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10ME64

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

Time: 3 hrs.

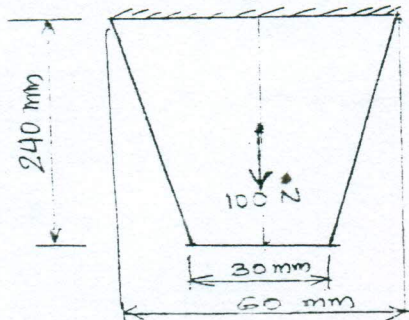
Max. Marks: 100

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

PART - A

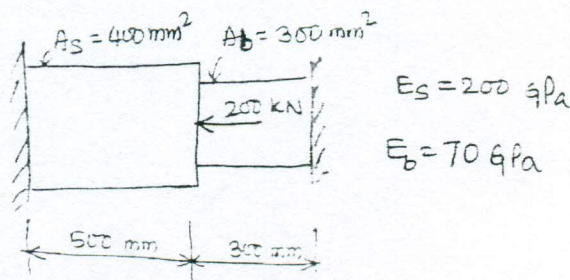
1. a. Derive the equilibrium equations of a three dimensional body subjected to a body force. (08 Marks)
 b. Explain the general description (steps) of FEM. (06 Marks)
 c. Briefly explain the types of elements based on geometry. (06 Marks)
2. a. State principle of virtual work and principle of minimum potential energy. (04 Marks)
 b. Calculate an expression for deflection in a simply supported beam under uniformly distributed load P_0 over 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/mm³ 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)



Important Note : 1. On completing your answers, carefully draw diagonal cross lines on the remaining blank spaces.
 2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42+8 = 50, will be treated as malpractice.



PART - B

- 5 a. Obtain the shape functions of quadratic bar element. (10 Marks)
- b. Use two point Gauss quadrature to evaluate the integral $I = \int_{-1}^1 (2\xi^2 - \xi) d\xi$. (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 $E = 70\text{GPa}$, $A = 0.01\text{m}^2$. (10 Marks)

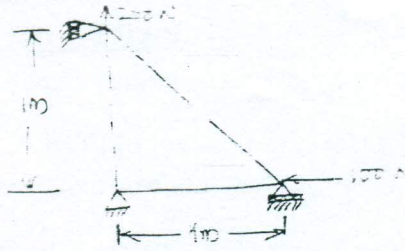


Fig Q6(b)

- 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). (10 Marks)

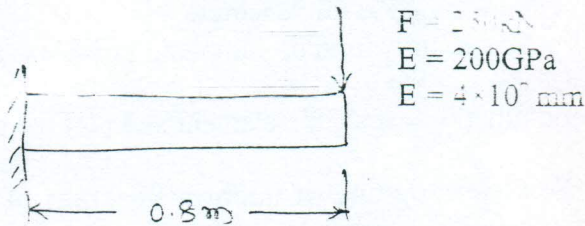


Fig. Q7(b)

- 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 $\bar{Q} = 400\text{W/m}^3$. (10 Marks)

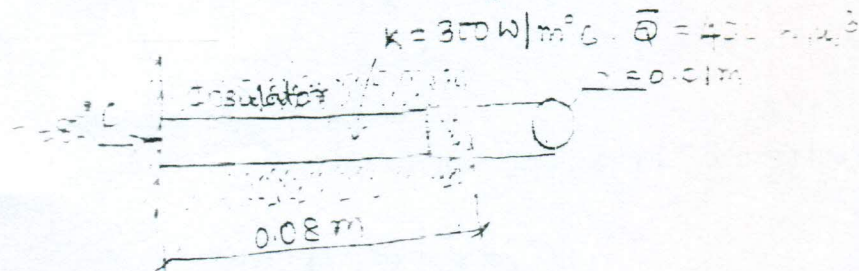


Fig Q8(b)
