P.B. SIDDHARTHA COLLEGE OF ARTS & SCIENCE

Siddhartha Nagar, Vijayawada – 520 010
Reaccredited at 'A+' level by NAAC
Autonomous&ISO 9001:2015 Certified

Title of the Course: PARTIAL DIFFERENTIAL EQUATIONS
Semester : II

Course Code	22MA2T3	Course Delivery Method	Blended Mode
Credits	4	CIA Marks	30
No. of Lecture Hours / Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2020-21	Year of offering : 2022-23	Year of Revision: ----	Percentage of Revision :---

Course Objectives: The objective of the course is to find the solutions of first and second order partial differential equations and to study some applications of partial differential equations.

CO-NO	COURSE OUTCOME	BTL	PO	PSO
CO1	Formulate and classify first order and second order partial differential equations	**K3**	**3**	**2**
CO2	Solve the first order linear and non linear equations using different methods	**K3**	**3**	**2**
CO3	Solve the wave equation with different initial and boundary conditions and can apply these solutions to physical problems	**K3**	**7**	**2**
CO4	Solve the Laplace equation with different initial and boundary conditions and can apply these solutions to physical problems	**K3**	**7**	**2**
CO5	Find Riemann Volterra solution of one dimensional wave equation	**K3**	**1**	**1**

Mapping of Course Outcomes:

CO-PO-PSO MATRIX										
22MA2T3	**CO-PO**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**
	CO1			**2**						**3**
	CO2			**3**						**3**
	CO3							**3**		**3**
	CO4							**3**		**3**
	CO5	**3**							**2**	

UNIT-I

First Order PDE's - Introduction - Methods of solution of $dx/P=dy/Q=dz/R$ - Orthogonal trajectories of a system of curves on a surface - Pfaffian Differential forms and equations - Solution of Pfaffian Differential Equations in three variables – Partial Differential equations- Origins of first order Partial Differential Equations- Cauchy's problem for first order equations.
[Sections 3 to 6 of Chapter 1, Sections 1 to 3 of Chapter 2 of the Prescribed Book [1]]

UNIT-II

Partial differential equations of the First order: Linear Equations of the first order - Integral Surfaces passing through a given curve- Surfaces orthogonal to a given system of Surfaces - Non Linear PDE of the first order - Cauchy's method of characteristics - Compatible systems of first order equations - Charpit's Method- Special types of first order equations - Solutions satisfying given conditions- Jacobi's Method.
[Sections 4 to 13 of Chapter 2 of the Prescribed Book [1]]

UNIT-III

Partial differential equations of the second order: The origin of second order equations - Linear partial differential equations with constant coefficients - Equations with variable coefficients - The solution of linear hyperbolic equations - Separation of variables - Monge's Method.[Sections 1, 4, 5 , 8, 9, 11 of Chapter 3 of the Prescribed Book [1]]

UNIT-IV

Laplace's Equation: Elementary solutions of Laplace's Equation - Families of equipotential surfaces - Boundary value problems - Separation of a variables - Problems with axial symmetry - Kelvin's Inversion theorem. [Sections 2 to 7 of Chapter 4 of the Prescribed Book[1]]

UNIT-V

The wave equation: Elementary solutions of the one dimensional form - The Riemann Volterra solution of one dimensional wave equation.[Problematic approach is Preferred]
[Sections 1 to 3 of Chapter 5 of the Prescribed Book [1]]

PRESCRIBED BOOK:

1. "**Elements of partial differential equations",** I. N. Sneddon, McGraw-Hill International Edition, Mathematics series.

REFERENCE BOOK:

1. "**An Elementary Course in Partial differential equations",**T. Amaranath, Second Edition, Narosa Publishing House.

Course has Focus on :Foundation

Websites of Interest:
1. www. nptel.ac.in
2. www.epgp.inflibnet.ac.in
3. www.ocw.mit.edu

P B SIDDHARTHA COLLEGE OF ARTS AND SCIENCE::VIJAYAWADA

(An autonomous college in the jurisdiction of Krishna University)

M. Sc. Mathematics

Second Semester

PARTIAL DIFFERENTIAL EQUATIONS – 22MA2T3

Time: 3 hours **Max. Marks: 70**

SECTION-A

Answer all questions. **(5x4=20)**

1 a) Explain the concept of orthogonal trajectories with an example. (CO1, L1)

(OR)

b) Define Pfaffian differential equation and state the necessary and sufficient condition for the integrability of Pfaffian differential equation. (CO1, L1)

(OR)

2 a) Explain Charpit's method. (CO2, L2)

b) Explain Jacobi's method. (CO2, L2)

3 a) Classify Second order PDE's and give an example. (CO3, L2)

(OR)

b) Define Greens function and Riemann's function. (CO3, L2)

4 a) State two types of boundary value problems for Laplace equations. (CO4, L2)

(OR)

b) Define family of equipotential surfaces and give an example. (CO4, L2)

5 a) Discuss the occurrence of wave equation in Physics with example. (CO5, L2)

(OR)

b) Write Riemann-Volterra solution for one dimensional wave equation. (CO5, L2)

SECTION-B

Answer the following questions. All questions carry equal marks. (5X10=50)

6. a) If there exists a relation between two functions u(x, y) and v(x, y) not involving x or y explicitly, then show that $\partial(u,v)/\partial(x,y)= 0$ (CO1, L3)

(OR)

b) Verify that the equation $(z+y)+z(z+x)dy-2xy$ dz =0 is integrable and find its primitive. (CO1, L3)

7 a) Find a complete integral of the equation $(p^2+q^2)y=qz$. (CO2, L3)

(OR)

b) Find a complete integral of $p^2x+q^2y=z$using Jacobi's method. (CO2, L3)

8 a) Reduce the equation $Z_{xx} = x^2Z_{yy}$ to canonical form. (CO3, L3)

(OR)

b) Solve the equation $r+4s+t+rt-s^2=2$ using Monge's method. (CO3, L3)

9 a) A rigid sphere of radius a is placed in a stream of fluid whose velocity in the undisturbed state is V. Determine the velocity of the fluid at any point of the disturbed stream. (CO4,L3)

(OR)

b) State and Prove Kelvin's inversion theorem. (CO4, L3)

10 a) Derive D'Alembert's solution of the one-dimensional wave equation. (CO5, L3)

(OR)

b) If ψ is determined by the differential equation $a^2(\partial^2\psi/\partial x^2)+b^2\psi=\partial^2\psi/\partial y^2$ where a and b are constants and satisfies the conditions $y=0$, $\psi=f(x)$,$\partial\psi/\partial y = g(x)$, then find ψ using Riemann-Volterra Method. (CO5, L3)

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