**ESOGU AERONAUTICAL ENGINEERING DEPARTMENT**

**COURSE INFORMATION FORM**

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| **Course Name** | **Course Code** |
| **Numerical Methods** | **152414001** |

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| **Semester** | **Number of Course Hours per Week** | | **ECTS** |
| **Theory** | **Practice** |
| 4 | 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** | At the end of this course, the students will  - learn the basic concepts of mathematical modeling, programming, approximations and round-off errors, truncation errors,  - learn the evaluation of roots of equations,  - learn basic concepts of solving linear algebraic equations, Gauss elimination, Gauss-Jordan, Gauss-Seidel methods,  - learn basic concepts of numerical differentiation and integration  - learn basic concepts of numerical solution of ordinary differential equations Runge-Kutta methods, multistep methods, boundary value problems |
| **Short Course Content** | Approximations and errors. Roots of equations. System of algebraic equations, eigenvalues and eigenvectors. Curve fitting, interpolation, least squares. Numerical differentiation and integration. |

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| **Learning Outcomes of the Course** | | **Contributed PO(s)** | **Teaching Methods \*** | **Measuring Methods \*\*** |
| **1** | Solve mechanical engineering problems using numerical techniques | 1, 2 | 1, 11 | A |
| **2** | Analyze errors due to digital computation | 2, 3 | 1, 11 | A |
| **3** | Compute integral and derivative of functions | 2, 3 | 1, 11 | A |
| **4** | Solve differential equations using numerical techniques | 3, 4 | 1, 11 | A |
| **5** |  |  |  |  |
| **6** |  |  |  |  |
| **7** |  |  |  |  |
| **8** |  |  |  |  |

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| **Main Textbook** | Steven C. Chapra, Raymond P. Canale, “Numerical Methods for Engineers”, McGraw-Hill. |
| **Supporting References** | Numerical Methods by R.W. Hornbec |
| **Necessary Course Material** | Computer and suitable programing language (MATLAB, Fortran, C, C+, python, etc.) |

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| **Course Schedule** | |
| **1** | Programming, flow charts and algorithms |
| **2** | Error analysis, truncation errors, introduction to selected programing language |
| **3** | Taylor series |
| **4** | Finding roots of single-variable functions numerically |
| **5** | Numerical solution of linear system equations |
| **6** | Finding maximum and minimum values of single-variable functions |
| **7** | Curve fitting |
| **8** | Midterm exam |
| **9** | Midterm exam |
| **10** | Numerical integration |
| **11** | Numerical differentiation |
| **12** | Numerical solution of ordinary differential equations |
| **13** | Boundary value problems |
| **14** | Eigenvalue – Eigenvector problems |
| **15** |  |
| **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) |  |  |  |
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|  |  |  |  |
| 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. | 3 |
| **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. | 3 |
| **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. | 2 |
| **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. | 3 |
| **9** | Understanding of professional and ethical issues and taking responsibility | 3 |
| **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** |  |  |

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

**Date:**06.06.2024