CBCS SCHEME

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14PHDCV002

Ph.D./M.Sc. (Engg.) by Research Degree Examination, April 2018
Structural Engineering

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions.***
2. ***Use of IS codes are permitted.***

1 a. What is aerated concretes and what are the several ways of manufacture of aerated concrete? **(10 Marks)**

b. Explain the complexities involved in making SCC. **(10 Marks)**

2 A beam of rectangular section in a multistorey frame is 250 mm wide by 500 mm deep. The section is subjected to a ultimate bending moment of 55 kN-m, ultimate torsional moment 30 kN-m and ultimate shear force of 40 kN. Use M20 grade concret and Fe415 steel. Design suitable reinforcements in the section. Effective cover to steel is 50 mm. **(20 Marks)**

3 A prestressed concrete beam having a cross-section as shown in Fig.Q3 carries a uniform load of 12 kN/m due to its own weight at the initial stage over a span of 16 m. Determine the prestressing force and its eccentricity to produce net stresses equal to 0 and -12 N/mm^2 at top and bottom fiber respectively.

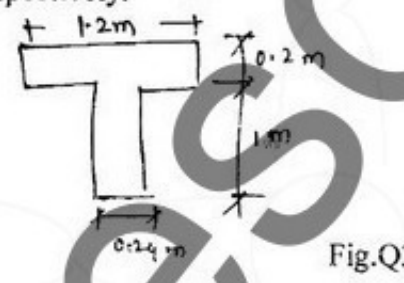

Fig.Q3 **(20 Marks)**

4 a. The principal stresses at a point in a stressed material are $\sigma_x = 200$ N/mm^2, $\sigma_y = 150$ N/mm^2, $\sigma_z = 120$ N/mm^2. Taking E = 210 kN/mm^2 and $\mu = 0.3$, what is the volumetric strain? **(08 Marks)**

b. The stress tensor at a point is given as

$$\begin{bmatrix} \sigma_x & \tau_{xy} & \tau_{xz} \\ \tau_{yx} & \sigma_y & \tau_{yz} \\ \tau_{zx} & \tau_{zy} & \sigma_z \end{bmatrix} = \begin{bmatrix} 200 & 160 & -120 \\ 166 & -240 & 100 \\ -120 & 100 & 160 \end{bmatrix} \text{ kN/m}^2$$

Determine the strain tensor at this point. Take, E = 210 × 10^6 kN/m^2 and $\mu = 0.3$. **(12 Marks)**

5 A three storey shear type structure subjected to the earthquake excitation. The weight on each storey of the structure from top to bottom is $W_1 = W_2 = W_3 = 9800$ kN. The stiffness of each storey is $K_1 = 3K$, $K_2 = 5K$ and $K_3 = 6K$ where K = 200 kN/cm and $h_1 = h_2 = h_3 = 3$m. Determine the natural frequency and mode shapes. **(20 Marks)**

6 Find the natural frequency for the truss system as shown in Fig.Q6. Use lumped mass.

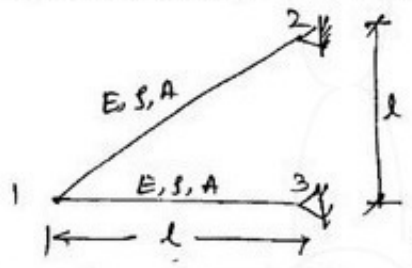

Fig.Q6 **(20 Marks)**

7 In the pin-jointed truss shown in Fig.Q7, all the bars are colled up to 30°C. Assume AE for all the members as constant is 100 (10^3) kN and $\alpha = 12(10^{-6})$/°C member lengths, AB = 6m, AC = 3m and AD = 5m. Using force-displacement, determine the member forces.

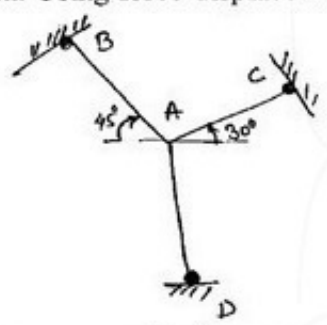

Fig.Q7 **(20 Marks)**

8 ACST element as shown in Fig.Q8 gets axial loading of $(Fx_1) = 10$ kN/m in x-direction and $(Fy_1) = 20$ kN/m in y-direction. Computer the nodal loads in the element.

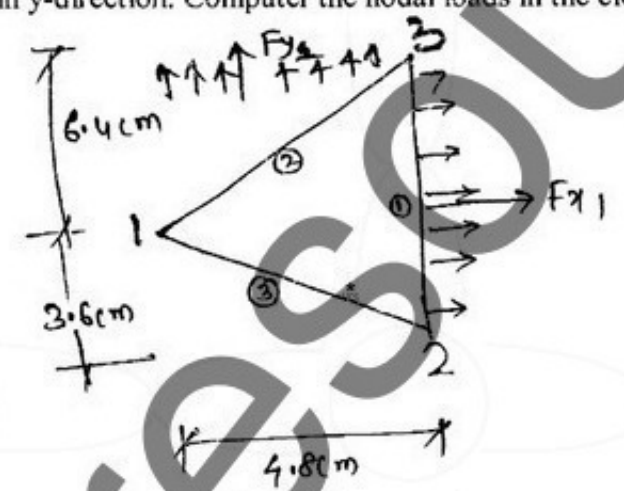

Fig.Q8 **(20 Marks)**

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