

1	Course Code	MA 207001
2	Course Title	Sobolev spaces and applications to Partial Differential Equations
3	Credits	4
4	Contact Hours (L-T-P)	L T P C 3 1 0 4
5	Prerequisites (if any)	Students should have basic knowledge of functional analysis
6	Course Status	Elective
7	Course Objective	Several interesting partial differential equations (PDEs) which model physical phenomena fail to possess the classical solutions. This led to the need of generalizing the notion of solutions (and their derivatives) of PDEs. For this the notion of weak solution (Distributional/weak derivatives) and Sobolev spaces are introduced. Sobolev spaces are a fundamental tool in the modern study of partial differential equations.
8	Course Contents	<p>Distribution: Review of Lebesgue integration and Classical function spaces, Spaces of infinitely differentiable functions and Holder spaces. Definition of distribution, some operations with distributions, convolution of functions and distributions, tempered distributions.</p> <p>Sobolev spaces: Definition and properties, extension theorem, Poincare inequality, imbedding theorems & trace theorem (without proof).</p> <p>Application to Elliptic Problems: Weak solution of elliptic boundary value problem (BVP), Lax-Milgram Theorem, regularity of weak solutions, maximum principle, eigenvalue problems, fixed point theorems and their application in semilinear elliptic BVP.</p> <p>Note: If time permits, we will also discuss second order parabolic equations: existence and regularity of weak solutions, Maximum principles.</p>
9	Text books/ References	<ol style="list-style-type: none"> 1. S. Kesavan, Topics in Functional Analysis and Applications, Wiley Eastern Ltd., New Delhi, 1989. 2. L. C. Evans. Partial Differential Equations. Second Edition, AMS, 2010. 3. G. Leoni. A First Course in Sobolev Spaces. AMS, 2009. 4. H. Brezis, Functional Analysis, Sobolev Spaces and Partial Differential Equations, Springer, 2011. 5. P. K. Bhattacharyya, Distributions: Generalized Functions with Applications in Sobolev Spaces, de Gruyter, 2012.