DEPARTMENT OF MATHEMATICS

Semester :VII	Integrated M.Sc. Mathematics	Academic Year : 2019 -20

Subject :060090704Advance Partial Differential Equation

Teaching Schedule

Course Objectives: To get knowledge of key concepts in advanced partial differential equations, e.g., some physical problems in engineering, Wave equation, Laplace equation, diffusion equation and real world problems that results in partial differential equations and able to solve problems by using of Separation of variable method, Green's function.

Course outcomes: Upon completion of the course, students shall be able to

CO1: classify partial differential equations (PDEs), convert in canonical form and apply an appropriate transformation technique to derive solution.

CO2: understand the derivation of laplace PDE.

CO3: get solutions of laplace equation using various analytical approaches.

CO4: formulate and solve one dimensional wave equation using different methods.

CO5: understand the fundamentals of green's function and its application to solve various one dimensional PDEs.

CO6: construct one dimensional PDEs for respective conditional problem and resolved it by various analytical methods.

Unit	Sub Unit	No. of Lect.(s)	Topics	Reference Chapter/ Additional Reading	Teaching Methodology to be used	Active Learning Activities	Evaluation Parameter
Unit 1: Introduction to Second order Partial Differential Equations							
[15]	1.1	1	Origin of second order partial differential equations	Ch#8 Ordinary and Partial Differential EquationsDr. M.D. Raisinghania	Chalk & Talk	**For Slow Learner:** Students must write answer of question(s) given by teacher after completion of each method and verified by teacher to resolve any query of students. **For Active Learner:** Student will solve exercise given in book after completion of Unit.	Unit Test -1 Assignment-1
	1.2	1	Classification of second order partial differential equations				
	1.3	2	Monge's method for partial differential equations of second order				
	1.4	2	Cauchy's problem for second order partial differential equations				
	1.5	2	Characteristic equations of second order partial differential				

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			equation				
	1.6	2	Rules for Finding C.I and P.I.				
Unit 2: Laplace Equation							
[15]	2.1	2	Mean value property	Ch#3 Ordinary and Partial Differential EquationsDr. M.D. Raisinghania	Chalk & Talk	**For Slow Learner:** Students must write answer of question(s) given by teacher after completion of each method and verified by teacher to resolve any query of students. **For Active Learner:** Student will solve exercise given in book after completion of Unit.	Unit Test -1 and 2 Assignment-2
	2.2	1	Weak and strong maximum principle				
	2.3	3	Poisson's formula				
	2.4	3	Dirichlet's principle				
	2.5	3	Existence of solution using Perron's method (without proof)				
	2.6	3	Solutions by method of separation of variables.				
Unit 3: Wave Equations							
[15]	3.1	3	One dimensional wave equation	Ch#4 Ordinary and Partial Differential EquationsDr. M.D. Raisinghania	Chalk & Talk	**For Slow Learner:** Students must write answer of question(s) given by teacher after completion of each method and verified by teacher to resolve any query of students. **For Active Learner:** Student will solve exercise given in book after completion of Unit.	Unit Test -2 Assignment-3
	3.2	4	D'Alembert's method				
	3.3	3	Method of spherical means				
	3.4	4	Duhamel's principle				
	3.5	3	solutions by method of separation of variables				
Unit 4: Green's Function							
[15]	4.1	2	Introduction of Green's function	Ch#5, CH#10 Ordinary and Partial Differential EquationsDr. M.D.	Chalk & Talk	**For Slow Learner:** Students must write answer of question(s) given by teacher after completion of each method and verified by teacher to resolve any query of students.	Internal Examination Assignment-4
	4.2	2	Green's function for laplace equation				
	4.3	2	The eigen function method				
	4.4	2	Green's function for wave equation – Helmholtz theorem				
	4.5	2	Green's function for diffusion				

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			equation	Raisinghania		**For Active Learner:** Student will solve exercise given in book after completion of Unit.	

Text book:
1. Dr. M.D. Raisinghania: Ordinary and Partial Differential Equations, S. Chand & Company PVT.LTD, 2008.

Reference book:
1. Amaranath: An Elementary Course in Partial Differential Equations, Wiley Eastern Ltd., New Delhi, 1975.

Course Objectives and Course Outcomes Mapping:
- Understand the fundamentals concepts of PDEs: CO1, CO2,CO6
- To become familiar with problem solving techniques: CO3, CO4, CO5

Course Units and Course Outcomes Mapping:

Unit No.	Unit	Course Outcomes					
		CO1	CO2	CO3	CO4	CO5	CO6
1	Introduction to second order partial differential equations	✓	✓				✓
2	Laplace equation		✓	✓			✓
3	Wave equations				✓		✓
4	Green's function					✓	✓

Programme Outcomes (PO)

PO1: Knowledge

Provides knowledge about the fundamentals of pure, applied and computing mathematics and its applications to students that creates the opportunities in industries and research centers.

PO2: Core Competence

Creates competency in science and mathematics to formulate, analyses and solve problem and/or also to pursue advanced study or research.

PO3: Breadth

Trains students having good knowledge in unearth core of academia and industry by the roots of mathematics.

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PO4: Evaluation

Imparts in students to raise trial and error-based curiosity and problem-solving functionality with research based advanced tutorial for higher level decision makings tools.

Programme Outcomes and Course Outcomes mapping:

Programme Outcomes	Course Outcomes					
	CO1	CO2	CO3	CO4	CO5	CO6
PO1	✓		✓		✓	✓
PO2		✓		✓		✓
PO3			✓	✓	✓	✓
PO4					✓	