BACHELOR OF TECHNOLOGY (C.B.C.S.) (2021-COURSE)
B. Tech. Sem - III MECHANICAL : WINTER- 2022
SUBJECT : STRENGTH OF MACHINE COMPONENTS

Day : Thursday | Time : 10:00 AM-01:00 PM

Date : 15-12-2022 | W-25348-2022 | Max. Marks : 60

N.B.

1) All questions are **COMPULSORY.**
2) Figures to the right indicate **FULL** marks.
3) Use of non-programmable calculator is allowed.
4) Assume suitable data if necessary.

Q.1 The following data relate to a bar subjected to a tensile test: **(10)**

Diameter of the bar, $d = 30$ mm (=0.03m)
Tensile load, $P = 54$ kN
Gauge length, $l = 300$ mm (= 0.3 m)
Extension of the bar, $\delta l = 0.112$ mm
Change in diameter, $\delta d = 0.00366$ mm

Calculate : **i)** Poisson's ratio **ii)** The values of three modulii.

OR

A steel bar of square cross section 35 mm x 35 mm, 500 mm long stretches 0.2 mm under a pull of 100 KN. The same bar in single shear test under a force of 122.5 KN shows a distortion of original right-angle corners by 0.00125 radian. Determine the values of the four elastic constants of the material.

Q.2 At a point in a strained material the normal stresses acting are +50 MPa and - 30 MPa at a plane right angle to each other, with a shear stress of 20 MPa. Determine: **i)** Principal stresses and their nature. **ii)** Normal and tangential stress on a plane inclined at angle of 25^0 with the plane of + 50 MPa. **(10)**

OR

Explain in detail Beltrami and Haigh theory.

Q.3 Draw the shear force and bending moment diagrams for the beam shown in Fig.3. Mark the position of the maximum bending moment and determine its value. **(10)**

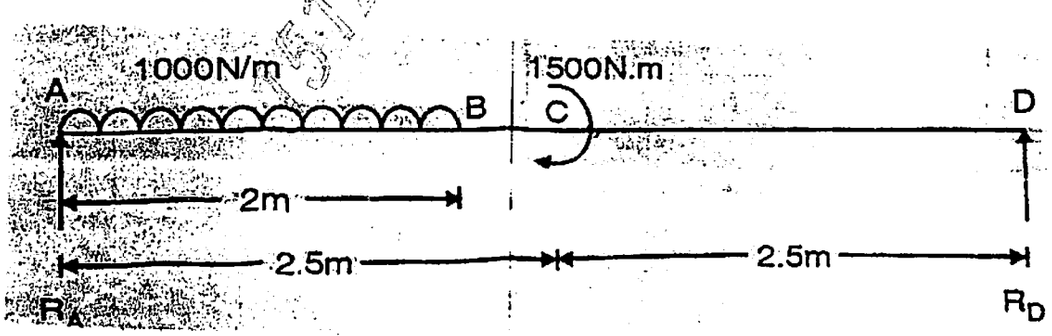

Fig.(3)

OR

Show that for a simply supported beam of length L subjected to a central concentrated load W deflection and mid span is given by

$Y = WL^3/48\ EI$

P.T.O.

Q.4 A cast iron beam is of I-section as shown in Fig.4 (a) The beam is simply supported on a span of 5 metres. If the tensile stress is not to exceed 40 N/mm^2, find the safe uniformly load which the beam can carry. Find also the maximum compress stress. **(10)**

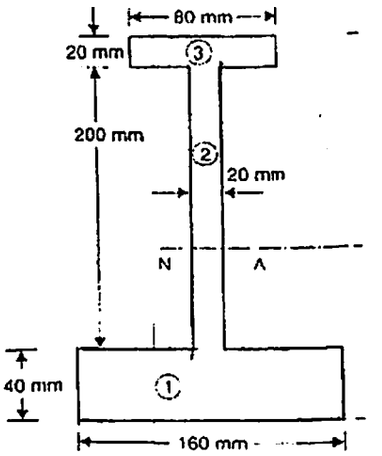

Fig. 4(a)

OR

The shear force acting on a beam at an I-section with unequal flanges is 60 KN. The section is shown in Fig.4 (b) The moment of inertia of the section about N.A is 2.849 x 10^4 mm^4 Calculate the shear stress at the N.A and also draw the shear stress distribution over the depth of the section.

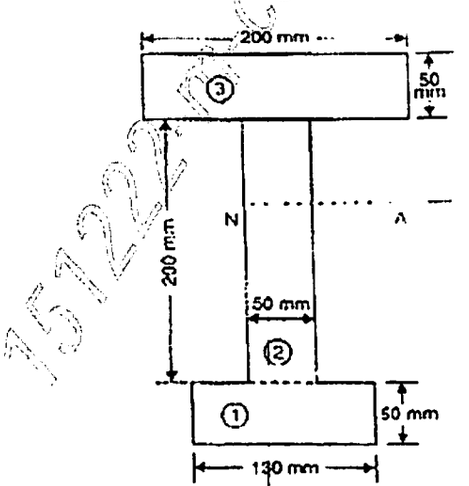

Fig 4(b)

Q.5 A solid steel shaft has to transmit 75 kW at 200 r.p.m. Taking allowable shear stress as 75 N/mm^2, find suitable diameter for the shaft, if the maximum torque transmitted at each revolution exceeds the mean by 30%. **(10)**

OR

Determine the diameter of a solid shaft which will transmit 300 kW at 255 r.p.m. The maximum shear stress should not exceed 30 N/mm^2 and twist should not be more than 1^0 in a shaft length of 2 m. Take modulus of rigidity = 1 x 10^5 N/mm^2.

Q.6 What is strain energy? Derive the stress required in member when impact load is applied. **(10)**

OR

State the limitations of Euler's formula. Hence derive Rankine formula for long as well as short columns to overcome the limitations.

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