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Question Paper Code: 37702

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018

Seventh Semester

Mechanical Engineering

01UME702 - FINITE ELEMENT ANALYSIS

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. What is meant by discretization of domain?
2. Distinguish between local and global coordinate system.
3. How do you calculate the size of the global stiffness matrix?
4. List the properties of shape function.
5. What meant by plane stress analysis?
6. Give the salient feature of isoparametric element.
7. What is meant by path line?
8. What is the difference between lumped mass and consistent mass?
9. Mention two natural boundary conditions as applied to thermal problems.
10. Define heat transfer.

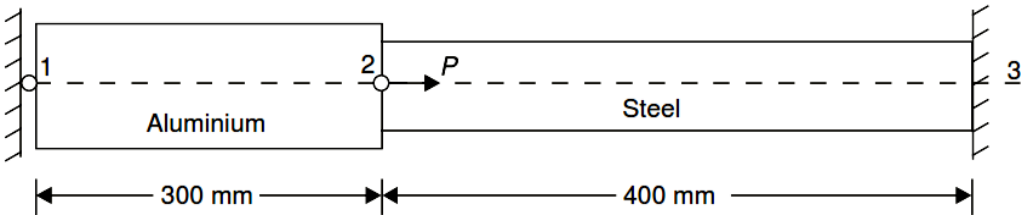
PART - B (5 x 16 = 80 Marks)

11. (a) The differential equation of the physical phenomenon is given by $d^2y/dx^2 + 500x^2 = 0;\ 0 \le x \le 1$, by using the trail function, $y = a_1(x - x^3) + a_2(x - x^5)$ solve using weighted residual methods. (16)

Or

(b) A simply supported beam is subjected to uniformly distributed load over entire span and it is subjected to a point load at the center of the span. Calculate the deflection at midspan by using RayleighRitz method. (16)

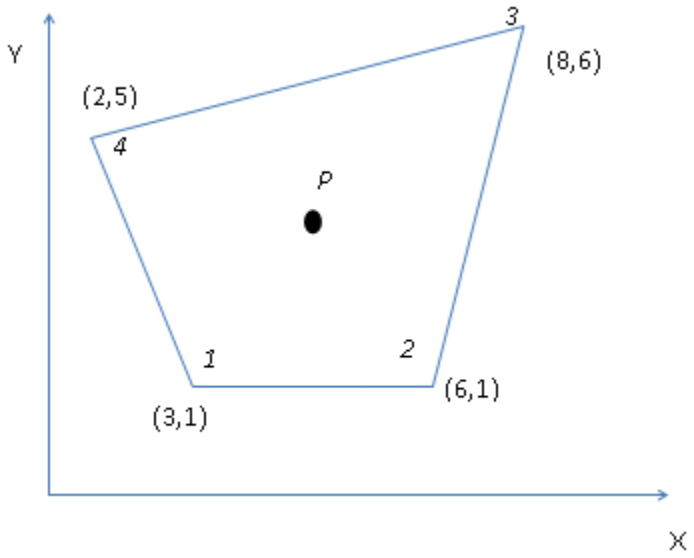
12. (a) Determine the nodal displacement at node 2, stresses in each material and support reactions in the bar as shown in figure. Due to the applied force of 400 *KN* and temperature rise of 30°*C*. Take $A_1 = 2400\ mm^2$, $A_2 = 1200\ mm^2$, $E_1 = 0.7 \times 10^5\ N/mm^2$, $E_2 = 2 \times 10^5\ N/mm^2$, $\alpha_1 = 22 \times 10^{-6}°\ C$ and $\alpha_2 = 12 \times 10^{-6}°\ C$. (16)



Or

(b) Using two finite elements, find the stress distribution in a uniformly tapering cross – sectional area 3 cm^2 and 2 cm^2 at their ends, length 100mm subjected to an axial tensile load of 50 N at smaller end and fixed at larger end. Take the value of young's modulus $2\times10^5 N/mm^2$. (16)

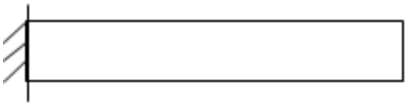
13. (a) For the isoperametric quadrilateral element shown in fig. Determine the local coordinates of the point p which has Cartesian coordinates(7, 4). (16)



Or

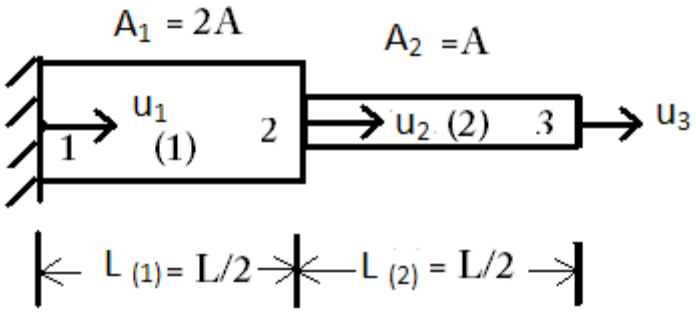
(b) Derive the shape function and stiffness matrix for a CST element in general coordinate system under plane strain condition. (16)

14. (a) For the one dimensional bar as shown in figure, determine the natural frequencies of longitudinal vibration using two elements of equal length. Take A = 600 mm^2, $E = 2 \times 10^5\ N/mm^2$, $\rho = 0.8 \times 10^{-4}\ N/mm^3$ and L = 400 mm. (16)



Or

(b) Identify the natural frequencies of longitudinal vibration of the constrained stepped bar shown in fig.6 Also find the mode shapes.



(16)

15. (a) Describe the major applications of MRP II software. (16)

Or

(b) A furnace wall is made up of three layers inside with K = 8.5 *W/mK*, middle layer with K = 0.25 *W/mK*, outer layer with K = 0.08 *W/mK*. The respective thickness of the inner, middle and outer layers is 25 *cm*, 5 *cm* and 3*cm* respectively. Inside temperature is 600° *C*, outside temperature of the wall is exposed to air of 30° *C* with h = 45 W/m^2K. Determine the nodal temperature. (16)

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