**ESOGU MECHANICAL ENGINEERING DEPARTMENT**

**COURSE INFORMATION FORM**

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| **Course Name** | **Course Code** |
| MACHINE DYNAMICS | 151816336 |

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| **Semester** | **Number of Course Hours per Week** | **ECTS** |
| **Theory** | **Practice** |
| 6 | 3 | 0 | 5 |

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| **Course Category (Credit)** |
| **Basic Sciences** | **Engineering Sciences** | **Design** | **General Education** | **Social** |
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| **Course Language** | **Course Level** | **Course Type** |
| Turkish | Undergraduate | Compulsory |

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| **Prerequisite(s) if any** |  |
| **Objectives of the Course** | To teach students methods in dynamical analysis and design of mechanisms and machines. |
| **Short Course Content** | Dynamics forces-equations, mass center-moment of inertia and forces, rotor dynamics, flywheel design, static-dynamic balancing, force and moment isolation/balancing of machines. |

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| **Learning Outcomes of the Course** | **Contributed PO(s)**  | **Teaching Methods \*** | **Measuring Methods \*\*** |
| **1** | Calculate work, power and energy of various mechanisms, | 1, 3, 11 | 1, 5, 10 | A, K |
| **2** | Solve problems using momentum and conservation of energy, | 1, 2, 3, 11 | 1, 5, 10 | A, K |
| **3** | Effectively draw free body diagrams of each link of a machine to arrive at the force analysis, | 1, 2, 3 | 1, 4, 5, 10 | A, K |
| **4** | Use energy relations to come up with the equations of motion (Lagrange method), | 1, 2, 3 | 1, 4, 5, 10 | A, K |
| **5** | Calculate the driving torque and forces for a specified motion of the mechanism, | 1, 2, 3, 11 | 1, 4, 5, 10 | A, K |
| **6** | Identify and explain the transmission of forces in a machine, | 1, 2, 3, 11 | 1, 4, 5, 10 | A, K |
| **7** | Calculate the shaking force and shaking moment, | 1, 2, 3, 11 | 1, 4, 5, 10 | A, K |
| **8** | Analyze the effects of a flywheel, design of flywheels, | 1, 2, 3 | 1, 5, 10 | A, K |
| **9** | Perform static and dynamic balancing of machinery. | 1, 2, 3, 11 | 1, 5, 10 | A, K |

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| **Main Textbook** | Design of Machinery: An Introduction to Synthesis and Analysis of Mechanisms and Machines, Robert L Norton, McGraw-Hill |
| **Supporting References** | Mechanism Design: Analysis and Synthesis, Arthur G. Erdman, George N. Sandor |
| **Necessary Course Material** |  |

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| **Course Schedule** |
| **1** | Introduction: Reminders from Dynamics |
| **2** | Force Analyses (Newton-Euler Equations) |
| **3** | The effect of forces that generate resistance to movement |
| **4** | Examples |
| **5** | Sample questions and answers |
| **6** | Power Equation |
| **7** | Virtual Work |
| **8** | Mid-Term Exam |
| **9** | Generalized Coordinates-forces, Lagrange Method |
| **10** | Mass Center and Moment of Inertia |
| **11** | Equations Of Motion in A Rotated Coordinate System |
| **12** | Motors- Flywheel Design |
| **13** | Dynamic Equivalent Mass |
| **14** | Static-Dynamic Balancing |
| **15** | Problem Solutions |
| **16,17** | Final Exam |

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| **Calculation of Course Workload** |
| **Activities** | **Number** | **Time (Hour)** | **Total Workload (Hour)** |
| Course Time (number of course hours per week) | 14 | 3 | 42 |
| Classroom Studying Time (review, reinforcing, prestudy,.) | 14 | 4.5 | 63 |
| Homework |  |  |  |
| Quiz Exam |  |  |  |
| Studying for Quiz Exam |  |  |  |
| Oral exam  |  |  |  |
| Studying for Oral Exam  |  |  |  |
| Report (Preparation and presentation time included) |  |  |  |
| Project (Preparation and presentation time included) |  |  |  |
| Presentation (Preparation time included) |  |  |  |
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| Mid-Term Exam |  |  |  |
| Studying for Mid-Term Exam | 1 | 2 | 2 |
| Final Exam | 1 | 20 | 20 |
| Studying for Final Exam | 1 | 2 | 2 |
|  | **Total workload** | **149** |
|  | **Total workload / 30** | **4.96** |
|  | **Course ECTS Credit** | **5** |

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| **Evaluation** |
| **Activity Type** | **%** |
| Mid-term | 50 |
| Quiz |  |
| Homework |  |
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| **Final Exam** | 50 |
| **Total** | 100 |

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| **RELATIONSHIP BETWEEN THE COURSE LEARNING OUTCOMES AND THE PROGRAM OUTCOMES (PO)** (5: Very high, 4: High, 3: Middle, 2: Low, 1: Very low) |
| **NO** | **PROGRAM OUTCOME** | **Contribution** |
| **1** | Sufficient knowledge of engineering subjects related with mathematics, science and engineering; an ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. | 5 |
| **2** | Ability to determine, define, formulate and solve complex engineering problems; for that purpose, an ability to select and use convenient analytical and experimental methods. | 5 |
| **3** | Ability to design a complex system, a component and/or an engineering process under real life constrains or conditions, defined by environmental, economic and political problems; for that purpose, an ability to apply modern design methods. | 5 |
| **4** | Ability to develop, select and use modern methods and tools required for … engineering applications; ability to effective use of information technologies. | 1 |
| **5** | In order to investigate … engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. | 1 |
| **6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. | 1 |
| **7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. | 1 |
| **8** | Awareness of life-long learning; ability to reach information; follow developments in science and technology and continuous self-improvement. | 1 |
| **9** | Understanding of professional and ethical issues and taking responsibility  | 1 |
| **10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. | 1 |
| **11** | Knowledge of actual problems and effects of engineering applications on health, environment and security in global and social scale; an awareness of juridical results of engineering solutions. | 4 |
| **12** |  |  |

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| **LECTUTER(S)** |
| **Prepared by** | Sezcan Yılmaz | Naci Zafer |  |  |
| **Signature(s)** |  |  |  |  |

**Date:**09.07.2024