Reg. No. : | | | | | | | | | | |

Question Paper Code: 31772

B.E. / B.Tech. DEGREE EXAMINATION, JAN 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)

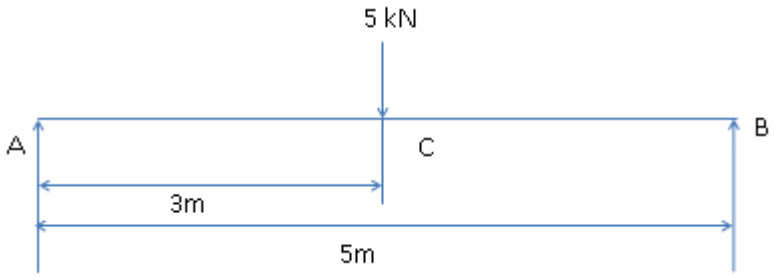
1. What is Rayleigh Ritz method?
2. Distinguish between local and global coordinate system.
3. How do you calculate the size of the global stiffness matrix?
4. List the properties of shape function.
5. What meant by plane stress analysis?
6. Give the salient feature of isoparametric element.
7. What is meant by path line?
8. What is the difference between lumped mass and consistent mass?
9. What is scalar variable problem?
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)

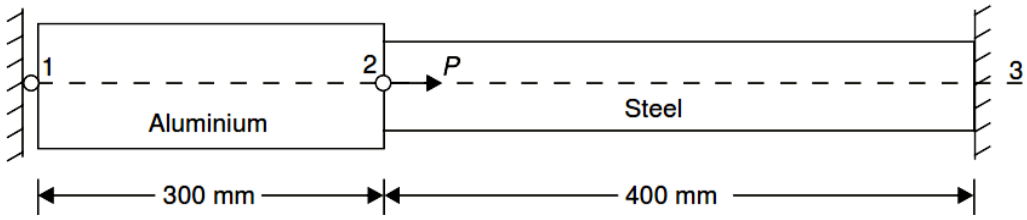
Or

(b) Determine the deflection under the point load of a simply supported beam of length 5m which is carrying a point load of 5KN acting 3m from the left end. Take E=2×10^5N/mm^2.and I=$1\times10^8 mm^4$use Rayleigh-Ritz method and compare with exact.



(16)

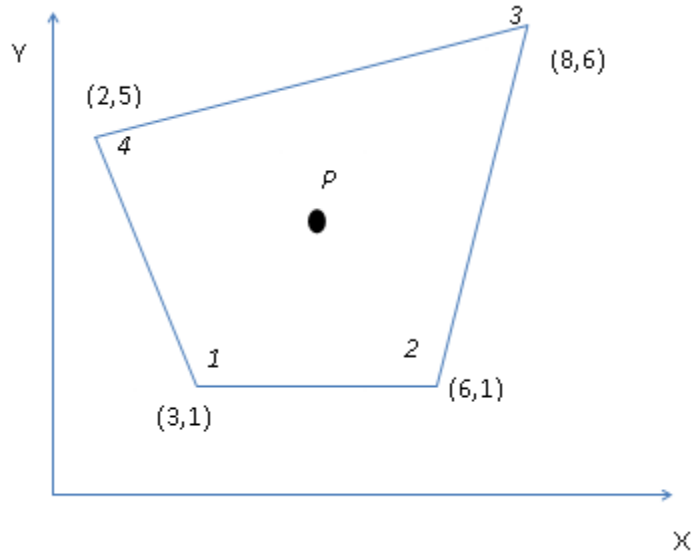
12. (a) Determine the nodal displacement at node 2, stresses in each material and support reactions in the bar as shown in figure. Due to the applied force of 400 *KN* and temperature rise of 30°*C*. Take $A_1 = 2400\ mm^2$, $A_2 = 1200\ mm^2$, $E_1 = 0.7 \times 10^5\ N/mm^2$, $E_2 = 2 \times 10^5\ N/mm^2$,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



Or

(b) Using two finite elements, find the stress distribution in a uniformly tapering cross – sectional area 3 $cm^2$and 2 cm^2at 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 2×10^5N/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)



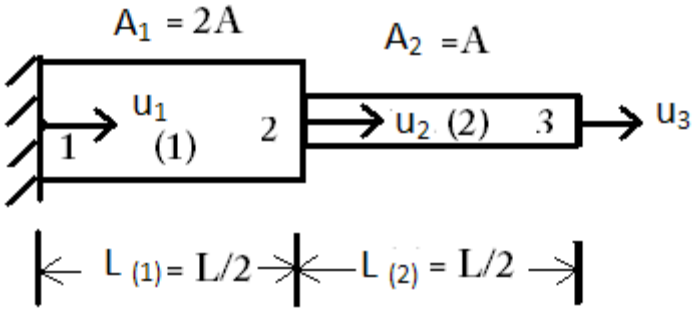
Or

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

14. (a) Obtain the natural frequencies of vibration for a stepped steel bar of area 625 mm^2 for a length 250mm and 312.5 mm^2 for a length of 125 mm. The element is fixed at the larger end. (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)