DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Semester Examination – MAY - 2019

Branch: SY Mechanical Engineering **Sem.: IV**
Subject with Subject Code: SOM (BTMEC403) **Marks: 60**
Date: 20-05-2019 **Time: 3 Hr.**

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Instructions to the Students

1. Each question carries 12 marks.
2. Attempt **any five** questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly

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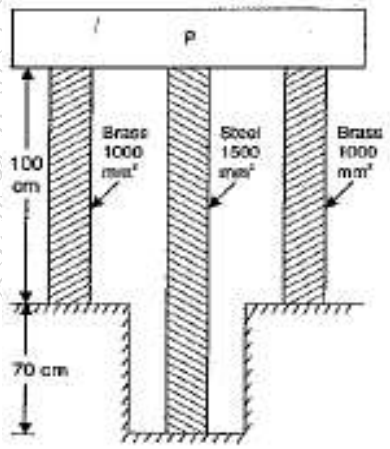
(Marks)

Q.1. a) Define the following terms

i) Young's Modulus
ii) Modulus of Rigidity
iii) Poisson's ratio
iv) Factor of safety
v) Hook's law **(05)**

b) Two brass rods and one steel rod together support a load as shown in Fig below. If the stresses in brass and steel are not to exceed 60 N/mm^2 and 120N/mm^2, find the safe load that can be supported .Take E for steel = 2 x 10^5 N/mm^2 and for brass = 1 x 10^5 N/mm^2. The cross sectional area of steed rod is 1500 mm^2 and of each brass rod is 1000 mm^2. **(07)**



OR

b) A steel rod of 3 cm diameter is enclosed centrally in a hollow copper tube of external diameter 5 cm and internal diameter of 4 cm. The composite bar is then subjected to an axial pull of 45000 N. If the length of each bar is equal to 15 cm. Determine:

i) The stresses in the rod and tube.
ii) Load carried by each bar. **(07)**

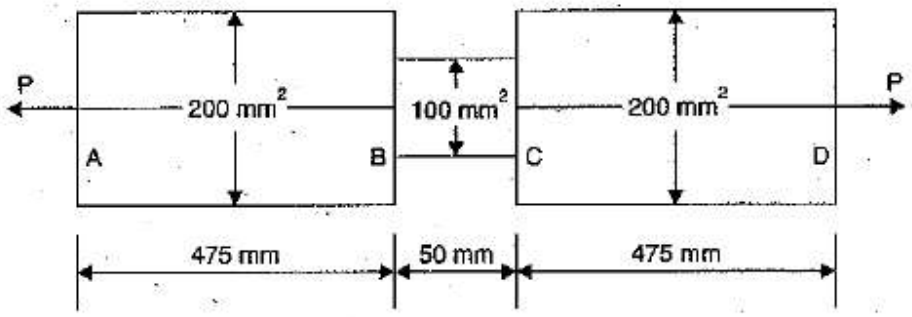
Q.2. a) Prove that stress induced in a body when the load is applied with the impact is given by

$$\sigma = \frac{P}{A}\left(1+\sqrt{1+\frac{2AEh}{P.L}}\right)$$

where P = Load applied with impact, A = Cross-sectional area of the body, h = height through which load falls, L= Length of the body, and E = Modulus of elasticity. **(06)**

OR

a) The maximum stress produced by a pull in a bar of length 1 m is 150 N/mm^2. The area of cross-sections and length are shown in Fig. Calculate the strain energy stored in the bar if E = 2 x 10^5 N/mm^2. **(06)**



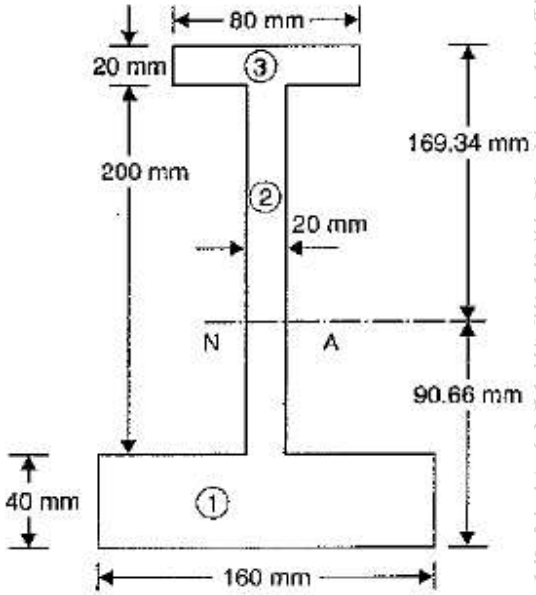
b) The stresses at a point in a bar are 200 N/mm^2 (tensile) and 100 N/mm^2 (compressive). Determine the resultant stress in magnitude and direction on a plane inclined at 60° to the axis of the major stress. Also determine the maximum intensity of shear stress in the material at the point. **(06)**

Q.3. a) A hollow rectangular section is having external size 500 mm x 450 mm internal size 400 mm x 350 mm. It carries a vertical load of 100 kN at outer edge of the column on X-axis. Calculate maximum and minimum intensities of stresses in the section. Assume 500 mm side horizontal. **(06)**

b) Draw the shear force and bending moment (B.M.) diagram for a simply supported beam of length 9 m and carrying a uniformly distributed load of 10 kN/m for a distance of 6 m from the left end. Also calculate the maximum B.M. on the section.

(06)

Q.4. A cast iron beam is of I-section as shown in Fig. The beam is simply supported on a span of 5 m. If the tensile stress is not to exceed 20 N/mm^2, Find the safe uniformly load which the beam can carry. Find also the maximum compressive stress. **(12)**



Q.5. **a)** A cantilever of length 3 m carries a point load of 10 kN at a distance of 2 m from the fixed end. If E = 2 x 10^5 N/mm^2 and I = 10^8 mm^4, find the slope and deflection at the free end using conjugate beam method. **(05)**

OR

a) A cantilever of length 2 m carries a point load of 20 kN at the free end and another load of 20 kN at its center. If E = 10^5 N/mm^2 and I = 10^8 mm^4 for the cantilever then determine by moment area method, the slope and deflection of the cantilever at the free end. **(05)**

b) A cantilever of length 2 m carries a uniformly distributed load 2 kN/m over a length of 1 m from the free end, and a point load of 1 kN at the free end. Find the slope and deflection at the free end if E = 2.1 x 10^5 N/mm^2 and I = 6.667 x 10^7 mm^4.

(07)

Q.6. **a)** Derive the relation for a circular shaft when subjected to torsion as given below

$$\frac{T}{J} = \frac{\tau}{R} = \frac{C\theta}{L}$$

where T = Torque transmitted,

J = Polar moment of inertia,
τ = Max. Shear stress,
R= Radius of the shaft,
C = Modulus rigidity,
θ = Angle of twist, and
L = Length of the shaft. **(06)**

b) A hollow shaft, having an inside diameter 60% of its outer diameter, is to replace a solid shaft transmitting the same power at the same speed. Calculate the percentage saving in material, if the material to be used is also the same. **(06)**

OR

b) A solid round bar 4 m long and 5 cm in diameter was found to extend 4.6 mm under a tensile load of 50 kN. This bar is used as a strut with both ends hinged. Determine the buckling load for the bar and also the safe load taking factor of safety as 4. **(06)**