**ESOGU AERONAUTICAL ENGINEERING DEPARTMENT**

**COURSE INFORMATION FORM**

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| **Course Name** | **Course Code** |
| **DYNAMICS** | **152413003** |

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| **Semester** | **Number of Course Hours per Week** | **ECTS** |
| **Theory** | **Practice** |
| 3 | 3 | 0 | 4 |

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| **Course Category (Credit)** |
| **Basic Sciences** | **Engineering Sciences** | **Design** | **General Education** | **Social** |
|  | X |  |  |  |

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| **Course Language** | **Course Level** | **Course Type** |
| English | Undergraduate | Compulsory |

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| **Prerequisite(s) if any** | - |
| **Objectives of the Course** | The objective of the course is to introduce the physical principles to the analysis of particle and rigid-body motion problems. |
| **Short Course Content** | Dynamics of particles and rigid bodies, applications of free-body diagrams, Newton's second law, the impulse-momentum method and the work-energy principle to solve dynamic problems in mechanical systems. |

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| **Learning Outcomes of the Course** | **Contributed PO(s)**  | **Teaching Methods \*** | **Measuring Methods \*\*** |
| **1** | Drawing the free-body diagram for a particle or for a rigid body in plane motion.  | 1, 2 | 1, 11 | A |
| **2** | Relating linear and angular impulse to changes in the linear and angular momentum of a particle. | 2, 3 | 1, 11 | A |
| **3** | Relating the work done by one or more forces to changes in the kinetic energy of a particle.  | 2, 3 | 1, 11 | A |
| **4** | Implementing the concepts of force/acceleration, impulse/momentum, and work/energy to closed systems of particles. | 3, 4 | 1, 11 | A |
| **5** | Relating the motion of one location on a rigid body to that of another. | 5, 6  | 1, 11 | A |
| **6** |  |  |  |  |
| **7** |  |  |  |  |
| **8** |  |  |  |  |

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| **Main Textbook** | Vector Mechanics for Engineers – Dynamics, F.P. Beer, E.R. Johnston, P.J. Cornwell |
| **Supporting References** | Engineering Mechanics – Dynamics, R.C. Hibbeler |
| **Necessary Course Material** | - |

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| **Course Schedule** |
| **1** | Introduction, basic terms |
| **2** | Particle kinematics; rectilinear motion (position-velocity-acceleration, relative and dependent motions, uniform rectilinear and uniform accelerated rectilinear motions), curvilinear motion (position-velocity-acceleration, relative motion, rectangular components), derivatives of vector functions |
| **3** | Particle kinematics; projectile motion, tangential-normal and radial-transverse components |
| **4** | Particle kinetics; Newton’s 2nd law of motion: linear momentum, equations of motion, dynamic equilibrium, free-body diagrams, normal-tangential and radial-transverse components (equ’s of motion), ang momentum |
| **5** | Particle kinetics; Newton’s 2nd law of motion: conservation of angular momentum, particle trajectory under a central force, radial-transverse components (equations of motion), Newton’s law of universal gravitation |
| **6** | Particle kinetics; Energy and Momentum Methods: work-energy principle, power and efficiency |
| **7** | Particle kinetics; Energy and Momentum Methods: potential energy, conservative forces (motions governed by conservative forces), conservation of energy, impulsive motion, impulse-momentum principle |
| **8** | Mid-Term Exam |
| **9** | Particle kinetics; Energy and Momentum Methods: impact, direct-oblique central impacts, problems involving multiple principles |
| **10** | Systems of particles: applying Newton’s law and momentum principles, motion of the mass center, angular momentum about the mass center, conservation of momentum |
| **11** | kinetic energy, work-energy principle and conservation of energy, impulse-momentum principle, steady stream of particles, mass gaining or losing streams |
| **12** | Kinematics of rigid bodies; translation, rotation, general plane motion, absolute and relative velocity acceleration in plane motion, instant center of rotation, motions relative to a rotating frame (planar and 3D) |
| **13** | Plane motion of rigid bodies: Forces and accelerations |
| **14** | Plane motion of rigid bodies: Energy and momentum principles |
| **15** | Plane motion of rigid bodies: Energy and momentum principles |
| **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,….) | 2 | 3 | 6 |
| 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) |  |  |  |
|  |  |  |  |
| Mid-Term Exam | 1 | 2 | 2 |
| Studying for Mid-Term Exam | 1 | 30 | 30 |
| Final Exam | 1 | 2 | 2 |
| Studying for Final Exam | 1 | 30 | 30 |
|  | **Total workload** | **112** |
|  | **Total workload / 30** | **3.7** |
|  | **Course ECTS Credit** | **4** |

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| **Evaluation** |
| **Activity Type** | **%** |
| Mid-term | 40 |
| Quiz |  |
| Homework |  |
| Bir öğe seçin. |  |
| Bir öğe seçin. |  |
| **Final Exam** | 60 |
| **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 own branch; 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. | 4 |
| **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. | 3 |
| **4** | Ability to develop, select and use modern methods and tools required for engineering applications; ability to effective use of information technologies. | 3 |
| **5** | In order to investigate engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. | 4 |
| **6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. | 4 |
| **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. |  |
| **9** | Understanding of professional and ethical issues and taking responsibility  |  |
| **10** | Awareness of project, risk and change management; awareness of entrepreneurship, innovativeness and sustainable development. |  |
| **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. |  |
| **12** |  |  |

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| **LECTUTER(S)** |
| **Prepared by** | Assoc. Prof. Selim Gürgen |  |  |  |
| **Signature(s)** |  |  |  |  |

**Date:**06.06.2024