Total No. of Questions : 12]

SEAT No. :

P1062

[Total No. of Pages : 4

[4659]-58

B.E. (Mechanical - Sandwhich)

c -FINITE ELEMENT METHOD

(2008 Course) (Elective - II) (Semester - I) (402063)

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

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate answer books.***
2) ***Answer any three questions from each section.***
3) ***Neat diagrams must be drawn wherever necessary***
4) ***Figures to the right side indicate full marks.***
5) ***Use of calculator is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION-I

Q1) a) Explain in details difference between Finite Element Method and Finite Difference Method. **[8]**

b) Explain following terms (any two): **[8]**

i) Penalty approach

ii) Rayleigh-Ritz Method

iii) Von-Mises stress

OR

Q2) a) Explain the principal of Minimum potential energy used in deriving element stiffness matrix and equations. **[8]**

b) Write short note on (any two): **[8]**

i) Stress-strain-temperature relations

ii) Plain stress and plain strain problem

iii) Elimination approach

Q3) a) Discuss characteristics of Global Stiffness Matrix. **[6]**

b) An axial load P = 200 kN is applied as shown in fig. Using penalty approach for handling boundary conditions, determine: **[12]**

i) Nodal displacements

ii) Stresses in each element

iii) Reaction forces

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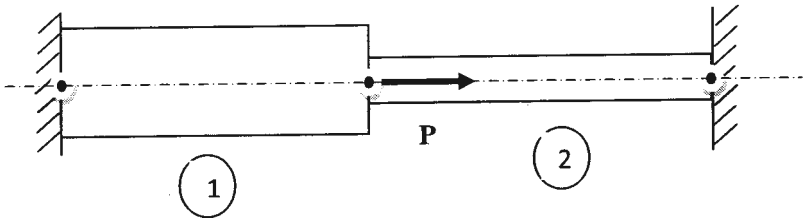
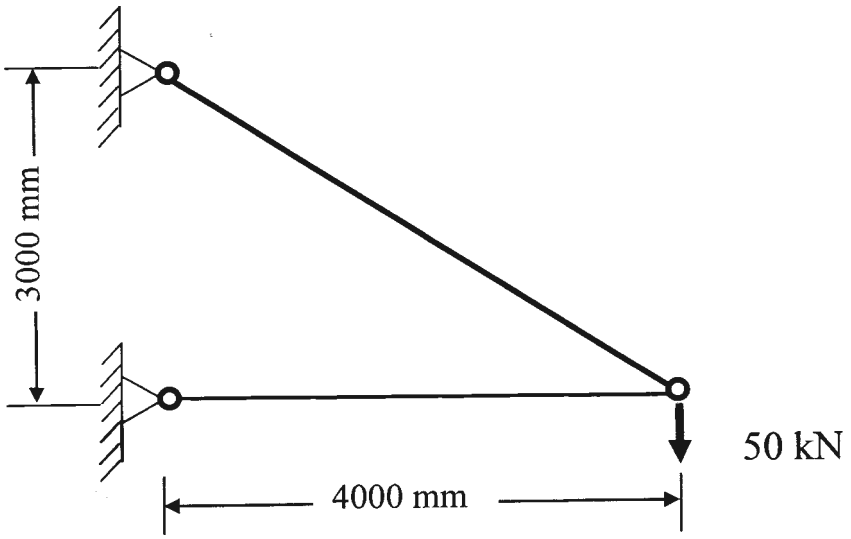


OR

Q4) a) Describe in details the concept of Cholesky's decomposition, the banded skyline solutions to solve simultaneous equations. **[6]**

b) A two member truss is as shown in fig. the cross sectional area of each member is 200 mm^2 and modulus of elasticity is 210 GPa. Determine the deflection, reactions and stresses in each of the members. **[12]**



Q5) a) Explain the concept of Plane Stress and Plane Strain in Finite Element Method. **[8]**

b) Discuss the problem Modeling and Boundary Conditions for the following cases: **[8]**

i) A cylinder of infinite length subjected to external pressure.

ii) Belleville spring.

