

COURSE DESCRIPTIONS

Faculty	Science and Information Technology				
Department	Mathematics	NQF level	6		
Course Title	Partial Differential equation I	Code	505305	Prerequisite	505203
Credit Hours	3	Theory	3	Practical	0
Course Leader	Hamzeh Zuerigat	email	hamzeh.zu@Jadara.edu.jo		
Lecturers	Hamzeh Zuerigat	emails	Hamzeh.zu@Jadara.edu.jo		
Lecture time	14:30-16:00	Classroom	D009		
Semester	First	Production		Updated	2022

ShortDescription

Introduction to Partial Differential Equations(PDEs), Classification of PDEs; some physical models: the heat equation, the wave equation, and Laplace's equations; separation of variables for linear homogeneous PDEs; Eigenfunction expansions, Fourier transforms: properties and some applications; Laplace transform, Duhamel's Principle, the heat equation for a finite rod, the wave equation for finite string, D' Alembert solution, second order equations and classification into canonical forms (parabolic, elliptic, and hyperbolic), the method of characteristics, The Laplace equation in Cartesian & polar coordinates.

Course Objectives

Upon completion of this course, the student should be able to:

1. Classify linear second order PDEs.
2. Use Separation of Variables, Fourier series, Laplace transforms, and canonical variables for solving linear second order IBVPs (Heat equation, the wave equation, Laplace's equation).
3. use the method of characteristics for solving first order PDEs.

Learning Outcomes

A. Knowledge - Theoretical Understanding

- a1. Provide basic knowledge in the theory of partial differential equations.
- a2. Transform the PDEs into a corresponding canonical (simple) form.

B. Knowledge - Practical Application

- b1. Find the solution of a linear second order IBVPs (Heat equation, the wave equation, Laplace's equation) Using mathematical methods (Separation of Variables, Fourier series, Laplace transforms, and canonical variables).
- b2. Find the solution of first order PDEs using the method of characteristics.

C. Skills - Generic Problem Solving and Analytical Skills
c1. Study main properties of the classical equations of Mathematical Physics.
D. Skills - Communication, ICT, and Numeracy
E. Competence: Autonomy, Responsibility, and Context
Teaching and Learning Methods
Lectures, discussions, and solving selected problems
Assessment Methods
Participation question, quiz, homework, and exams

Course Contents					
Week	Hours	CLOs	Topics	Teaching & Learning Methods	Assessment Methods
1	3	a1	Mathematical models leading to P.D.E. Classification of 2 nd order equations, Initial & boundary conditions.	Lectures, discussions, and solving selected problems	Participation question, quiz, homework
2	3	a1, b1	Separation of variables.	Lectures, discussions, and solving selected problems	Participation question, quiz, homework
3	3	a1, b1	Transforming Nonhomogeneous BCs into Homogeneous Ones, Transforming Hard Equations into Easier Ones	Lectures, discussions, and solving selected problems	Participation question, quiz, homework
4	3	a1, b1	Solutions by eigenfunctions.	Lectures, discussions, and solving selected problems	Participation question, quiz, homework
5	3	a1, b1	Fourier Transform and its use to solve this type of equations.	Lectures, discussions, and solving selected problems	Participation question, quiz, homework
6	3	a1, b1, c1	Laplace transform and P.D.E.	Lectures, discussions, and solving selected problems	Participation question, quiz, homework

7	3	a1, b1, c1	Duhamel's Principle.	Lectures, discussions, and solving selected problems	Participation question, quiz, homework
8	3	a1, b1	D' Alembert solution of the wave equation.	Lectures, discussions, and solving selected problems	Participation question, quiz, homework
9	3	a1, b1, c1	Separation of variables & finite string vibration.	Lectures, discussions, and solving selected problems	Participation question, quiz, homework
10	3	a1, a2, b1, c1	Canonical forms & reduction of 2 nd order P.D.Es to them.	Lectures, discussions, and solving selected problems	Participation question, quiz, homework
11	3	a1, a2, b1, c1	Superposition.	Lectures, discussions, and solving selected problems	Participation question, quiz, homework
12	3	a1, b2, c1	1 st order equations, the method of characteristics.	Lectures, discussions, and solving selected problems	Participation question, quiz, homework
13	3	a1, c1	The Laplace equation in Cartesian & polar coordinates.	Lectures, discussions, and solving selected problems	Participation question, quiz, homework
14	3	a1, b1, c1	General nature of boundary conditions.	Lectures, discussions, and solving selected problems	Participation question, quiz, homework
15	3	a1, a2, b1, b2, c1	Review	Lectures, discussions, and solving selected problems	Participation question, quiz, homework

Infrastructure	
Textbook	Partial Differential Equations for scientists & engineers, Stanley Farlow, Courier Corporation, 1993.
References	Linear Partial Differential Equations for Scientists and Engineers, Tyn Myint-U and L. Debnath, 4-th edition, Birkhauser, Boston, (2006).

Required reading	
Electronic materials	
Other	

Course Assessment Plan						
Assessment Method		Grade	CLOs			
First(Midterm)		30				
Second (if applicable)						
Final Exam		50				
Coursework		20				
Coursework assessment methods	Assignments	5				
	Case study					
	Discussion and interaction	5				
	Group work activities					
	Labtests and assignments					
	Presentations					
	Quizzes	10				
Total		100				

Plagiarism
<p>Plagiarism is claiming that someone else's work is your own. The department has a strict policy regarding plagiarism and, if plagiarism is indeed discovered, this policy will be applied. Note that punishments apply also to anyone assisting another to commit plagiarism (for example by knowingly allowing someone to copy your code).</p> <p>Plagiarism is different from group work in which a number of individuals share ideas on how to carry out the coursework. You are strongly encouraged to work in small groups, and you will certainly not be penalized for doing so. This means that you may work together on the program. What is important is that you have a full understanding of all aspects of the completed program. In order to allow proper assessment that this is indeed the case, you must adhere strictly to the course work requirements as outlined above and detailed in the coursework problem description. These requirements are in place to encourage individual understanding, facilitate individual assessment, and deter plagiarism.</p>

Chair of Mathematics Department: Dr. Belal Batiha



Course Leader: Dr. Hamzeh Zureigat



