**ESOGU AERONAUTICAL ENGINEERING DEPARTMENT**

**COURSE INFORMATION FORM**

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| **Course Name** | **Course Code** |
| DESING of CONTROL  SYSTEMS |  |

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| **Semester** | **Number of Course Hours per Week** | | **ECTS** |
| **Theory** | **Practice** |
| 8 | 3 | 0 | 3 |

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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 | Elective |

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| **Prerequisite(s) if any** | None |
| **Objectives of the Course** | Introduce the fundamentals of control systems design through computer applications |
| **Short Course Content** | Review of control systems. Design of PID controllers and variants by root locus method. Controller design in frequency domain. Phase lag/lead controllers. Nyquist stability criteria. Case studies. MATLAB and Simulink applications. |

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| **Learning Outcomes of the Course** | | **Contributed PO(s)** | **Teaching Methods \*** | **Measuring Methods \*\*** |
| **1** | Plot and interpret the root locus of a SISO feedback system, | X | 1, 5, 10,11 | A |
| **2** | Gain familiarity with the concepts of phase margin, gain margin, Nyquist stability criteria, | X | 1, 5, 10,11 | A |
| **3** | Design P, PI, PD, and PID controllers by pole placement in s-plane using the root locus, to meet steady state and transient response requirements, | X | 1, 5, 10,11 | A |
| **4** | Design lead/lag compensators in frequency domain through Bode plots and Nyquist plots, | X | 1, 5, 10,11 | A |
| **5** | Solve open-ended complex control problems, | X | 1, 5, 10,11 | A |
| **6** | Use appropriate software to solve control system design problems. | X | 1, 5, 10,11 | A |

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| **Main Textbook** | Modern Control Engineering”, K. Ogata, Prentice Hall, 5th Ed., 2009 |
| **Supporting References** | 1. Modern Control Systems, R.C. Dorf, R. H. Bishop, Prentice Hall, 2008.  2. Control System Design, G.C. Goodwin, S.F. Graebe, M.E. Salgado,  Prentice Hall, 2001 |
| **Necessary Course Material** |  |

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| **Course Schedule** | |
| **1** | Introduction. Control systems review. |
| **2** | Transient response, steady state response, frequency response; design requirements and specifications |
| **3** | Root locus |
| **4** | P, PD, PI, and PID controller design with root locus |
| **5** | Case studies |
| **6** | Case studies |
| **7** | Case studies |
| **8** | Mid-Term Exam |
| **9** | Frequency response review |
| **10** | Frequency response; phase and gain margins; Nyquist stability criterion |
| **11** | Lag compensator design fundamentals |
| **12** | Lead compensator design fundamentals |
| **13** | Case studies |
| **14** | Case studies |
| **15** | Review |
| **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 | 2 | 28 |
| Homework | 0 | 0 | 0 |
| Quiz Exam | 0 | 0 | 0 |
| Studying for Quiz Exam | 0 | 0 | 0 |
| Oral exam | 0 | 0 | 0 |
| Studying for Oral Exam | 0 | 0 | 0 |
| Report (Preparation and presentation time included) | 0 | 0 | 0 |
| Project (Preparation and presentation time included) | 0 | 0 | 0 |
| Presentation (Preparation time included) | 0 | 0 | 0 |
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| Mid-Term Exam | 1 | 1 | 1 |
| Studying for Mid-Term Exam | 14 | 2 | 28 |
| Final Exam | 1 | 1 | 1 |
| Studying for Final Exam | 14 | 2 | 28 |
|  | **Total workload** | | **86** |
|  | **Total workload / 30** | | **2.86** |
|  | **Course ECTS Credit** | | **3** |

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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 Aeronautical engineering; an ability to apply theoretical and practical knowledge on solving and modeling of Aeronautical engineering problems. | 4 |
| **2** | Ability to determine, define, formulate and solve complex Aeronautical 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, economic and political problems  for that purpose, an ability to apply modern design methods | 4 |
| **4** | Ability to develop, select and use modern methods and tools required for Aeronautical engineering applications; ability to effective use of information technologies | 4 |
| **5** | In order to investigate Mechanical engineering problems; ability to set up and conduct experiments and ability to analyze and interpretation of experimental results. | 3 |
| **6** | Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence. | 3 |
| **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. | 3 |
| **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 |

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| **LECTUTER(S)** | | | | |
| **Prepared by** |  |  |  |  |
| **Signature(s)** |  |  |  |  |

**Date:**06.06.2024