



ARSD College, University of Delhi

Model Course Handout/Lesson Plan

Course Name : B.Sc. (Hons) Mathematics						
Semester	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
IV	BMATH408	Partial Differential Equations	4x14=56	0	4x14=56	4+2=6
Teacher/Instructor(s)		Dr. Preeti Jain				
Session		2021-22				

Course Objective: The main objectives of this course are to teach students to form and solve partial differential equations and use them in solving some physical problems.

Course Learning Outcomes:

The course will enable the students to:

- Formulate, classify and transform first order PDEs into canonical form.
- Learn about method of characteristics and separation of variables to solve first order PDE's.
- Classify and solve second order linear PDEs.
- Learn about Cauchy problem for second order PDE and homogeneous and nonhomogeneous wave equations.
- Apply the method of separation of variables for solving many well-known second order PDEs.

Lesson Plan:

Unit No.	Learning Objective	Lecture No.	Topics to be covered
1.	First Order PDE and Method of Characteristics	1	Introduction of first order partial differential equations (PDE)
		2	Classification of PDE
		3-4	Construction and geometrical interpretation of first order PDE
		5-6	Method of characteristic of first order PDE
		7-8	General solution of first order PDE
		9-10	Canonical form of first order PDE
		11-12	Method of separation of variables for first order PDE.

2.	Mathematical Models and Classification of Second Order Linear PDE	13-14	Vibrating String and Vibrating Membrane
		15-16	Gravitational potential, Conservation laws and Burger's equations
		17-18	Classification of second order PDE,
		19-20	Reduction to canonical forms,
		21-24	Equations with constant coefficients, General solution.
3.	The Cauchy Problem and Wave Equations	25- 28	Cauchy problem for second order PDE,
		29-30	Homogeneous wave equation
		31-32	Initial boundary value problems,
		33-34	Nonhomogeneous boundary conditions,
		35-36	Finite strings with fixed ends
		37-38	Non-homogeneous wave equation
		39-40	Goursat problem.
4.	Method of Separation of Variables	41-44	Method of separation of variables for second order PDE,
		45-48	Vibrating string problem using method of separation of variables
		49	Existence (without discussing proof) and uniqueness of vibrating string problem
		50	Heat conduction problem
		51- 52	Existence (without discussing proof) and uniqueness of the solution of heat conduction problem.
		53-56	Non-homogeneous problem.

Evaluation Scheme:

No.	Component	Duration	Marks
1.	Internal Assessment		25
	• Quiz		
	• Class Test		
	• Attendance		
	• Assignment		

2.	End Semester Examination	3 hr	75
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Details of the Course		
Unit	Contents	Contact Hours
	First Order PDE and Method of Characteristics	
1	Introduction, Classification, Construction and geometrical interpretation of first order partial differential equations (PDE), Method of characteristic and general solution of first order PDE, Canonical form of first order PDE, Method of separation of variables for first order PDE.	12
	Mathematical Models and Classification of Second Order Linear PDE	
2	Gravitational potential, Conservation laws and Burger's equations, Classification of second order PDE, Reduction to canonical forms, Equations with constant coefficients, General solution.	12
	The Cauchy Problem and Wave Equations	
3	Mathematical modeling of vibrating string and vibrating membrane, Cauchy problem for second order PDE, Homogeneous wave equation, Initial boundary value problems, Nonhomogeneous boundary conditions, Finite strings with fixed ends, Non-homogeneous wave equation, Goursat problem.	16
	Method of Separation of Variables	
4	Method of separation of variables for second order PDE, Vibrating string problem, Existence and uniqueness of solution of vibrating string problem, Heat conduction problem, Existence and uniqueness of solution of heat conduction problem, Non-homogeneous problem.	16
	Total	56
Suggested Books:		
Sl. No.	Name of Authors/Books/Publishers	Year of Publication/Reprint
1	Myint-U, Tyn and Debnath, Lokenath- Linear Partial Differential Equation for scientist and engineers -Birkaiser Boston, Indian Reprint	2007
2	Sneddon, I. N. <i>Elements of Partial Differential Equations</i> , Dover Publications. Indian Reprint.	2006
3	Stavroulakis, Ioannis P & Tersian, Stepan A. <i>Partial Differential Equations: An Introduction with Mathematica and MAPLE</i> (2nd ed.). World Scientific.	2004

Mode of Evaluation:	Internal Assessment / End Semester Exam
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Progress Report:

Unit No.	Learning Objective	Date	Topics to be covered
1.	First Order PDE and Method of Characteristics Mathematical Models and Classification of Second Order Linear PDE		Introduction of first order partial differential equations (PDE)
			Classification of PDE
			Construction and geometrical interpretation of first order PDE
			Method of characteristic of first order PDE
			General solution of first order PDE
			Canonical form of first order PDE
			Method of separation of variables for first order PDE.
			Vibrating String and Vibrating Membrane
			Gravitational potential, Conservation laws and Burger's equations
			Classification of second order PDE,
			Reduction to canonical forms,
			Equations with constant coefficients, General solution.
2.	The Cauchy Problem and Wave Equations		Cauchy problem for second order PDE,
			Homogeneous wave equation
			Initial boundary value problems,
			Nonhomogeneous boundary conditions,
			Finite strings with fixed ends
			Non-homogeneous wave equation
3.	Method of Separation of Variables		Goursat problem.
			Method of separation of variables for second order PDE,
			Vibrating string problem using method of separation of variables
			Existence (without discussing proof) and uniqueness of vibrating string problem
			Heat conduction problem
			Existence (without discussing proof) and uniqueness of the solution of heat conduction problem.
			Non-homogeneous problem.

