



Elective Courses (List A)

MAT 642 – Advanced Numerical Analysis

Course Code & Number	Course Name	Credit Hours	Lec.	Lab.	Tut.	Prerequisites
MAT 642	Advanced Numerical Analysis	4	3	1	1	MAT 613, MAT 641

Syllabus:

Finite Differences: Approximation of first and second order derivatives, one-sided finite differences, analysis of truncation error, Higher order approximation, Example of 1D and 2D Poisson equation, Treatment of complex geometries, Evolution problems, analysis of stability.

Finite Elements: Galerkin approximation, mathematical Formulation of FEM, examples of elements: P_1 elements; conforming and nonconforming elements, Convergence, Shape functions and stiffness matrix.

Computer Implementation: Applications to engineering problems.

Reference:

1. R. Leveque; *Finite Difference Methods for Ordinary and Partial Differential Equations: Steady-State and Time-Dependent Problems*; 1st Edition, SIAM, 2007. (Main Reference)
2. T. Chandrupatla and A. Belegundu; *Introduction to Finite Elements in Engineering*; 4th Edition, Pearson, 2011.
3. S. Brenner and R. Scott; *The Mathematical Theory of Finite Element Methods*; 3rd Edition, Springer; 2008.

