Course Name:
Computer Applications in Civil Engineering

<table>
<thead>
<tr>
<th>Course Number: 20-350</th>
<th>Credit: 3</th>
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<tbody>
<tr>
<td>Program: Undergraduate</td>
<td>Course Type: Technical elective</td>
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<tr>
<td>Prerequisite: -</td>
<td>Corequisite: -</td>
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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: