Code: 9A03703 **R09**

B.Tech IV Year I Semester (R09) Supplementary Examinations June 2016

FINITE ELEMENT METHODS

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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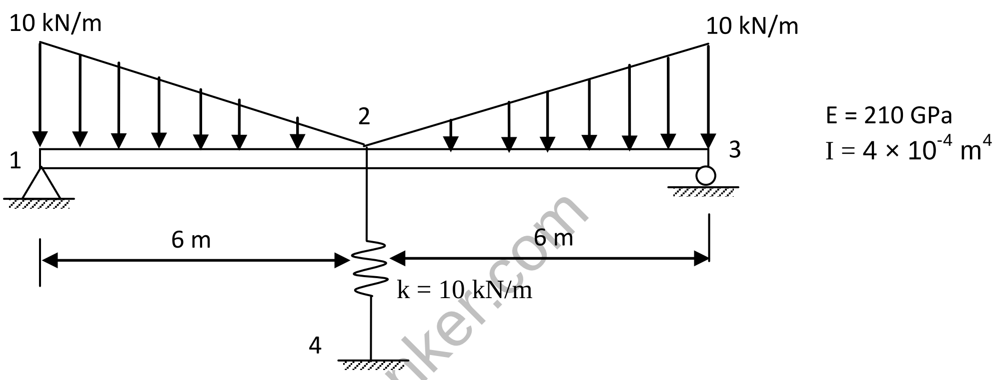
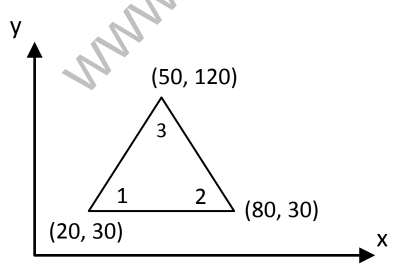
1 Explain the general consideration in FEM while discretization of structures.

2 Derive the stiffness matrix for a quadratic spar element.

3 For the beam shown in figure below, determine the nodal displacements and slopes.



4 For the plane stress element shown in the figure below, the nodal displacements are given as: u_1 = 2 mm, v_1 = 1 mm; u_2 = 0.5 mm, v_2 = 0.25 mm and u_3 = 3 mm, v_3 = 1 mm, The coordinates are given in units of mm. Assume plane stress conditions. Let E = 210 GPa, υ = 0.3 and thickness (t) = 10 mm. determine elements stresses. All dimensions are in mm.



5 Derive the shape functions for a LST element.

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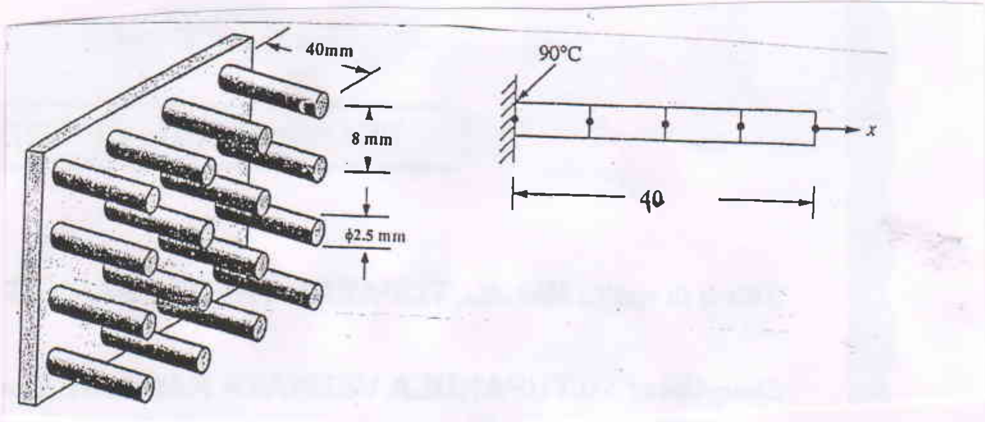
6 A hot surface is cooled by attaching fins to it, as shown in figure below. The surface of the plate (left end of the fin) in 90°C. The fins are 40 mm long and 2.5 mm in diameter. The fins are made of copper (k = 400 W/m^2 °C). The temperature of the surrounding air is $T_\infty = 25°C$ with heat transfer coefficient on the surface (including the end surface) of 30 W/m^2 °C. A model of the typical fin is also shown in figure. Use four elements in your finite element model to determine the temperature along the fin length.



7 Derive the stiffness matrix for one dimensional fluid flow element.

8 Determine the natural frequency and mode shape of transverse vibration of a cantilever beam of length 100 mm with the cross section of 7.5 mm × 2.5 mm. Take young's modulus as 200 GPa and density as 7800 kg/m^3. Model using one element.

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