**ESOGU MECHANICAL ENGINEERING DEPARTMENT**

**COURSE INFORMATION FORM**

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| **Course Name** | **Course Code** |
| CALCULUS II | 151812213 |

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| **Semester** | **Number of Course Hours per Week** | | **ECTS** |
| **Theory** | **Practice** |
| 2 | 4 | 0 | 5 |

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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** | None |
| **Objectives of the Course** | To provide the basic mathematical skills required of engineering students |
| **Short Course Content** | Series, vectors, operations, dot and cross product, vector functions, gradient, divergence, rotation, partial derivatives, directional derivative, arc length, wire systems, center of gravity, inertia calculations, path/area integrals, work, multiple integrals, COM and inertia for planar systems, volume calculations, Divergance and Stokes theorems and applications. |

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| **Learning Outcomes of the Course** | | **Contributed PO(s)** | **Teaching Methods \*** | **Measuring Methods \*\*** |
| **1** | Understands and uses series, infinite series, power series of functions, Taylor and MacLaurin series. | 1, 2, 4, 6 | 1, 5, 6, 10, 11 | A, B, K |
| **2** | Uses analytical geometry with the help of vectors and interprets lines, planes and surfaces in 3-dimensional space. | 1, 2, 4, 6 | 1, 5, 6, 10, 11 | A, B, K |
| **3** | Understand and use multivariable functions, partial derivatives, directional derivatives, gradient vectors, and tangent planes. | 1, 2, 4, 6 | 1, 5, 6, 10, 11 | A, B, K |
| **4** | Finds local and absolute extreme values ​​of multivariable functions, uses Lagrange Factors and solves optimization problems, | 1, 2, 4, 6 | 1, 5, 6, 10, 11 | A, B, K |
| **5** | Understands and uses double and triple integrals in different coordinate systems. | 1, 2, 4, 6 | 1, 5, 6, 10, 11 | A, B, K |

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| **Main Textbook** | Thomas, Weir, Hass, Giardino, Thomas’ Calculus, 11th Ed., Addison & Wesley Publication. 2009 |
| **Supporting References** | F. Ayres, Differential and Integral Calculus, Schaum Series. 1984  Calculus: A complete Course, R. A. Adams, C. Essex, 7th Edition; Pearson Addison Wesley |
| **Necessary Course Material** | Projector, Computer |

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| **Course Schedule** | |
| **1** | Series, geometric, harmonic and p-series, convergence tests, comparison, root and ratio tests. Absolute convergence concept. Taylor and MacLaurin series and convergence intervals. |
| **2** | Arc length for cartesian, polar and parametric curves, wire/cage systems, center of gravity (COG) and inertia moment calculations |
| **3** | Vectors, properties, dot and cross product. Projection of vectors. Vector functions, derivatives, position, velocity and acceleration vectors, tangential and normal components of acceleration |
| **4** | Path integrals and work calculations. Dependence/independence of work on path. |
| **5** | Multiple variable functions. Partial derivatives, generalized chain rule, implicit partial differentiation. |
| **6** | Critical points and types. Gradient, divergence, curl of a vector/scalar functions, directional derivative |
| **7** | Double integrals, area calculations in cartesian, polar and homothetic coordinate systems. |
| **8** | Mid-Term Exam |
| **9** | COG and inertia calculations for homogeneous and inhomogeneous planar systems. |
| **10** | Green’s theorem and its applications, work independent of path |
| **11** | Quadratic surfaces, surface equations, Planes, cones, paraboloids, sphere, spheroids etc. Triple integrals |
| **12** | Calculation of volume of a 3D bodies in cartesian, cylindrical, spherical and toroidal coordinates. COG and inertia moment calculations for homogeneous 3D systems. COG and inertia moment calculations for inhomogeneous 3D systems |
| **13** | Surface integrals, surface parametric equations, surface area element. |
| **14** | Surface area calculations COG and inertia moment calculations for homogeneous surface systems |
| **15** | Stokes and Divergence theorem and its applications |
| **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 | 4 | 56 |
| Classroom Studying Time (review, reinforcing, prestudy,….) | 14 | 2 | 28 |
| Homework | 0 | 0 | 0 |
| Quiz Exam | 2 | 1 | 2 |
| Studying for Quiz Exam | 2 | 5 | 10 |
| 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 | 2 | 2 |
| Studying for Mid-Term Exam | 1 | 25 | 25 |
| Final Exam | 1 | 2 | 2 |
| Studying for Final Exam | 1 | 25 | 25 |
|  | **Total workload** | | **150** |
|  | **Total workload / 30** | | **5** |
|  | **Course ECTS Credit** | | **5** |

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| **Evaluation** | |
| **Activity Type** | **%** |
| Mid-term | 40 |
| Quiz | 10 |
| Quiz | 10 |
| **Final Exam** | 40 |
| **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. | 4 |
| **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, economic and political problems; for that purpose an ability to apply modern design methods. | 2 |
| **4** | Ability to develop, select and use modern methods and tools required for engineering applications; ability to effective use of information technologies. | 4 |
| **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. | 3 |
| **7** | Ability to communicate in written and oral forms in Turkish/English; proficiency at least one foreign language. | 3 |
| **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 |
| **12** |  |  |

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| **LECTUTER(S)** | | | | |
| **Prepared by** | Asst. Prof. Dr. Zerrin SERT |  |  |  |
| **Signature(s)** |  |  |  |  |

**Date:**23.07.2024