OR

Q6) a) Explain the term Quadratic Strain Triangles (QST). **[6]**

b) A CST element is defined by nodes at I (30, 40), J (140, 70), and K (80, 140) and the displacements at these nodes are (0.1, 0.5), (0.6, 0.5) and (0.4, 0.3) respectively. Determine the displacement the natural coordinates and the shape function at point P (77, 96) within the element. **[10]**

SECTION-II

Q7) a) Derive an equation of potential energy for individual beam element. **[6]**

b) A beam of length 10 m, fixed at one end and supported by a roller at the other end carries a 20kN concentrated load at the centre of the span. By taking the modulus of elasticity of material as 200 GPa and moment of inertia as 24 x 10^{-6} m^4, determine: **[10]**

i) Deflection under load

ii) Shear force and bending moment at mid span

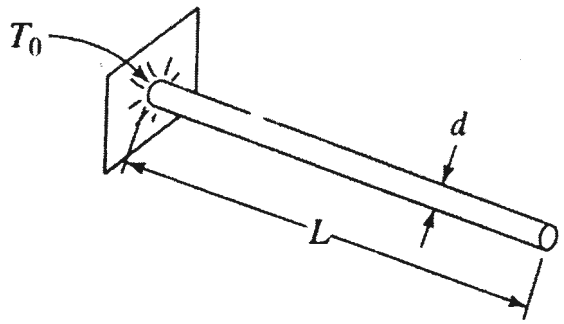
iii) Reactions at supports

OR

Q8) a) Derive stiffness matrix for beam element. **[6]**

b) The beam of 4.5 m length is fixed at each end. A downward force of 12 kN and moment of 10 kN - m (ccw) act at the center of the beam. Let E = 200 GPa and I = 4 x 10^{-4} m^4 throughout the beam. Determine the displacement and rotation under applied loads. **[10]**

Q9) A circular fin of 40 mm diameter (d) is fixed to a base maintained at 50 °C (T_o) as shown in fig. the film is insulated on the surface except end face which is exposed to air at 25 °C. The length of the pin is 1000 mm (L), the fin is made of metal with thermal conductivity of 37 W/mK. If the convection heat coefficient with air is 15 W/m^2K. Find the temperature distribution at 250, 500, 750 and 1000 mm from base. **[16]**



OR

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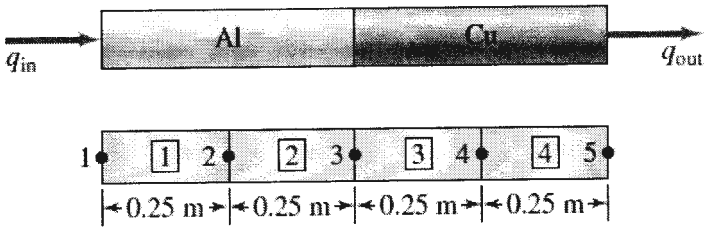
Q10)a) Write short note on one dimensional heat conduction analysis. **[6]**

b) The circular rod depicted in Figure 4 has an outside diameter of 60 mm, length of 1 m, and is perfectly insulated on its circumference. The left half of the cylinder is aluminum, for which kx = 200 W/m-^{o}C and the right half is copper having kx = 389 W/m-^{o}C. The extreme right end of the cylinder is maintained at a temperature of 80^{o}C, while the left end is subjected to a heat input rate 4000 W/m^{2}. Using four equal-length elements, determine the steady-state temperature distribution in the cylinder. **[10]**



Q11)a) Explain the different types of non-linearity encountered in structural analysis. **[6]**

b) Explain the necessity of crash analysis? What are its advantages and disadvantages. **[6]**

c) Differentiate between static and dynamic analysis. **[6]**

OR

Q12)Write short notes on (any three): **[18]**

a) FEA packages

b) NVH analysis

c) Pre and post processors

d) Quality checks in meshing

e) Model analysis

EEE

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