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| | Course name: MATH 314 Partial Differential Equations | | | | Department: Mathematics | | | Semester |
| | | | | | | | | 6 |
| | Methods of Education | | | | | | | Credit (ECTS) |
| | Lecture | Recitation | Lab | Exams | Homework/ Quiz | Other | Total | 5 |
| | 42 | 0 | 0 | 38 | 0 | 56 | 150 | |
| Language | English | | | | | | | |
| Compulsory/Elective | Elective | | | | | | | |
| Prerequisites | MATH 111, MATH 112, MATH 211, MATH 212 | | | | | | | |

Course Contents

| Weeks | Subjects |
|---|---|
| 1 | • Preliminary concept of partial differential equations<br>• Historical background of partial differential equations<br>▪ Classification of partial differential equations |
| 2 | • First-order equations<br>• Quasilinear equations<br>• The method of characteristics |
| 3 | • Examples of the characteristics method<br>• The existence and uniqueness theorem |
| 4 | • Second-order linear equations in two indenpendent variables<br>• Classification of Second-order linear equations |
| 5 | • Canonical form of hyperbolic equations<br>• Canonical form of parabolic equations<br>• Canonical form of elliptic equations |
| 6 | • The one-dimensional wave equation<br>• Canonical form and general solution<br>• The Cauchy problem and d'Alembert's formula |
| 7 | • The method of separation of variables<br>• The Heat equations<br>• Separation of variables for the wave equation |
| 8 | • Sturm–Liouville problems and eigenfunction expansions<br>• The Sturm–Liouville problem |
| 9 | • The basic properties of Sturm–Liouville eigenfunctions and eigenvalues<br>• Elliptic equations |
| 10 | • Basic properties of elliptic problems<br>• The maximum principle |
| 11 | • Applications of the maximum principle<br>• Green's identities<br>• The maximum principle for the heat equation |

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| | **12** | • Separation of variables for elliptic problems<br>• Poisson's formula |
| | **13** | • Green's functions and integral representations<br>• Green's function for Dirichlet problem in the plane<br>• Neumann's function in the plane |
| | **14** | • Variational methods<br>• Calculus of variations<br>• Function spaces and weak formulation |

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| Course Objectives | **1.**To familiarize students with the basic concepts, principles and methods of Partial Differential Equations<br>**2.**To provide the knowledge of applications of Partial Differential Equations | | |
| Learning Outcomes and Competences | To understand and use basic methods with:<br>• Solving Homogeneous Heat, Wave , Laplace's Equations<br>• Characteristics of Integral Transforms (Laplace – Fourier)<br>• Special functions and Orthogonal Polynomials<br>• Sturm-Liouville and Generalized Fourier Series<br>• PDE's in Higher Dimensions | | |
| Textbook and /or References | • Partial Differential Equations: An Introduction, Walter A. Strauss (Author), Wiley; 2 edition (December 21, 2007)<br>• Kısmi Türevli Denklemler, Kerim KOCA, Gazi Kitabevi, 2013 | | |
| Assessment Criteria | | If any, mark as (X) | Percentage (%) |
| | Midterm Exams | X | 40 |
| | Quizzes | | |
| | Homework | | |
| | Projects | | |
| | Term Paper | | |
| | Laboratory work | | |
| | Other | | |
| | Final Exam | X | 60 |
| Instructors | | | |