CE556: Computational Structural Lab (0-0-2:1)

**Course objectives:** This course is designed to provide training of writing codes on basics of Finite Element Method (FEM) and its implementation using commercial finite element software and MATLAB.

1. Bar element: Formulation of local and global stiffness matrix using linear and quadratic shape functions; Application in the field of structural mechanics (mechanical and thermal loading, etc.); Validation of the above formulation using any commercial finite element code.
2. Trusses: Formulation of stiffness matrix in local and global coordinate system using shape functions; Calculating stress and deflection; Validation of the above formulation using any commercial finite element code.
3. Beam element: Formulation of local and global stiffness matrix using shape functions; Application in the field of structural mechanics; Validation of the above formulation using any commercial finite element code.
4. Frames: Formulation of stiffness matrix in local and global coordinate system using shape functions; Application in the field of structural mechanics; Validation of the above formulation using any commercial finite element code.
5. Linear triangular elements: Formulation of stiffness matrix using constant strain triangles, Formulations of axisymmetric problems using constant strain triangles; Validation of the above formulation using any commercial finite element code.
6. Isoparametric formulations: Formulation of stiffness matrix using 4-noded quadrilaterals, hexahedral and higher order elements; Application in the field of structural mechanics; Validation of the above formulation using any commercial finite element code.
7. Dynamic considerations: Formulation of mass matrix; Evaluation of Eigen values and Eigen vectors; Application in the field of structural mechanics; Validation of the above formulation using any commercial finite element code.

**Text Books and References:**

1. Smith, I.M., Griffits, D.V., Margetts, L., “*Programming the finite element method*”, Wiley.
2. Bang, H., Kwon, Y. W., “*The Finite Element Method Using MATLAB*”, CRC Press.
3. Peter, K., “*Matlab Guide to Finite Elements: An Interactive Approach*”, Springer International.
4. Chandrupatla, T. R., Belegundu, A. D., “*Introduction to Finite Elements in Engineering*”, PHI.
5. Reddy, J. N., “*An Introduction to the Finite Element Method*”, Tata McGraw Hill, 2nd Ed,

2003.

1. Cook, R. D., Malkus, D. S., and Plesha, M. E., “*Concepts and Applications of Finite Element Analysis*”, John Wiley & Sons, 4th Ed, 2002.
2. Bathe, K. J., “*Finite Element Procedures*”, Prentice Hall of India Pvt. Ltd., 2002.