solutions and development about the tribology problems. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The ability of the mechanical engineer to gain the necessary research, investigation, calculation and solution skills in tribological systems. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Ability to apply knowledge of basic sciences (Mathematics, Physics, Chemistry)  2. Ability to analyze and evaluate data  3. Ability to select, design and develop one tribological system, desired qualities (friction, wear, etc.)  4. Ability to identify, formulate and solve problems in the branch  5.Establishment of oral and written communication skills  6. Ability to understand the national and global effects of engineering solutions  7.The ability to following current topics. | | | | | | | |
| **TEXTBOOK** | | | | | Industrial Tribology, Theo Mang, Kirsten Bobzin and Thorsten Bartels, Wiley VCH, 2011. | | | | | | | |
| **OTHER REFERENCES** | | | | | Coating Tribology Properties, Mechanisms, Techniques and Applications in Surface Engineering, Kenneth Holmberg and Allan MAtthews, Elsevier, 2009 | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | General Information |
| 2 | Tribological Systems |
| 3 | Surface Engineering in Tribology |
| 4 | Friction |
| 5 | Friction Tests |
| 6 | Midterm Examination 1 |
| 7 | Wear |
| 8 | Wear Mechanisms |
| 9 | Lubricants |
| 10 | Lubrication Systems |
| 11 | Midterm Examination 2 |
| 12 | Tribological Materials |
| 13 | Tribology of Coatings |
| 14 | Tribology of Coatings |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assist.Prof.Dr. Koray KILIÇAY | **Date:** |  |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** |  | **TITLE** | Steels and Heat Treatments |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 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 | | 20 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 40 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | It is necessary for students who take the course to take undergraduate level courses in basic materials science, metallography and engineering materials in order to understand this course. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Understanding the properties of steel materials and microstructural properties commonly used in engineering, explaining the general and special heat treatments applied to steels with application reasons. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Teaching that the internal structures of materials have a significant effect on mechanical properties and that mechanical properties can be improved by interfering with these internal structures by heat treatments. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | 1. Learning the importance and properties of steel materials,  2. To learn the structural properties of steel materials with heat treatment. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Defining steels and heat treatments, interpreting the properties of the materials, learning the place of the given information in the application, designing the heat treatment related to the selection of materials, evaluating the materials according to the working conditions | | | | | | | |
| **TEXTBOOK** | | | | | 1. ASM Handbook V.4, Heat Treatment2. Malzeme Bilimi ve Mühendisliği, Smith, W.F., Çev.Kınıkoğlu, N.G., Literatür Yay.3. Malzemelerin Yapı ve Özellikleri, I-II-III-IV, Moffat, W.G., Pearsall, G.W., Wulff, J., Çev. Onaran, K., Erman, B., İTÜ Yay. | | | | | | | |
| **OTHER REFERENCES** | | | | | Steel Heat Treatment: Equipment and Process Design, George E. Totten, CRC Press, 28 Eyl 2006 - 714 sayfa | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to steel materials |
| 2 | Production of steels, steel standarts |
| 3 | Introduction to heat treatment, Fe-C phase diagram |
| 4 | TTT and CCT diagrams |
| 5 | Hardening, normalising and tempering |
| 6 | Re-cristallization, sofhening |
| 7 | Martempering, austempering |
| 8 | Surface hardening treatments, cementation |
| 9 | Nitriding, boriding, |
| 10 | Induction and flame hardening |
| 11 | surface modification techniques |
| 12 | Fracture analysis of heat treated parts |
| 13 | Case studies |
| 14 | Case studies |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assoc.Prof.Dr. Osman Nuri ÇELİK | **Date:** | 0476th 2020 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** |  | **TITLE** | Energy Management and Sustainable Environment |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 30 |
| Project | | | | | 1 | | 40 |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | |  |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Definition of energy, renewable energy sources, energy production processes, energy saving and efficiency, waste heat recovery systems, sustainable environment, energy management and sustainability in buildings and industry | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Students will learn about energy sources and conversion processes, the importance of energy management, energy intensive industry sectors and the selection of saving processes in the sector. They will learn the points to be considered in the selection of waste heat recovery systems, and studies that can be done for energy saving in both residential and industrial buildings will be explained. