**R09**

**Code No: D2001**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**M.Tech II - Semester Examinations, March/April 2011**
**FINITE ELEMENT METHODS**
**(STRUCTURAL ENGINEERING)**

**Time: 3hours** **Max. Marks: 60**

**Answer any five questions**
**All questions carry equal marks**
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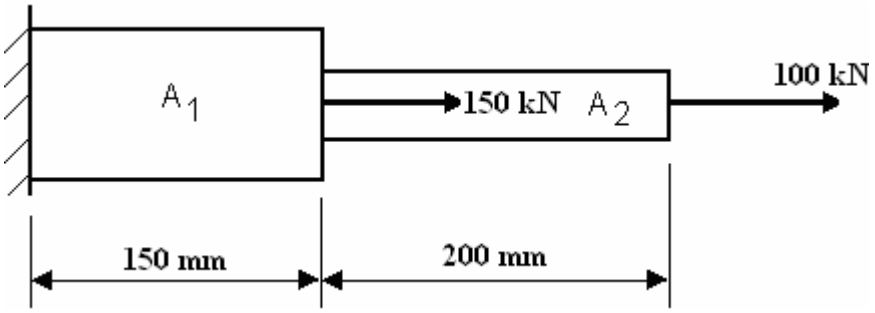
1. For a simply supported Beam of uniformly distributed load of Intensity $P_o$ per unit length and a concentrated load P at centre, Find the Transverse deflection using Raleigh-Ritz method of Functional Evaluation and compare the result with exact Analytical solution. [12]

2. a) Write a short notes on plane stress, plane strain and axi-symmetric problems.
   b) In a plane stress problem $\sigma_x$= 60 MPa, $\sigma_y$= - 35 MPa, $\tau_{xy}$ = 50 MPa, E = 200 GPa, $\mu$= 0.3.
   i) Determine strain component $\varepsilon_z$
   ii) If the problem is a case of plane strain case determine stress component $\sigma_z$.[12]

3. a) Derive the Element Stiffness Matrix for a Truss bar element oriented arbitrarily in a 2-D plane starting from fundamentals.
   b) Find the displacements, reaction forces and stresses induced in the axially loaded stepped bar shown in the Figure. Take E = 2.1 x $10^5$ N/mm$^2$. $A_1$= 50 mm$^2$ $A_2$=30 mm$^2$. [12]




4. a) The nodal coordinates of the triangular element are 1 (1,1), 2 (4,2), 3 (3,5). At the interior point P, the x coordinate is 3.5 and $N_1$ is 0.4. Determine $N_2$, $N_3$ and y coordinate at point P.
   b) Explain natural and simple natural coordinates. [12]

5. Derive the shape functions for the four noded quadrilateral isoparametric element and indicate the purpose for the computing its stiffness matrix. [12]

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6. a) List some disadvantages of using 3-D elements.
   b) Explain the procedure to determine the stiffness matrix of a tetrahedral element. [12]

7. a) Explain Mindlin's approximations for bending of plates.
   b) Imagine that each side of a rectangular box is modeled by a mesh of that shell elements. Internal pressure is applied. Along the edges where the sides intersect, What DOF can probably be set to zero, and why? [12]

8. a) State the difference between Material non-linearity and Geometric non-linearity
   b) Describe Newton – Raphson iteration technique for solving material non-linearity problems. [12]

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