Course No	Course Name	L-T-P-Credits
MA 548	**Partial Differential Equations II**	**3-0-0: 3**

Prerequisite: nil

Course Objectives: This course aims to introduce the theory of distribution, Sobolev spaces and their applications to PDEs. The main objective is to lay a foundation for the research in various areas of PDE.

Course Outcomes: After successful completion of the course, students will be able to:

1. Understand the difference between classical and weak solutions of PDEs; and limitations of classical solutions, regularity of weak solutions.
2. Determine weak solutions of PDEs.
3. Understand theory of distribution, weak derivatives and the needs of Sobolev spaces.
4. Apply the knowledge in various research fields for example functional analysis, differential equations, etc.

SYLLABUS

Module	Contents	Hours
I	Introduction: Well-posed problems, classical solutions, regularity of weak solutions.	05
II	Representation formulas for solutions: Transport equation, Laplace's equation, heat equation and wave equation.	09
III	Sobolev spaces: Test Function and distribution, definition and properties, weak derivatives, approximation by smooth functions, trace theory, Sobolev inequalities, the space H-1.	12
IV	Application to Elliptic Problems: Weak solution of elliptic boundary value problems, regularity of weak solutions, maximum principle	10

Essential Readings:

1. L. C. Evans, "*Partial Differential Equations*", Graduate Studies in Mathematics, Vol. 19, AMS, 2nd edition, 2010.
2. H. Brezis, "*Functional Analysis, Sobolev Spaces and Partial Differential Equations*", Springer, 2011.

Supplementary Readings:

1. S. Kesavan, "*Topics in Functional Analysis and Applications*", New Age International Private Limited, 2015.

2. R. A. Adams and J. J. F. Fournier, "*Sobolev Spaces*", Vol. 140, Pure & Applied Mathematics, Academic Press, 2nd edition, 2003.