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To be able to evaluate our potential to meet energy demand with domestic resources, to understand the necessity of our import-oriented energy policies to be directed to domestic resources and to evaluate the development of our installed power and to evaluate the investment models related to energy generation facilities and to evaluate them with environmental legislation. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To be able to determine energy related units and explain primary and secondary energy sources,  2. To be able to understand the consumption coverage rates of primary energy sources used in our country,  3. To be able to explain the energy supply and demand rates of our country  4. To have the knowledge and equipment to analyze the sectoral energy consumption and evaluate the sectors. | | | | | | | |
| **TEXTBOOK** | | | | | B.L. Capehart, W.C. Turner,W.J.Kennedy, “Guide to Energy Management”, CRC Press, 2011Enerji Yönetimi ve Politikaları, Anadolu Üniversitesi Yayınları, Editör; Prof.Dr. Murat Tanışlı, 2018 Eskişehir | | | | | | | |
| **OTHER REFERENCES** | | | | | Frank Kreith and Yogi Goswami, "Energy Management and Conservation Handbook", CRC Press, 2008Practical Guide to Energy Management for Facilities Engineers and Plant Managers by Thomas E. Mull Amer Society of Mechanical Engineers | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to Energy |
| 2 | Basic concepts in energy management |
| 3 | Energy production processes |
| 4 | Renewable energy sources |
| 5 | Renewable energy sources |
| 6 | Sectoral energy consumption and energy saving potential |
| 7 | Sectoral energy consumption and energy saving potential |
| 8 | Energy efficiency and legal legislation |
| 9 | Waste heat recovery systems |
| 10 | Waste heat recovery systems |
| 11 | Energy generation systems and sustainability |
| 12 | Alternative methods for sustainable energy supply and demand |
| 13 | Energy management and sustainability in buildings |
| 14 | Energy management and sustainability in industry |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assist.Prof.Dr. Çisil TİMURALP | **Date:** | 06/05/2020 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** | 5037 | **TITLE** | Failure Analysis |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 (√)]** | | | | | | |
| 0 | | 2 | | | | 1 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 15 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 15 |
| Report | | | | |  | |  |
| Seminar | | | | | 1 | | 20 |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Principles of damage analysis, stages of damage analysis  Types of damage, distortion damage  Fracture damage  Fatigue damage  Corrosion damage  Stress corrosion cracking  Corrosion fatigue  Hydrogen embrittlement  Friction and wear | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To teach the reasons of machine elements and damage.  To teach the techniques used in damage analysis.  To teach the design and material knowledge that causes damage. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To learn the causes and solutions of engineering problems that occur in industry-oriented production and manufacturing stages. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Fundamentals of failure analysis  To analyze a mechanical failure  Having the knowledge of failure types  Taking precautions to prevent similar failures | | | | | | | |
| **TEXTBOOK** | | | | | Failure Analysis of Engineering Materials, Charles Brooks, Ashok Choudhury, McGraw Hill,2002 | | | | | | | |
| **OTHER REFERENCES** | | | | | ASM Handbook Volume 11: Failure Analysis and Prevention, R.J. Shipley and W.T. Becker, ASM International, 2002. | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Fundamentals of failure analysis, Steps of failure analysis |
| 2 | Failure types, Distortion fracture |
| 3 | Fracture failure |
| 4 | Fracture failure |
| 5 | Fatigue failure |
| 6 | Fatigue failure |
| 7 | Corrosion failure |
| 8 | Corrosion failure |
| 9 | Stress Corrosion failure |
| 10 | Hydrogen embrittlement |
| 11 | Friction and wear |
| 12 | Friction and wear |
| 13 | Examination of the conference papers |
| 14 | Examination of the conference papers |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Research Assistant Dr. Abdullah Sert | **Date:** | 31.10.2019 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** |  | **TITLE** | Tool and Die Design |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | |  |  | COMPULSORY  (   ) | | ELECTIVE  (   ) |  |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 60 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | Knowledge on strength of materials and material science | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Tools and dies are an important part of production. In this course design of cutting tools and dies will be given. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To learn design of cutting tools, sheet metal forming, extrusion, forging and plastik dies. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Mechanical engineers work in production facilities. Researchers that study production should be knowledgable in tool and die design. This course aims to fill that knowledge. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Cutting tool design knowledge  Die design knowledge  Utilizing topics learned and applying them to design tools and dies.  Ability to analyze design requirements and ascertain the optimal design method. | | | | | | | |
