425MATH

Introduction to Partial Differential Equations

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Outline

1. Important information
2. Marks
3. Book
4. Syllabus
5. Time of Exams

- Email : halrashidi@ksu.edu.sa
- My website: https://faculty.ksu.edu.sa/halrashidi/home
- My office: 50 at the third floor in Building 5.
- office hours: I am available every Sunday, Tuesday and Thursday from 9.15-10.20 am and from 11.45-12.50 pm.

Your Marks are divided into two parts

- 40%: Final Exam.
- 60%:
  - 30% Midterm Exam.
  - 10% Exercises.
  - 20% Two Short exams.

Text Books:

1. Introduction to partial differential equations and boundary value problems By Rene Dennemeyer.
2. R.McOWEN , Partial Differential Equations ,Methods and Applications.Prentice Hall,1995.
3. Partial Differential equations: An introduction By Walter A. Strauss.
4. Introduction to Partial Differential Equations By Peter J. Olver.
5. Partial Differential Equations By Lawrence C. Evans.

Syllabus

1. Differential equations; classification; solutions; sources.
2. First-order equations. Linear and quasi-linear equations; Lagrange method for solving quasi-linear equations; Cauchy's problem.
3. Linear second-order equations. classification into elliptic, parabolic, and hyperbolic types; solution by operator method and by separation of variables; Cauchy's problem.

Syllabus

4. Laplace's equation. Properties of harmonic functions and the maximum modulus principle; boundary-value problems (Dirichlet, Neumann, mixed); uniqueness of the solution; boundary-value problems in 2 and 3 dimensions; solution by separation of variables and Fourier series using Cartesian, polar, cylindrical, and spherical coordinates; Poisson's integral representation for the solution of Dirichlet's problem in a circle.
4. The wave equation. Mathematical model of a vibrating string; solution by separation of variables; D'Alenbert's solution; problems in 2 space dimensions; vibrations under friction and gravity.

Syllabus

6. The heat equation. Physical derivation using the laws of heat transfer; homogeneous and non-homogeneous boundary conditions; solution by separation of variables and Fourier series; boundary-value problems involving special functions; heat transfer in an infinite bar; representation of the solution by a Fourier integral.

Outcomes of the course

After studying this course, the student will able to:

1. Know where the P.D.Es exist.
2. Solve some first linear and quasi-linear P.D.Es by using Lagrange's method.
3. Classify three types of linear P.D.Es and then find their solutions.
4. Know the harmonic functions and its properties.
5. Know the definition of the Cauchy's problem for first and second P.D.Es.
6. Apply the method of separation of variables for solving some boundary values problems.
7. Study the existence and uniqueness solutions of some boundary values problem.

- First Short Exam: Week 5, Date:3/3/1444 (29/9/2022)(Thursday).
- Midterm Exam: Week 6, Date: 9/3/1444 (5/10/2022)(Wednesday).
- Second Short Exam: Week 8, Date:24/3/1444 (20/10/2022)(Thursday).