UNITIZATION OF SYLLABUS & TEACHING PLAN

Department of MATHEMATICS

Bankura Christian College

B.Sc. Honours in Mathematics

5th Semester (July to December, 2023), A.Y.: 2023 – 24

Subject: Mathematics **Paper: Core T11**

Course Title: Partial Differential Equations and Applications

Course Instructor: Dr Subhasis Bandyopadhyay

Course Learning Outcomes: This course will enable the students to:

- Be familiar with the modeling assumptions and derivations that lead to PDEs.
- Recognize the major classification of PDEs, their canonical form and the qualitative differences between the classes of equations
- Apply a range of techniques to solve first & second order partial differential equations.
- Model physical phenomena using partial differential equations such as the heat and wave equations.
- Learn and explain different concepts on Mechanics viz., central force and planetary motion, constrained motion, varying mass problems.

Syllabus:

Unit – 1

Partial Differential Equations – Basic concepts and Definitions. Mathematical Problems. First- Order Equations: Classification, Construction and Geometrical Interpretation. Method of Characteristics for obtaining General Solution of Quasi Linear Equations. Canonical Forms of First-order Linear Equations. Method of Separation of Variables for solving first order partial differential equations.

Unit – 2

Derivation of Heat equation, Wave equation and Laplace equation. Classification of second order linear equations as hyperbolic, parabolic or elliptic. Reduction of second order Linear Equations to canonical forms.

Unit – 3

The Cauchy problem, Cauchy-Kowalewskaya theorem, Cauchy problem of an infinite string. Initial Boundary Value Problems. Semi-Infinite String with a fixed end, Semi-Infinite String with a Free end. Equations with non-homogeneous boundary conditions. Non- Homogeneous Wave Equation. Method of separation of variables, Solving the Vibrating String Problem. Solving the Heat Conduction problem.

Unit – 4

Central force. Constrained motion, varying mass, tangent and normal components of acceleration, modelling ballistics and planetary motion, Kepler's second law.

References Books:

1. Tyn Myint-U and Lokenath Debnath, Linear Partial Differential Equations for Scientists and Engineers, 4th edition, Springer, Indian reprint, 2006.
2. Sneddon, I. N., Elements of Partial Differential Equations, McGraw Hill.
3. Miller, F. H., Partial Differential Equations, John Wiley and Sons.
4. Loney, S. L., An Elementary Treatise on the Dynamics of particle and of Rigid Bodies, Loney Press
5. K.Sankara Rao, Introduction to Partial Differential Equations, PHI, Third Edition, 2015.
6. Amarnath T., An Elementary Course in Partial Differential Equations, Narosa.
7. Prasad Phoolan, Ravindran.Renuka, Partial Differential Equations,New Age International Publishers.
8. Chorlton ,F., Textbook of Dynamics, CBS Publishers & Distributors.

Teaching Plan

MONTH & YEAR	WEEK	PORTIONS	No. of Lectures
August 2023 [Date of Commencement of Regular Classes: 28 – 08 – 2023]	1	----------	------
	2	----------	-------
	3	----------	------
	4	----------	-------
	5	Basic concepts and Definitions. Mathematical Problems. First- Order Equations: Classification, Construction and Geometrical Interpretation.	**2**
September 2023	1	Method of Characteristics for obtaining General Solution of Quasi Linear Equations.	**3**
	2	Canonical Forms of First-order Linear Equations. Method of Separation of Variables for solving first order partial differential equations.	**4**
	3	Introduction to second order PDE, Classification of second order linear equations as hyperbolic, parabolic or elliptic. Reduction of second order Linear Equations to canonical forms.	**5**
	4	Derivation of Heat equation, Wave equation and Laplace equation.	**5**
	5	The Cauchy problem, Cauchy-Kowalewskaya theorem, Cauchy problem of an infinite string.	**5**
October 2023	1	Initial Boundary Value Problems. Semi-Infinite String with a fixed end, Semi-Infinite String with a Free end.	**5**
	2	Equations with non-homogeneous boundary conditions. Non-Homogeneous Wave Equation. Method of separation of variables.	**4**
	3	**CLASS TEST / ASSIGNMENTS**	**1**
	4	**Puja Holidays (18-10-2023 TO 28-10-2022) As per Academic Calendar**	
	5	**Puja Holidays**	------
November 2023	1	Solving the Vibrating String Problem. Solving the Heat Conduction problem.	**4**
	2	Solving the problems based on Heat equation and Wave equation.	**5**
	3	**Holidays (Kali Puja, Bhatridwitiya etc.)(12-11-23 To 16-11-23)**	
	4	Central force. Kepler's second law.	**3**
	5	Central Forces and related problems… contd.	**2**
December 2023	1	Modelling ballistics and planetary motion. Tangent and normal components of acceleration,	**3**
	2	Constrained motion and related problems.	**5**
	3	Constrained motion … contd. Varying mass Problems	**5**
	4	**Revision /Class Test/Assignments**	**3**
	5	**Christmas Holidays & Study Leave**	------