Code No: **R42016** **R10** **Set No. 1**

IV B.Tech II Semester Supplementary Examinations, April - 2018

FINITE ELEMENT METHODS

(Civil Engineering)

Time : 3 hours **Max. Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

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1 A fixed beam of length ‘l’ and moment of inertia ‘I’ is subjected to uniformly distributed load over the entire span and a point load ‘P’ at the center of the span. Take young’s modulus as E. Derive the expression for its maximum deflection by using Rayleigh Ritz method [15]

2 a) Explain the term Axis symmetric problems and derive the constitutive relationships for the problems. [8]

b) The axial bar shown in the figure 2(b) below is tapered and the areas of cross section at ends are A_1 and A_2. Calculate the strain energy of the bar assuming the material obeys hooks law.

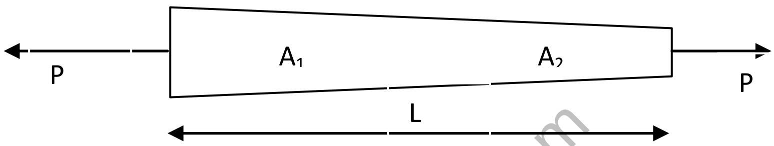

Figure 2 (b) [7]

3 a) Derive and plot the shape functions for1D linear element and 1D quadratic element. [8]

b) Determine the axial deformation of a non uniform bar, $A=A_0+A_1x$, under its own weight (*P* per unit length). Use two linear elements. The bar end is fixed at x=0. A is the cross section. [7]

4 a) Derive the stiffness matrix of the isoparametric four-noded finite element. [10]

b) Discuss convergent and compatibility requirements. [5]

5 a) Derive the shape function 4noded rectangular elements using natural co-ordinate system. [8]

b) Explain the procedure for deriving stiffness matrix for a beam element. [7]

6 a) Differentiate between Lagrangian and Serendipity elements. [7]

b) Derive the shape functions for CST element. [8]

7 a) Derive the strain-displacement matrix for an axisymmetric element. [7]

b) Explain the significance of Jacobian matrix J in finite element analysis? Write the Jocabian matrix J for an axisymmetric ring element in terms of (r, z) co-ordinates. [8]

8 An axial bar with non-uniform section shown in the figure.8. Treating this as consisting of two bars, obtain the stiffness matrix and Condense out the internal degree of freedom by Gauss elimination procedure.

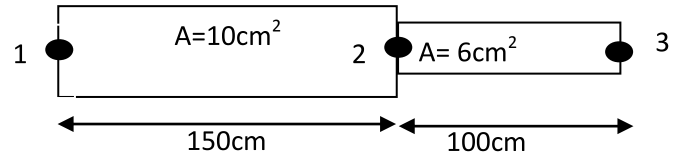

Figure.8 [15]