P P SAVANI UNIVERSITY

Second Semester of B. Tech. Examination

May 2019

SECV1070 Solid Mechanics

18.05.2019, Saturday **Time: 12:30 p.m. To 3:00 p.m.** **Maximum Marks: 60**

Instructions:

1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator is allowed.

SECTION – I

Q - 1 Answer the following (Any Four) **[04]**

(i) The ratio of lateral strain to longitudinal strain is called_____.

(ii) Define the term: Moment of inertia.

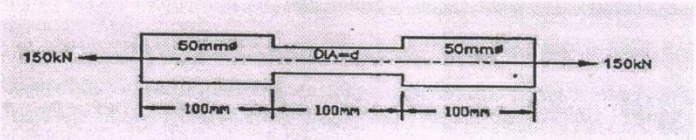
(iii) What is the difference between hardness and strength?

(iv) Define Modulus of rigidity.

(v) Define stress and express its unit.

(vi) A square steel rod having 6m length, after applying the tensile load length increase by 0.05mm and modulus of elasticity is 2.14 X 10^8 kN/m² then what will be the stress?

Q - 2 (a) For a bar shown in below fig. find the diameter of the middle portion, if the stress at that location is to be limited to 140 N/mm². Also find the total change in the length of bar. **[06]**
E = 2 x 10^5 N/mm².



Q - 2 (b) Explain stress-strain curve for ductile material. **[05]**

OR

Q - 2 (a) A gun metal rod 20mm diameter, screwed at the ends, passes through a steel tube 25 mm and 30 mm internal and external diameters. The nuts on the rod are screwed tightly on the ends of the tube. Find the intensity of stress in each metal, when the common temperature rises by 200°F. Take **[06]**
$\alpha_s = 6 * 10^{-6}/°F, \alpha_g = 10 * 10^{-6}/°F, E_s = 200\ GPa, E_g = 100GPa$

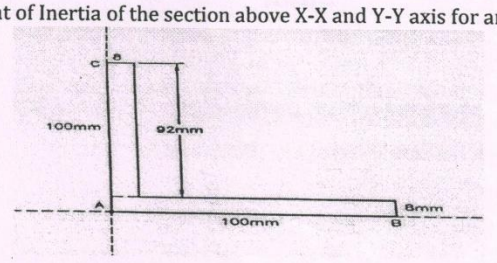
Q - 2 (b) Develop an equation for total extension of uniformly tapering circular rod. **[05]**

Q - 3 Derive relationship between modulus of elasticity and modulus of rigidity. **[07]**

OR

Q - 3 Derive expression for Young's modulus in terms of bulk modulus and Poisson's ratio. **[07]**

Q - 4 Determine Moment of Inertia of the section above X-X and Y-Y axis for any one section shown in fig. **[08]**



SECTION – II

Q - 1 Answer the following. (Any Five) **[05]**

List out the different types of beam as per the support condition.
Define the term Major principal stress.
Define principal planes.
Draw the sketch of simple supported beam with uniformly varying load.
List out the different types of load.
Draw the sketch of shear force and bending moment diagrams for a cantilever with a point load at the free end.
Define normal and tangential stresses.

Q - 2 (a) A cantilever of length 2.0 m carries a uniformly distributed load of 1 kN/m run over a length of 1.5 m from the free end. Draw the shear force and bending moment diagrams for the cantilever. **[08]**

Q - 2 (b) The tensile stresses at a point across two mutually perpendicular planes are 120 N/mm² and 60 N/mm². Determine the normal, tangential and resultant stresses on a plane inclined at 30° to the axis of the minor stress by Graphical method. **[07]**

OR

Q - 2 (a) A cantilever of length 4 m carries a gradually varying load, zero at the free end to 2 kN/m at the fixed end. Draw the S.F. and B.M. diagram for the cantilever. **[08]**

Q - 2 (b) At a point in a strained material the principal tensile stresses across two perpendicular planes, are 80 N/mm² and 40 N/mm². Determine normal stress, shear stress and the resultant stress on a plane inclined at 20° with the major principal plane. Determine also the obliquity. **[07]**

Q - 3 A simply supported beam of length 6m, carries point load of 3 kN and6 kN at distance of 2 m and 4m from the left end. Draw the shear force and bending moment diagrams for the beam. **[10]**

OR

Q - 3 A simply supported beam of length 5 m carries a uniformly increasing load of 800 N/m run at one end to 1600 N/m run at the other end. Draw the S.F. and B.M. diagrams for the beam. Also calculate the position and magnitude of maximum bending moment. **[10]**

Use Appropriate Equations

• Simple Stress & Strain $\delta l = \frac{Pl}{AE}$ • For Circular Tapering section $\delta l = \frac{4Pl}{\pi E d_2 d_1}$ $\frac{\sigma_1}{E_2} = \frac{\sigma_2}{E_1}$ • K=mE/3(m-2)	• Change in volume: $\frac{\delta v}{v} = \frac{P}{btE}\left(1 - \frac{2}{m}\right)$ • $(\alpha_1 . T \pm \frac{\sigma_1}{E_1} = \alpha_2 . T \pm \frac{\sigma_2}{E_2})$	• $\sigma_n = \frac{\sigma_x + \sigma_y}{2} - \frac{\sigma_x - \sigma_y}{2} * \cos 2\theta - \tau_{xy} \sin 2\theta$ • $\tau = \frac{\sigma_x - \sigma_y}{2} * \sin 2\theta - \tau_{xy} \cos 2\theta$ • $\sigma_r = \sqrt{{\sigma_n}^2 + \tau^2}$

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