**ESOGU AERONAUTICAL DEPARTMENT**

**COURSE INFORMATION FORM**

|  |  |
| --- | --- |
| **Course Name** | **Course Code** |
| FUNDAMENTALS of CONTROLSYSTEMS | 152415004 |

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

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

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

|  |  |
| --- | --- |
| **Prerequisite(s) if any** |  None |
| **Objectives of the Course** | 1) Introduction to design, analysis, and synthesis of control systems. Toteach the fundamental concepts of mathematical modeling and Control ofengineering systems |
| **Short Course Content** | The course aims to provide the student the knowledge of designing systems which can be automatically controlled and of making design changes to a system to increase its performance. The specific topics addressed are: Classical control theory in the frequency and time domains, stability- performance methods based on Bode/Nyquist and root-locusdiagrams, representation in state space, reduction of multiple subsystems, application of feedback analysis and design to physical systems with feedback |

|  |  |  |  |
| --- | --- | --- | --- |
| **Learning Outcomes of the Course** | **Contributed PO(s)**  | **Teaching Methods \*** | **Measuring Methods \*\*** |
| **1** | to obtain mathematical modeling of engineering systems | X | 1, 5, 10,11 | A |
| **2** | system representation by block diagrams, | X | 1, 5, 10,11 | A |
| **3** | time response analysis of dynamic systems.  | X | 1, 5, 10,11 | A |
| **4** | stability analysis of systems, | X | 1, 5, 10,11 | A |
| **5** | performance specifications and analysis, | X | 1, 5, 10,11 | A |
| **6** | frequency response of a system and frequency response analysis of existing systems (Bode & Nyquist methods) | X | 1, 5, 10,11 | A |
| **7** | Root Locus method for the control system design and analysis | X | 1, 5, 10,11 | A |
| **8** | proportional, integral, and derivative (PID) control | X | 1, 5, 10,11 | A |
| **9** | knowledge of MATLAB “Control Toolbox”commands. | X | 1, 5, 10,11 | A |

|  |  |
| --- | --- |
| **Main Textbook** | Control Systems Engineering, Norman S. Nise |
| **Supporting References** | 1) Otomatik Kontrol Sistemleri, Benjamin C. Kuo & Farid Golnaraghi2) Modern Control Engineering, Ogata, K. 3) Otomatik Kontrol /Sistem Dinamiği ve Denetim Sistemleri, İbrahim Yüksel |
| **Necessary Course Material** | None |

|  |
| --- |
| **Course Schedule** |
| **1** | Introduction to Control Systems |
| **2** | Math. Modeling: Modeling in the Time Domain (Modeling, Approximations &Linearization  |
| **3** | Mathematical Modeling: Modeling in the Time Domain (Mechanical, Electrical,Electromechanical, Thermal & Hydraulic Elements & Systems) |
| **4** | Math. Modeling: Modeling in the Frequency Domain (Laplace Transform Review) |
| **5** | Math. Modeling: Modeling in the Frequency Domain (Transfer Functions, ImpedanceApproach) |
| **6** | Block Diagrams |
| **7** | State-Space Model, State-Space Model Conversion to/From Transfer Functions |
| **8** | Mid-Term Exam |
| **9** | Time Response (Stability, Routh Hurwitz Criteria) |
| **10** | Time Response (Feedback Control & Steady-State Errors) |
| **11** | Time Response (First, Second and Higher Order System Responses, Effects of Nonlinearities) |
| **12** | Frequency Response Analysis (Bode Plots) |
| **13** | Frequency Response Analysis (Nyquist Diagram) |
| **14** | Controller design with Root Locus curve |
| **15** | Review |
| **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 | 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 |
|  |  |  |  |
|  |  |  |  |
| 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** |

|  |
| --- |
| **Evaluation** |
| **Activity Type** | **%** |
| Mid-term | 40 |
| Quiz |  |
| Homework |  |
| Bir öğe seçin. |  |
| Bir öğe seçin. |  |
| **Final Exam** | 60 |
| **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 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 engineeringproblems 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 reallife constrains or conditions, defined by environmental, economic and political problemsfor 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 ofengineering solutions. | 1 |

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

**Date:**06.06.2024