Code No: 09A60302 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B. Tech III Year II Semester Examinations, November/December-2013
FINITE ELEMENT METHODS
(Common to AE, ME)

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

Answer any five questions
All questions carry equal marks

- - -

1.a) Derive the interpolation functions at all nodes for the quadratic serendipity element.

b) Evaluate the integral by using one and two-point Gaussian quadrature and compare with exact value. [15]

$$I = \int_{-1}^{+1}\int_{-1}^{+1}(x^3 + x^2y + xy^2 + \sin 2x + \cos 2y)dx\,dy$$

2.a) Clearly explain the finite element formulation for an axisymmetric shell with an axisymmetric loading. Determine the matrix relating strains and nodal displacements for an axisymmetric triangular element.

b) Establish the Hermite shape functions for a beam element Derive the equivalent nodal point loads for a u.d.l. acting on the beam element in the transverse direction and also determine stiffness matrix. [15]

3.a) Write about different boundary considerations in beams.

b) Determine the support reactions and maximum vertical deflection for the continuous beam shown in Figure.1. [15]

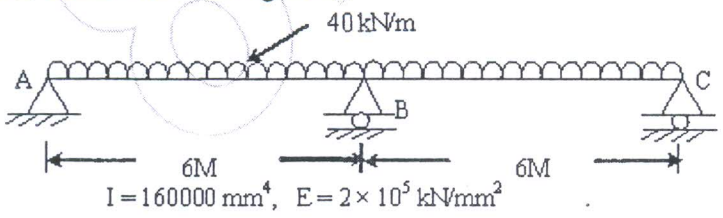

Figure.1

4.a) Discuss in detail about 2D heat conduction in Composite slabs using FEA.

b) Using the isoparametric element, find the Jacobian and inverse of Jacobian matrix for the element shown in Fig.2, 3(a) & 3(b) for the following cases.

i) Determine the coordinate of a point P in x-y coordinate system for the $\xi = 0.4$ and $\eta = 0.6$.

ii) Determine the coordinate of the Q in ξ and η system for the $x = 2.5$ and $y = 1.0$.

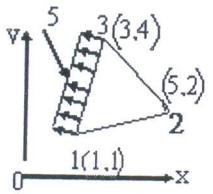

Fig. 2

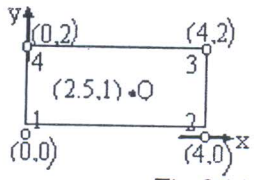

Fig. 3 (a)

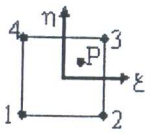

Fig. 3 (b)

Calculate the temperature distribution and the heat dissipating capacity of a fin shown in Figre.4. The thermal conductivity of the material is 200 W/m°K. The surface transfer coefficient is 0.5 W/m^{2}K. The ambient temperature is 30°C. the thickness of the fin is 1 cm. [15]

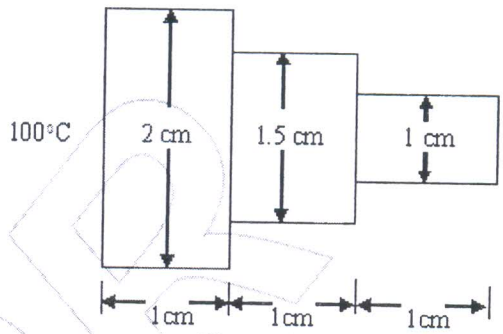

Figure.4

6.a) Write the steps involved in finite-element analysis of a typical problem.

b) Determine the nodal displacements, element stresses and support reactions for the bar as shown in Figure 5. Take E = 200 × 10^9 N/m^2. [15]

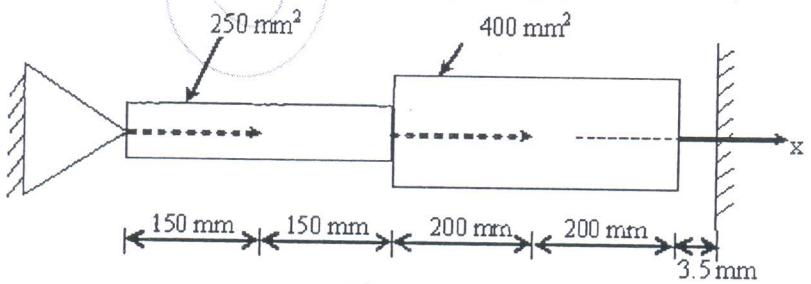

Figure.5

7.a) Derive the equilibrium equation for an elastic continuum using potential energy by displacement approach.

b) Explain the following methods used for the formulation of element characteristics and load matrices:

i) Variational approach ii) Galerkin approach. [15]