**ESOGU MECHABICAL ENGINEERING DEPARTMENT**

**COURSE INFORMATION FORM**

|  |  |
| --- | --- |
| **Course Name** | **Course Code** |
| DYNAMICS | 151813560 |

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

|  |
| --- |
| **Course Category (Credit)** |
| **Basic Sciences** | **Engineering Sciences** | **Design** | **General Education** | **Social** |
| $$×$$ | $$×$$ | - | - | - |

|  |  |  |
| --- | --- | --- |
| **Course Language** | **Course Level** | **Course Type** |
| Turkish | Undergraduate | Compulsory |

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Learning Outcomes of the Course** | **Contributed PO(s)**  | **Teaching Methods \*** | **Measuring Methods \*\*** |
| **1** | By the end of this course, students will be able to solve certain types of differential equation problems involving particle kinematics; | 1 | 1, 4, 5, 8, 10 | A, K |
| **2** | relate the force applied to a particle to the rate of change of the linear momentum of a particle; use that relation to analyze the motion of a particle and the forces acting upon it in one or more directions;  | 1, 2 | 1, 4, 5, 8, 10 | A, K |
| **3** | draw the free-body diagram for a particle or for a rigid body in plane motion  | 1 | 1, 4, 5, 10 | A, K |
| **4** | relate linear and angular impulse to changes in the linear and angular momentum of a particle;  | 1 | 1, 4, 5, 8, 10 | A, K |
| **5** | relate the work done by one or more forces to changes in the kinetic energy of a particle;  | 1 | 1, 4, 5, 10 | A, K |
| **6** | implement the concepts of force/acceleration, impulse/momentum, and work/energy to closed systems of particles;  | 1, 2 | 1, 4, 5, 8, 10 | A, K |
| **7** | relate the motion of one location on a rigid body to that of another; and | 1 | 1, 4, 5, 8, 10 | A, K |
| **8** | extend the concepts of force/acceleration, impulse/momentum, and work/energy to one or more rigid bodies. | 1, 2 | 1, 4, 5, 8, 10 | A, K |

|  |  |
| --- | --- |
| **Main Textbook** | [Vector Mechanics for Engineers – Dynamics](http://www.mheducation.com/highered/product/vector-mechanics-engineers-statics-dynamics-beer-johnston-jr/M0073398241.html), F.P. Beer, E.R. Johnston, P.J. Cornwell |
| **Supporting References** | 1. [Engineering Mechanics – Dynamics](https://www.pearson.com/us/higher-education/product/Hibbeler-Engineering-Mechanics-Dynamics-14th-Edition/9780133915389.html), R.C. Hibbeler
2. [Engineering Mechanics – Dynamics](http://eu.wiley.com/WileyCDA/WileyTitle/productCd-EHEP003481.html), J.L. Meriam, L.G. Kraige
 |
| **Necessary Course Material** | Calculator |

|  |
| --- |
| **Course Schedule** |
| **1** | Introduction; Basic terms  |
| **2** | Particle Kinematics: Rectilinear Motion: Position-velocity-acceleration, uniform rectilinear and uniform accelerated rectilinear motions |
| **3** | Particle Kinematics: Rectilinear Motion: Relative and dependent motions |
| **4** | Particle Kinematics: Curvilinear Motion: Position-velocity-acceleration, relative motion, rectangular components, derivatives of vector functions, projectile motion, tangential-normal components |
| **5** | Particle Kinematics: Radial-transverse components |
| **6** | Particle Kinetics: Newton’s 2nd law of motion: Linear momentum, equations of motion, dynamic equilibrium, free-body diagrams |
| **7** | Particle Kinetics: Newton’s 2nd law of motion: Examples, normal-tangential and radial-transverse components, conservation of angular momentum, Newton’s law of universal gravitation |
| **8** | Mid-Term Exam |
| **9** | Systems of particles: Application of Newton’s law and momentum principles, motion of the mass center, angular momentum about the mass center, conservation of momentum, kinetic energy, work-energy principle and conservation of energy |
| **10** | Systems of Particles: Impulse-momentum principle, steady stream of particles, mass gaining or losing streams |
| **11** | 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 3-D) |
| **12** | Plane Motion of Rigid Bodies: Forces and accelerations  |
| **13** | Plane Motion of Rigid Bodies: Forces and accelerations: applications  |
| **14** | Plane Motion of Rigid Bodies: Energy and momentum principles  |
| **15** | Plane Motion of Rigid Bodies: Impulse and momentum principle, collision, angular momentum |
| **16,17** | Final Exam |

|  |
| --- |
| **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 | 56 |
| 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 | 20 | 20 |
| Final Exam | 1 | 2 | 2 |
| Studying for Final Exam | 1 | 20 | 20 |
|  | **Total workload** | **142** |
|  | **Total workload / 30** | **4.73** |
|  | **Course ECTS Credit** | **5** |

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

|  |
| --- |
| **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 Mechanical Engineering; an ability to apply theoretical and practical knowledge on solving and modeling of Mechanical Engineering problems.  | 5 |
| **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. | 3 |
| **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. | 1 |
| **4** | Ability to develop, select and use modern methods and tools required for Mechanical Engineering applications; ability to effective use of information technologies. | 1 |
| **5** | In order to investigate Mechanical 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. | 1 |
| **12** |  |  |

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

**Date:**15.11.2024