P P SAVANI UNIVERSITY

Third Semester of B. Tech. Examination

December 2018

SECV2011 STRENGTH OF MATERIAL

18.05.2019, Saturday **Time: 09:00 a.m. To 11:30 a.m.** **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 (a) Attempt the following (Any five)

i. Enlist the various types of stresses produced in the material. **[05]**

ii. Define modulus of rigidity.

iii. Define stress and express the unit of it.

iv. The ratio of lateral strain to longitudinal strain is called_____.

v. Define Ductility.

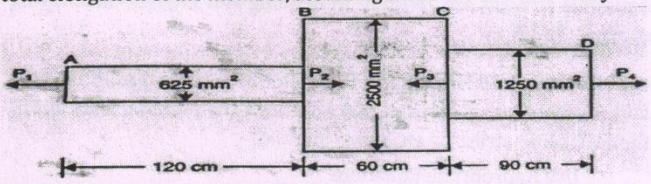
vi. A rod 5m long and of diameter 3.0 cm is subjected to an axial pull of 40kN. If modulus of elasticity of material of rod is 2×10^5 N/mm², determine the Stress.

Q - 2 (a) An M.S bar having 1 m length and hallow circular section with internal diameter 0.75 of external diameter. Axial compressive load acting on it is 100 KN. If ultimate compressive stress is 300 N/mm² and E = 200 GPa, determine external and internal diameters of the section. Also find change in length. **[07]**

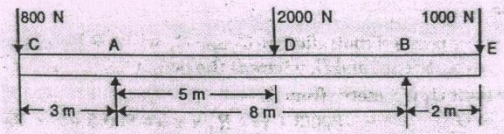
Q - 2 (b) A cantilever of length 2.0 m carries a uniformly distributed load of 1 kN/m run over a length of 1.5 m from the free end. Draw the shear force and bending moment diagrams for the cantilever. **[08]**

OR

Q – 2 (a) A member ABCD is subjected to point loads P_1, P_2, P_3, and P_4 as shown in fig. calculate the force P_2 necessary for equilibrium, if P_1 = 45 kN, P_3 = 450 kN, P_4 = 130 kN. Determine the total elongation of the member, assuming the modulus of elasticity to be 2.1×10^5 N/mm². **[07]**



Q - 2 (b) Draw the shearing force and bending moment diagrams for a given beam. **[08]**



Q – 3 (a) Determine the value of Young's modulus and Poisson's ratio of a metallic bar of length 3m, breath 40 mm and depth 40 mm when the bar is subjected to an axial compressive load of 500 kN. The decrease in length is given as 0.065 cm and increase in breath is 0.002 cm. **[05]**

Q – 3 (b) Explain in detail Stress-Strain curve for MS bar. **[05]**

OR

Q - 3 (b) Draw S.F and B.M diagram for a cantilever beam 6m span. A load of 10kN acting at free end and 20 kN is acting at 3m from free end, also u.d.l 8 kN/m is acting on 2m, From fixed end. **[10]**

SECTION – II

Q - 1 (a) A rectangular beam 200mm deep and 300mm wide is simply supported over a span of 8m. What uniformly distributed load per meter the beam may carry, if the bending stress is not to exceed 120 N/mm². **[08]**

Q - 1 (b) A hollow rectangular masonry pier is 1.2 m x 0.8 m, overall the wall thickness being 0.15 m. A vertical load of 100kN is transmitted in the vertical plane bisecting 1.2 m side at an eccentricity of 0.1 m from the geometric axis of the section. Calculate the maximum and minimum stress intensities in the section. **[07]**

OR

Q - 1 (a) Two wooden planks 150mm x 50mm each are connected to form a T-section of a beam, If a moment of 6.4 kN.m is applied around the horizontal N.A, find the bending stress at both the extreme fibers of the C/S also find shearing stresses developed at N.A of beam for 50kN shear force and draw Shear and bending stress diagrams. **[08]**

Q - 1 (b) A masonry pier of 6m x 3m supports a load of 30 kN 1m from smaller and 1m larger side find stresses developed at each corner of the pier. **[07]**

Q - 2 (a) A rectangular beam 200mm wide and 350 mm deep is subjected to a maximum shear force of 60kN, determine **[07]**

1. Average shear stress,
2. Maximum shear stress, and
3. Shear stress at a distance of 30 mm above the neutral axis.

(Hint: $\tau = \frac{F}{2I}\left(\frac{d^2}{4} - y^2\right)$

Q - 2 (b) The Principal stresses at a point are 150 N/mm² and 120 N/mm² both being tensile. Find the normal, Tangential and resultant stress across a plane through the point inclined at 50° to the plane having the 150 N/mm² stress by graphical Method. **[08]**

OR

Q - 2 (a) A S.S beam of span 1.3m having a c/s 150mm wide and 250mm deep carries a point load W at center. The permissible stresses are 7N/mm² in bending and 1N/mm² in shearing calculate safe load W. [Hint: $\frac{M}{I} = \frac{\sigma}{y}$] **[07]**

Q - 2 (b) The Principal stresses at a point are 70 N/mm² and 40 N/mm² both being tensile. Find the normal, Tangential and resultant stress across a plane through the point inclined at 50° to the plane having the 70 N/mm² stress by analytical Method. **[08]**

Use Appropriate Equations

- Torsion
$$\frac{G\theta}{l} = \frac{\tau}{R} = \frac{T}{J}$$
- Turning Moment:
$$T = \frac{\pi}{16}\tau D^3$$
- Polar Moment of Inertia:
$$J = \frac{\pi}{32}D^4$$

Power = $\frac{2\pi NT}{60}$

- Simple Stress & Strain
$$\delta l = \frac{Pl}{AE}$$
- For Circular Tapering section
$$\delta l = \frac{4Pl}{\pi E d_2 d_1}$$
- Shear Stress
$$\tau = F\frac{A\bar{y}}{Ib}$$

- Bending Equation
$$\frac{M}{I} = \frac{\sigma_b}{y} = \frac{E}{R}$$
- Direct and Bending Stress
- σ_{max} or $\sigma_{min} = \frac{P}{A}(1 \pm \frac{6e}{b})$
$$\frac{P}{A} \pm \frac{My\bar{x}}{I_{yy}} \pm \frac{M_x\bar{y}}{I_{xx}}$$

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