PVP 12

Code: **MEMD1T4**

I M.Tech - I Semester – Regular/Supplementary Examinations – January - 2017

FINITE ELEMENT METHODS
(MACHINE DESIGN)

Duration: 3 hours Max. Marks: 70

Answer any FIVE questions. All questions carry equal marks

1. Determine the deflection at the centre of a simply supported beam of span length *l* subjected to uniformly distributed load w/unit length throughout its length as shown in Figure-1 using Rayleigh-Ritz method. Take the flexural rigidity, EI is constant for the beam. 14 M

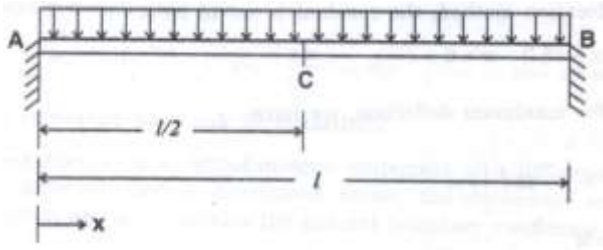
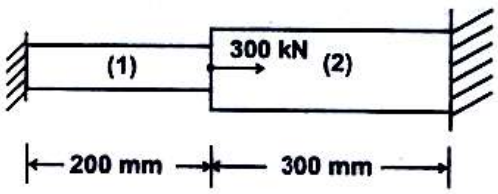


Figure-1

2. An axial load of 300 kN is applied at 20 ^{0}C to the rod as shown in Figure-2. The temperature is then raised to 60 ^{0}C. Determine:
   a) Nodal displacements 6 M
   b) Reaction forces at the support. 4 M
   c) stresses in elements 4 M



Aluminum	Steel
E_1 = 70 GPa	E_2 = 200 GPa
A_1= 900 mm^2	A_2= 1200 mm^2
α_1 =23x10^{-6} /^{0}C	α_2 =12x10^{-6} /^{0}C
L_1= 200mm	L_2= 300mm

Figure-2

3. a) Derive the stiffness matrix for the truss element. 9 M

b) Briefly discuss about the effect of temperatures on truss element. 5 M

4. A beam fixed at one end and supported by a roller at the other end, has a 20 kN concentrated load applied at the center of the span, as shown in Figure-3. Calculate the deflection under the load and support reactions. 14 M

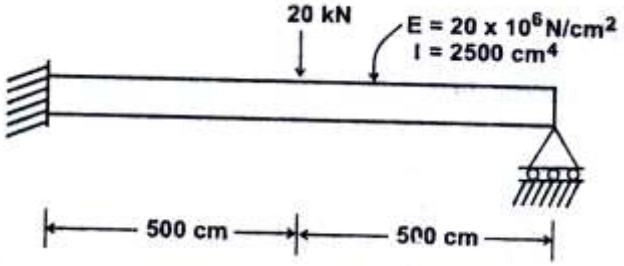


Figure-3

5. Compute the strain-displacement matrix for the element show in Figure-4. Also determine the element strains. Take

u = [0 0 2 1 0 -1]^T. All quantities are in mm. 14 M

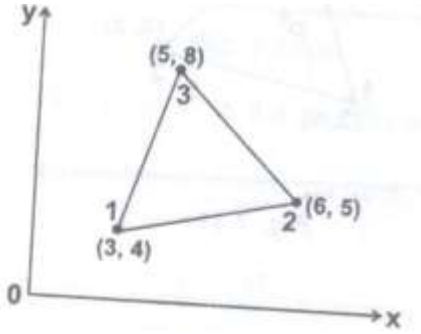


Figure-4

6. a) Evaluate the following integral using one point and two point Gauss Quadrature. Compare this with exact solution. 10 M

$$\int_{-1}^{1}[3\,e^{x} + x^{2} + \frac{1}{x+2}]\,dx$$

b) Differentiate sub-parametric and super-parametric elements. 4 M

7. Determine the Eigen values and Eigen vectors for stepped bar shown in Figure-5. Take E = 200GPa and Specific density ρ = 7000 kg/m^3 14 M

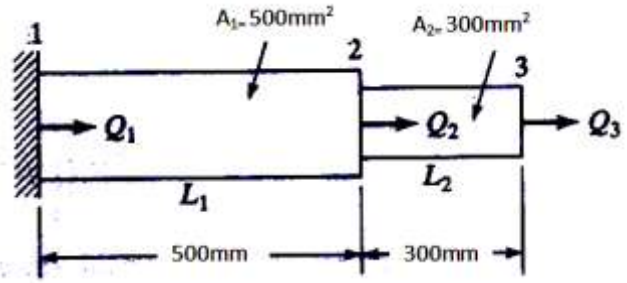


Figure-5

8. Explain the following:
    a) h-refinement and p-refinement 4 M
    b) Complete and incomplete interpolation functions. 4 M
    c) Convergence requirements 6 M