Department of Civil Engineering

Course Name:

Computer Applications in Civil Engineering

Course Number: 20-350	**Credit:** 3
Program: Undergraduate	**Course Type:** Technical elective
Prerequisite: -	**Corequisite:** -

Course Content (outline):

- Chapter 1: Approaches in solving civil engineering problems (2 Lectures)

  Simultaneous linear equations and matrices
  Advantages and limitations of numerical analyses
  Steps in solving problems with finite element method

- Chapter 2: An introduction to stiffness method

  Definition of stiffness matrix
  Stiffness matrix for spring elements
  Assembling the stiffness matrix for
  Boundary conditions
  Potential energy approach for the determination of spring stiffness matrix

- Chapter 3: Truss structures

  Stiffness matrix of a bar in local coordinates
  Transformation of vectors in two dimensions
  Global stiffness matrix of a truss structure
  Stress in a bar element
  Transformation matrix and stiffness matrix in three dimensions
  Inclined supports
  Potential energy approach for the determination of truss equations

- Chapter 4: Beams

  Stiffness matrix of a beam element
  Distributed loading
  Beam elements with internal hinge
  Potential energy approach for the determination of beam equations

- Chapter 5: Framed structures

  Beam stiffness matrix in two dimensions
  Stiffness matrix for frames
  Inclined supports

- Chapter 6: Plane stress and plane strain (4 Lectures)

  Definition of plane stress and plane strain
  Stiffness matrix and equations for 3 noded triangular element
  Body forces and distributed loadings

- Chapter 7: Practical considerations in finite element problems (2 Lectures)

  Equilibrium and compatibility

Interpretation of the results
Convergence

- Chapter 8: Constant strain triangular and axisymmetric elements (2 Lectures)

  Stiffness matrix and related equations

- Chapter 9: Thermal stresses (2 Lectures)

  Formulation of thermal problems in the finite element method

- Chapter 10: Finite difference method (4 Lectures)

  Use of Taylor series for solving differential equations
  Finite difference approach in solving civil engineering problems
  Comparison of finite element and finite difference methods

References:

- Daryl L. Logan “A First Course in the Finite Element Method”, 6th ed.