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| I | Course Code | **MA197003** |
| II | Course Title | **Mathematical Theory of Finite Element Method** |
| III | Credits | L T P C<br>3 0 1 4 |
| IV | Prerequisites (if any) | |
| V | Course Contents | **UNIT-I:** Elements of function spaces: Spaces of continuous functions, Spaces of integrable functions, Sobolev spaces; Weak solutions to elliptic problems, Lax Milgram Lemma: Existence and uniqueness of solutions. Piecewise Polynomial Spaces, Interpolation, L2-projection, Variational formulation of elliptic boundary value problems.<br><br>**UNIT-II:** Finite element methods: Galerkin orthogonality and Cea's lemma, Piecewise polynomial approximation in Sobolev spaces, Optimal error bounds in the energy norm, The Aubin-Nitsche duality argument, Numerical Integration, construction of element stiffness matrices and assembly into global stiffness matrix.<br><br>**UNIT-III:** Finite element approximation of Parabolic initial boundary value problems: Semidiscrete and fully-discrete schemes with convergence analysis.<br><br>**Lab Component:** Implementation of algorithms and computational experiments using MATLAB. |
| VI | Text books/ References | 1. S. Brenner & R. Scott, The Mathematical Theory of Finite Element Methods, Springer-Verlag, 1994.<br>2. C. Johnson, Numerical Solution of Partial Differential Equations by the Finite Element Method. CUP, 1990.<br>3. K.W. Morton, Lecture Notes on Finite Element Methods. Oxford University Computing Laboratory, 1991.<br>4. M. G. Larson & F. Bengzon, The Finite Element Method: Theory, Implementation and applications, Springer-Verlag, 2013. |