| **TEXTBOOK** | | | | | Fundamentals of Tool Design Fourth Edition, Dr. John G. Nee, 1998, SME | | | | | | | |
| **OTHER REFERENCES** | | | | | Principles and Methods of Sheet Metal Fabricating, George Sachs,1966, Reinhold Publishing, New YorkTool Design, C. Donaldson, G.H. LeCain, V.C. Goold, 1973, Mc Graw HillPres İşleri Tekniği, A. Turan Güneş, 1981Handbook of Die Design, Ivana Suchy, 1997, Mc Graw Hill | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Responsibilities of Tool designer |
| 2 | Tool design materials |
| 3 | Cutting tool design |
| 4 | Workholder design |
| 5 | Jig and fixture design |
| 6 | Design of Pressworking tools: Forces |
| 7 | Design of Pressworking tools: Application |
| 8 | Design of bending and forming dies |
| 9 | Design of progressive and drawing dies |
| 10 | Design of extrusion and forging dies |
| 11 | Gage design |
| 12 | Die cost estimation |
| 13 | Plastic mould design |
| 14 | CAD usage in tool and die design |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Dr. Gökçe Mehmet AY | **Date:** | 31/10/2019 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** |  | **TITLE** | MECHANICS OF COMPOSITE MATERIALS |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 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 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | This course investigates general structure of composite materials, production techniques, mechanical behavior and failure criteria of laminated composite materials. In order to teach the classical lamination theory better, anisotropic elasticity is also covered within this course. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Composite materials are among advance materials which are effectively utilized in aerospace and automotive industry. This course leads students in learning about composite materials and designing parts by using such materials. Moreover, this course provides students with sufficient knowledge in solid mechanics. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Examination of mechanical behavior of composite materials requires special approaches and theories. By learning such theories, students gain ability to design parts composed of composite materials. Additionally, they know about various production techniques. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students who succeed in this class,  1) Get information about constituents and production techniques of composite materials.  2) Have ability to design a components using laminated composites.  3) Get fundamental knowledge in Elasticity.  4) Develop ability to think analytically. | | | | | | | |
| **TEXTBOOK** | | | | | Robert M. Jones, Mechanics of Composite Materials, Taylor and Francis, 1999. | | | | | | | |
| **OTHER REFERENCES** | | | | | Course Notes | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Constituents of composite materials |
| 2 | Production Techniques |
| 3 | Production Techniques |
| 4 | Anisotropic Elasticity |
| 5 | Anisotropic Elasticity |
| 6 | Midterm Examination 1 |
| 7 | Macro-mechanical behavior of a lamina |
| 8 | Micro-mechanical behavior of a lamina |
| 9 | Micromechanical behavior of a lamina |
| 10 | Macro-mechanical behavior of a laminate |
| 11 | Midterm Examination 2 |
| 12 | Macro-mechanical behavior of a laminate |
| 13 | Strength of laminates and Failure criteria |
| 14 | Strength of laminates and Failure criteria |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Assist.Prof.Dr. Onur Arslan | **Date:** | 07.11.2019 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** |  | **TITLE** | Advanced Engineering Design |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | |  |  | COMPULSORY  (   ) | | ELECTIVE  (   ) |  |
| **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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 60 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Engineers are expected to use science and technology knowledge in order to solve problems and then optimize these problems with respect to material, technology, economic, law, environment and human based constraints. In this course students will gain systematic problem solving knowledge whether they are coming from a design or product improvement background. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Objectives of this course are, students to understand design process, to view design with systematic approach, to understand effect of technical systems to the design process, to gain a systematic approach to problem solving and use this approach from conceptualizing to actualizing. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Design is the basics of engineering. An engineer can be a novel product designer or a product developer or a system designer maintenance engineer. All these engineering roles require an understanding of design. This course aims to give students a systematic approach to problem solving. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Analysis of problems  Understanding of the effect of product planning to design  Evaluating of conceptual design  Understanding effect of mechanical and mechatronic systems to design  Gaining an insight about designing for low cost  Gaining an insight about designing for quality | | | | | | | |
