Printed Pages : 2 **Roll No.** | | | | | | | | | | | **NME012**

B. TECH.
THEORY EXAMINATION (SEM–VI) 2016-17
FINITE ELEMENT METHOD

Time : 3 Hours ***Max. Marks : 100***

Note : *Be precise in your answer. In case of numerical problem assume data wherever not provided.*

SECTION – A

1. Attempt all parts of the following question: 10 x 2 = 20

(a) What are the merits and the demerits of Finite Element Methods?

(b) Explain Gauss quadrature approach for evaluating one-dimensional and two-dimensional integrals with an example.

(c) Explain the principle of minimum potential energy?

(d) What is meant by displacement function? Define Geometric Variance.

(e) What is the difference between Finite element method and classical method?

(f) Write down the element stiffness matrix for 2D beam element.

(g) If a displacement field is described as follows:

a. $u = (-x^2+2y^2+6xy)10^{-4}$ and $v = (3x + 6y - y^2)10^{-4}$,Determine the strain components ϵ_{xx} , ϵ_{yy} , and ϵ_{xy} at the point x = 1; y = 0.

(h) With suitable examples, explain the meaning and formulations of properties of axisymmetric elements. State their applications.

(i) What is Galerkin approach and how to used in FEM analysis?

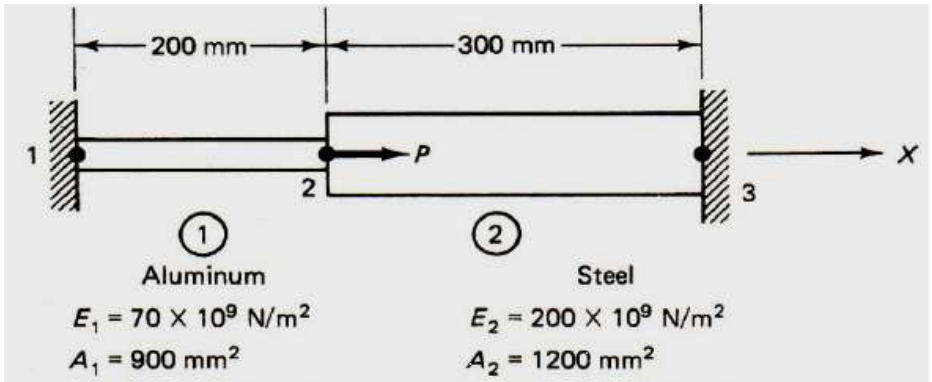
(j) Explain the features of Hermition interpolation function with an example.

SECTION – B

2. Attempt any five of the following questions: 5 x 10 = 50

(a) Explain and differentiate between the local coordinates, Global coordinates and Natural coordinates in FEM.

(b) Determine the displacements and support reactions for the uniform bar shown in Fig.1. P=300KN



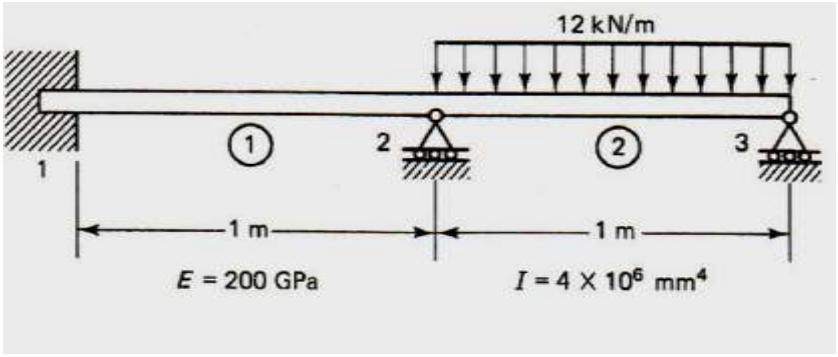
(c) A beam of length 2 m is fixed at both ends. Estimate the deflection at the center of the beam where load is acting vertically downward of 10 kN. Divide the beam into two elements. Compare the solution with theoretical calculations. Take E = 2 × 1011 N/m2, A = 250 mm2.

(d) (i) Derive the shape functions for a 4 node (corner) rectangular element using Lagrange method.

(ii) Derive the jacobian for a four noded rectangular element having coordinates (0,0), (4,0), (4,2), and (0,2).

(e) Discuss the steps involved in the finite element formulation of a physical system what are its major advantages and limitations?

(f) Determine the vertical deflection at the midpoint of the distributed load for the beam shown in Fig.



(g) (i) What are the convergence and compatibility requirements? Discuss in detail.

(ii) Differentiate conforming and non non-conforming elements.

(h) Write short notes on the following:

(i) Shape functions

(ii) One dimensional conduction with convection.

(iii) Jacobian of the transformation

(iv) Importance of Boundary conditions

SECTION – C

Attempt any two of the following questions: 2 x 15 = 30

3. (i) Derive the constant strain triangle (CST) infinite element modeling isoperimetric representation.

(ii) What is weighted residual method and give the steps of a single continuous trial function.

4. Develop the stiffness matrix and determine nodal displacement for given truss shown in Fig. Also find stresses in bar AB and BC.

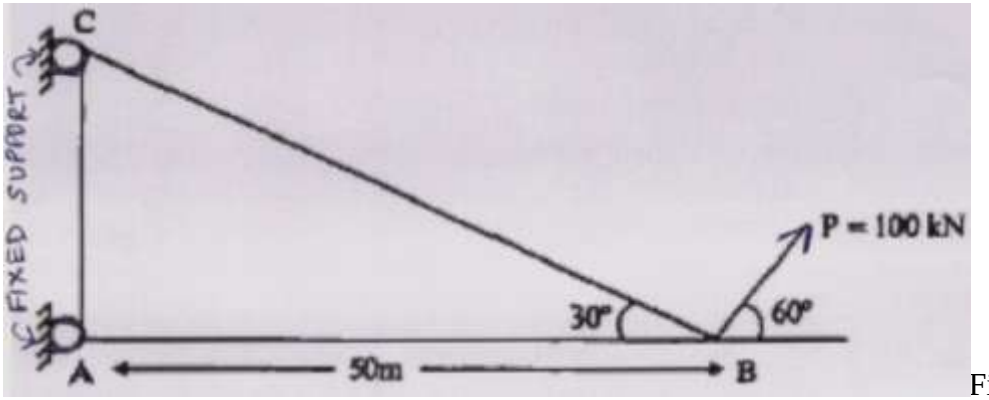


Fig- 3

Take cross section area for members as $0.2m^2$, E= 220GPa

5. (i) With a suitable example explain the formulation of finite element equations by total potential energy approach. Assume suitable data for the example. Use I-D analysis.

(ii) Derive the stress-strain relationship and strain displacement elevation.

(iii) With the help of a neat diagram, describe the various components of stress and strains.