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Sixth Semester B.E. Degree Examination, June/July 2016
Finite element method

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Missing data may suitably be assumed.***

PART – A

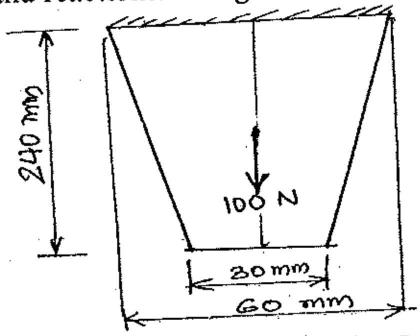
1 a. Derive the equilibrium equations of a three dimensional body subjected to a body force. **(08 Marks)**
b. Explain the general description (steps) of FEM. **(06 Marks)**
c. Briefly explain the types of elements based on geometry. **(06 Marks)**

2 a. State principle of virtual work and principle of minimum potential energy. **(04 Marks)**
b. Calculate an expression for deflection in a simply supported beam under uniformly distributed load P_0 ever entire span of length L using Rayleigh Ritz method. **(10 Marks)**
c. What are the steps involved in Galerkin's method to find out deflection? **(06 Marks)**

3 a. Explain two dimensional Pascal's triangle. **(05 Marks)**
b. Define interpolation polynomial, simplex, complex and multiplex elements and cubic element. **(05 Marks)**
c. Find the shape functions of a CST element and plot the same. **(10 Marks)**

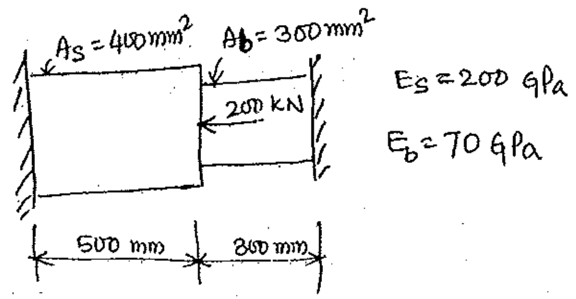
4 a. Fig Q4(a) shows a thin plate of uniform thickness of 1 mm, weight density = 76.6×10^{-6} N/mm^3 and subjected to point load of 1kN at its midpoint. Take E = 200 GPa. Evaluate nodal displacement, stresses, and reactions. Using elimination techniques. **(10 Marks)**

Fig Q4(a)



b. Find the nodal displacement, stresses and reactions of a Fig. Q4(b). Using penalty approach method. **(10 Marks)**

Fig Q4(b)



PART – B

5 a. Obtain the shape functions of quadratic bar element. **(10 Marks)**

b. Use two point Gauss quadrature to evaluate the integral $I = \int_0^3 (2^\xi - \xi)d\xi$. **(10 Marks)**

6 a. Derive an expression for stiffness matrix of a 2 noded truss element. **(10 Marks)**

b. Determine the nodal displacements in the truss segments subjected to concentrated load as shown in Fig Q6 (b). Take E = 70GPa A = 0.01 m^2. **(10 Marks)**

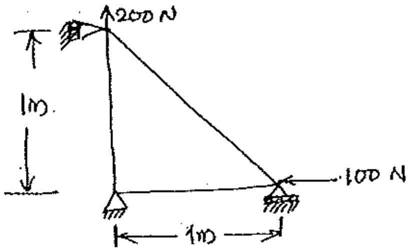
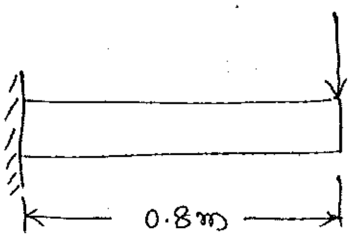


Fig Q6(b)

7 a. Obtain Hermite shape functions of a beam element. **(10 Marks)**

b. Find the deflection at the tip and the support reaction of a cantilever shown in Fig. 7(b).



F = 250kN
E = 200GPa
E = 4×10^6 mm^4

Fig. Q7(b)

(10 Marks)

8 a. Obtain the governing equation of a one dimension heat conduction. **(10 Marks)**

b. Calculate the temperature distribution in a one dimensional fin with the physical properties shown in Fig 8(b). There is a uniform generation of heat inside the wall of $\overline{Q} = 400$ W/m^3.

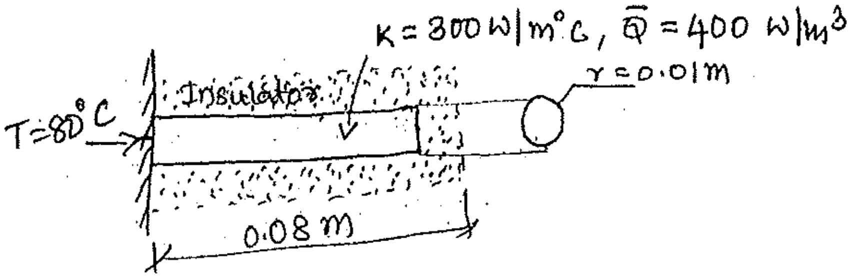


Fig. Q8(b)

(10 Marks)

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