| **TEXTBOOK** | | | | | Engineering Design, A Systematic Approach, 3rd Edition, G. Pahl andW. Beitz, J. Feldhusen and K.-H. Grote, Springer 2007 | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introductin: Job of the engineer in design and necesssity for systematic approach |
| 2 | Fundemantal concepts: Relations between technical systems and design, and fundemantals of systematic approach |
| 3 | Product planning, finding solution and evaluation |
| 4 | Prıduct development process |
| 5 | Evaluating design requirements |
| 6 | Conceptual design steps |
| 7 | Design actuation steps: Clarity, Simplicity, Safety |
| 8 | Design actuation princibles |
| 9 | Design for different aims |
| 10 | Design for different aims |
| 11 | Mechanical connections, mechatronics and adaptronics |
| 12 | Size and modular products |
| 13 | Design for quality |
| 14 | Design for low cost |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Gökçe Mehmet AY | **Date:** | 05/05/2020 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MECHANICAL ENGINEERING (MSc)** | **SEMESTER** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | | | |
| **CODE** |  | **TITLE** | Viscous Flow |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 (√)]** | | | | | | |
|  | | 3 | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 60 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Basic equations: Derivation of continuty equation, derivation of monetum equations for compressible viscous fluid, derivation of energy equations. Solutions of Navier-Stokes equations: Coutte flow, Poiseuille flow, flow araound rotating disc, flow in narrowing and expanding channels. Laminer boundary layer: derivation of boundary layer equations for two dimensional flows, flow in the corner, flow in the shrinking channel, derivation of the Von Karman İntegral equation, flow on the flat plate, flow on the cylinder. Thermal boundary layer in laminer flow: simplification of boundary layer, Coutte Flow, Poiseuille Flow. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Derive basic equations governing viscous flow. To teach and apply analytical methods used in solving these equatins. To solve engineering problems by simpliftying equations. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Awereness of the new and emerging practices of the profession; ability to examine and learn when necessary. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Understanding the basic properties of viscous flows  Evaluation of the approaches used to solve viscous flow problems  Understanding the solution methods  Analysis of solution result | | | | | | | |
| **TEXTBOOK** | | | | | Currie, I. G., (1993). Fundamental Mechanics of Fluids. McGraw-Hill Book Company.White, F.M., (1974). Viscous Fluid Flow. McGraw-Hill Book Company. | | | | | | | |
| **OTHER REFERENCES** | | | | | Schlichting, H., (1979). Boundary Layer Theory. McGraw-Hill Company. | | | | | | | |

|  |  |
| --- | --- |
| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Fundamental Law of Viscous Flow |
| 2 | Introduction to Boundary Layer Theory |
| 3 | Basic Equations of Boundary LAYER, Continuty and Momentum Equations |
| 4 | Enery Equation |
| 5 | Analytical Solution of Navier-Stokes Equations |
| 6 | Coutte Flow |
| 7 | Flow Between Two Rotating Cylinders, Stokes 1st Problem |
| 8 | Stokes 2nd Problem |
| 9 | Two Dimensional Boundary Layer Equations for Laminer Flow on Plate |
| 10 | Integral and Simulation Solutions of Momentum and Energy Equations |
| 11 | General Properties of Thermal Boundary Layer |
| 12 | Thermal Boundary Layer in Laminer Flow Conditions |
| 13 | Boundary Layer in Laminer and Natural Convection Conditions |
| 14 | Boundary Layer in Laminer and Natural Convection Conditions |
| 15,16 | Final Examination |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MECHANICAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Sufficient knowledge of mechanical engineering subjects related with science and own branch; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. |  |  |  |
| **LO 2** | Ability to determine, define, formulate and solve complex mechanical engineering problems; for that purpose an ability to select and use convenient analytical and experimental methods. |  |  |  |
| **LO 3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economical and political problems; for that purpose an ability to apply modern design methods. |  |  |  |
| **LO 4** | Ability to develop, select and use modern methods and tools required for mechanical engineering applications; ability to effective use of information technologies. |  |  |  |
| **LO 5** | In order to investigate mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. |  |  |  |
| **LO 6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. |  |  |  |
| **LO 7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. |  |  |  |
| **LO 8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. |  |  |  |
| **LO 9** | Understanding of professional and ethical issues and taking responsibility |  |  |  |
| **LO 10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |  |  |
| **LO 11** | Knowledge of actual problems and effects of mechanical engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by :** | Res.Assist. Dr. Özge Yetik | **Date:** | 20/03/2019 |

**Signature**: