PARTIAL DIFFERENTIAL EQUATIONS

Semester	Subject Code	Category	Lecture		Theory	Practical	Credits
			Hrs/Week	Hrs/Sem			
I	21CPMA2C	Core	6	90	6	0	5

COURSE OBJECTIVES:

The students will be able to

- This course aims to acquaint the students with various mathematical techniques viz. in variable separable method and integral transform techniques
- Using Green's function approach to solve various boundary value problems involving parabolic, elliptic and hyperbolic differential equations which arise in many physical situations.

COURSE OUTCOMES:

On the successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level(K1-K4)
CO1	Obtain solutions of the partial differential equation in integral surfaces, orthogonal surfaces, compatible system, charpit's method and canonical forms.	K2
CO2	Derive Laplace and Poisson equation, Dirichlet and Neumann problem for a Circle and Rectangle.	K3
CO3	Obtain and form a solution of diffusion equation in cylindrical and spherical co-ordinates.	K4
CO4	Comprehend the initial value problem and boundary value problem for two-dimensional wave equation and Duhamel's Principle.	K2
CO5	Analyze the problems in green's Function for Laplace equation, wave and diffusion equation.	K3

Knowledge Level: K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze.

MAPPING WITH PROGRAMME OUTCOMES:

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	M	S
CO2	M	M	S	M	S	M
CO3	S	S	S	M	S	S
CO4	M	M	M	M	M	S
CO5	S	M	S	S	S	M

S- Strong; M- Medium; L- Low

UNIT I - PARTIAL DIFFERENTIAL EQUATIONS OF FIRST ORDER 18 Hours

Formation and Solution of Partial Differential Equation – Integral surfaces – Cauchy Problem for first order equation – Orthogonal surfaces – First order Non – Linear Equations – Cauchy Method of Characteristics – Compatible system – Charpit's method. Fundamentals: Classification and Canonical forms of PDE - Adjoint Operators - Riemann's Method.

Chapter 0: 0.4 to 0.11 [Omit 0.1, 0.2, 0.3 and 0.11.1] and Chapter 1: 1.1 to 1.5

UNIT II - ELLIPTIC DIFFERENTIAL EQUATIONS 18 Hours

Derivation of Laplace and Poisson equation – BVP – Separation of Variables – Dirichlet Problem and Neumann problem for a rectangle – Interior and exterior Dirichlet problem for a circle – Interior Neumann problem for a circle – solution of Laplace equation in Cylindrical and Spherical coordinates.

Chapter 2: 2.1, 2.2, 2.5 to 2.12 [omit 2.3, 2.4 and 2.13]

UNIT III - PARABOLIC DIFFERENTIAL EQUATIONS 18 Hours

Formation and solution of Diffusion equation – Dirac – Delta function- Separation of Variables Method – Solution of Diffusion Equation in Cylindrical and Spherical coordinates.

Chapter 3: 3.1 to 3.7 [omit 3.8 and 3.9]

UNIT IV - HYPERBOLIC DIFFERENTIAL EQUATIONS 18 Hours

Formation and solution of one – dimensional wave equation – Canonical Reduction – IVP – D'Alembert's solution – Vibrating string — IVP and BVP for two – dimensional wave equation – Periodic solution of one- dimensional wave equation in cylindrical and spherical coordinates systems – Vibration of Circular Membrane – Uniqueness of the solution for the wave equation – Duhamel's Principle – Examples.

Chapter 4: Section 4.1 to 4.12 [omit 4.6 and4.13]

UNIT V - GREEN'S FUNCTION 18hrs

Green's Function for Laplace Equation – Methods of Images – Eigen function method – Green's Function for the Wave and Diffusion equations. Laplace Transform Method: Solution of Diffusion and Wave equation by Laplace transform.

Chapter 5: 5.1 to 5.6 Chapters 6: only 6.13, 6.13.1 and 6.13.2 [omit 6.14]

DISTRIBUTION OF MARKS: THEORY 70% AND PROBLEMS 30%.

TEXT BOOK:

S.No	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1	S. SankaraRao	Introduction to partial differential equations	2nd Edition Prentice Hall of India, New Delhi	2005

REFERENCE BOOKS:

S.No.	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1	R.C. Mc Owen	Partial differential equations	McGraw Hill New Delhi	2005.
2	I.N. Snedden	Elements of Partial Differential Equations	McGraw Hill New Delhi,1983.	1983
3	R. Dennemeyer,	Introduction to Partial Differential Equations and Boundary Value Problems	McGraw Hill, New York,1968.	1968
4	M.D.Raisinghania	Advanced Differential Equations,	S.Chand& Company LTD, New Delhi	2001

WEB SOURCES:

1.http://www.math.toronto.edu/ivrii/PDE-textbook/PDE-textbook.pdf2.

2. http://www1.maths.leeds.ac.uk/~kersale/Teach/M3414/Notes/m3414_1.pdf

TEACHING METHODOLOGY:

1. Class room Teaching

2. Assignments

3. Seminars

4. Discussions

5. PPT Presentations.

SYLLABUS DESIGNER:

Mrs. B. Vijayalakshmi, Assistant Professor of Mathematics.