



## Finite Element Analysis (1040 / 1010)

P. Pages : 3

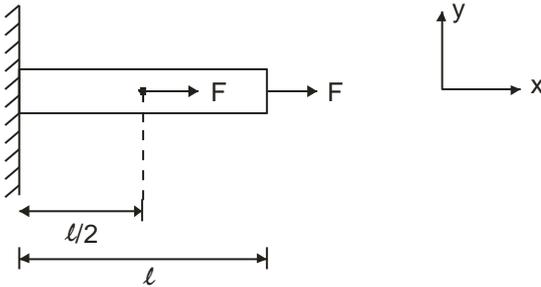
Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Answer **any five** questions.
5. Use of non programmable calculator is allowed.
6. Assume suitable data if necessary.

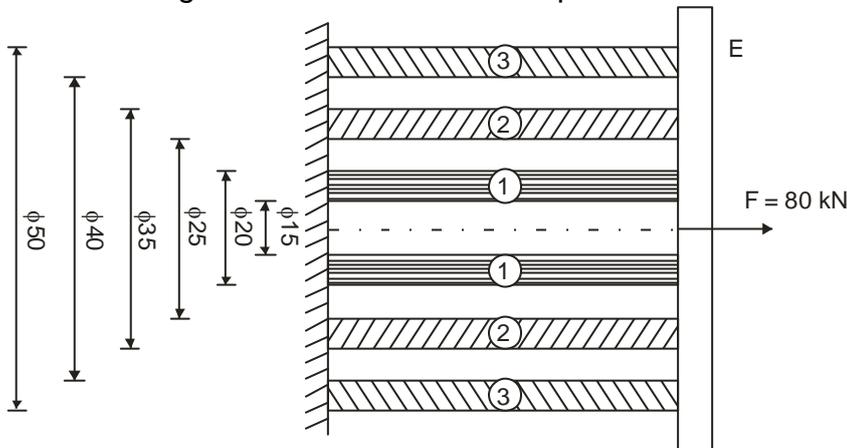
1. a) A steel rod of 20 mm diameter and 30 mm length as shown in figure B subjected to two equal forces of magnitude of 20 kN at the midpoint and end. The modulus of elasticity for steel is 207000N/mm<sup>2</sup>. Using the Rayleigh – Ritz method determine – 14
- i) the approximate displacement function.
  - ii) the approximate strain function
  - iii) the approximate stress function



- b) Explain the relationship between local and natural coordinates system for two noded spar element. 6
2. a) For the differential equation governing the displacement 12
- $$u: \left( \frac{d^2 u}{dx^2} \right) + u = 1$$
- obtain the approximate displacement function using Galerkin method, for boundary conditions  $u(0) = 1$  and  $u(1) = 0$

b) Explain different types of elements used in discretization process along with sketch, no. of nodes, Dof per node and applications. 8

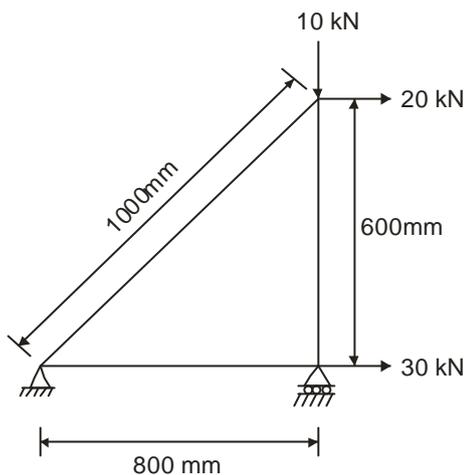
3. a) The concentric rings of different materials are joined together as shown in figure. Determine the displacement at the free ends : 10



b) Explain "Finite Element Analysis as an integral part of Computer Aided Design". 10

4. a) The three bar truss made of steel ( $E = 200 \times 10^3 \text{ N/mm}^2$ ) is subjected to horizontal forces of 30 kN and 20 kN and vertical force of 10 kN as shown in figure. The cross sectional area is  $300 \text{ mm}^2$  for each element. Using the finite element method, determine – 14

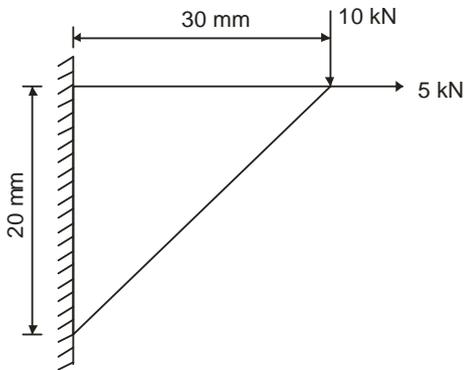
- i) the nodal displacements
- ii) the stresses in each element
- iii) the reaction force at the supports.



b) Write short notes on : 6

- i) Preprocessing
- ii) Processing
- iii) Post processing.

5. a) A two dimensional loaded plate as shown in figure. Determine the displacements of nodes 1 and 2 using plane stress condition by considering it as a single element, Ignore body force. Also determine the reaction forces and the stresses in the element. Assume thickness as 10 mm,  $E = 70 \text{ GPa}$  and  $\mu = 0.3$  20



6. a) 10

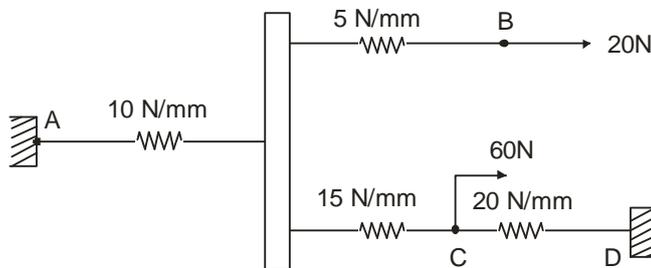
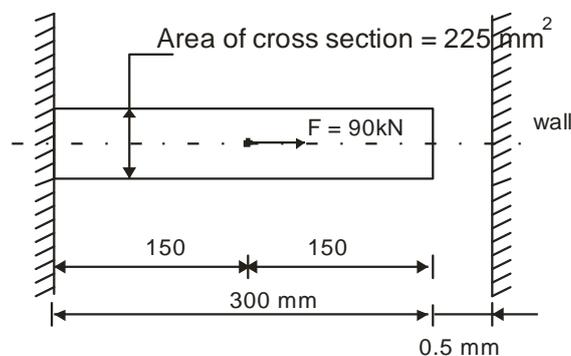


Figure shows a cluster of four springs. The assembly is fixed at the points A and D while the forces of 20N and 60N are applied at points B and C respectively using the finite element method determine –

- i) the deflection of each spring. ii) the reaction force at supports.
- b) Explain mesh generation and impositioning in finite element analysis. 10
7. a) For the loading system as shown in figure, determine the displacement, stresses and support reaction. Assume modulus of elasticity as  $80 \times 10^3 \text{ N/mm}^2$ . 20



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