D 30319 (Pages : 3) Name..................................

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# THIRD SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION DECEMBER 2003

## PTCE/EE/CE 2 K 302/PT 2 K 403—MECHANICS OF SOLIDS

Time : Three Hours Maximum : 100 Marks



*Answer* **all** *questions.*
*Assume suitable data that are not given.*

I. (a) Define stress, strain and Young's modulus.

(b) What is Strain energy ? Give the expression for strain energy due to axial load.

(c) Derive the relation between bending moment and shear force.

(d) Explain and compare Centroidal axis and Neutral axis.

(e) Draw the conjugate beam for simply supported beam, cantilever beam and overhanging beam with overhanging on one side.

(f) Obtain the maximum slope for a cantilever beam subjected to a concentrated load at the free end by conjugate beam method.

(g) Write short notes on Rankine formula.

(h) Compare thin cylinder and thick cylinder in terms of stresses.

II. (a) A composite bar made up of aluminium and steel is rigidly fixed between two supports as shown in Fig. 1. The bars are free of stress at 60° C. Find the stresses in the two bars when the temperature falls to 30° C if (i) the supports do no yield on (ii) the supports come nearest by 0.1 mm. Take E for steel and aluminium as $2.1 \times 10^5$ N/mm.$^2$ and $0.7 \times 10^5$ N/mm.$^2$ respectively. The coefficient of Thermal expansion for steel and aluminium are $11.7 \times 10^{-6}$/° C and $2.34 \times 10^{-6}$/° C.

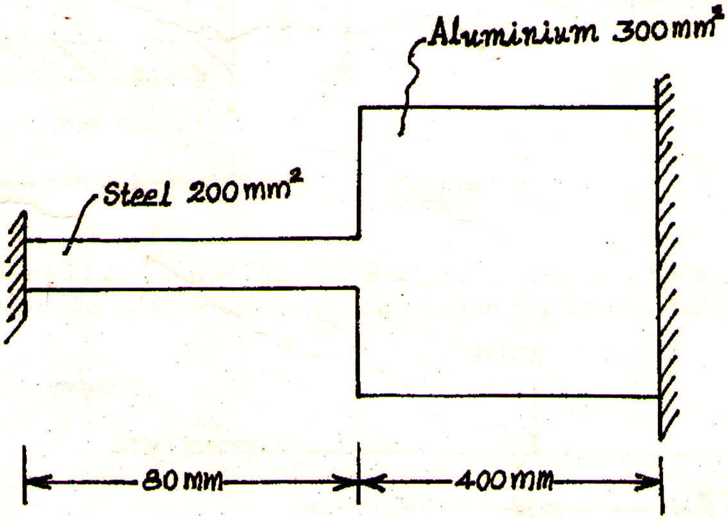


FIG. 1.

*Or*

Turn over

(b) Direct stresses of 100 $N/mm.^2$ tensile and 80 $N/mm.^2$ compressive act on two perpendicular planes at a certain point in a body. They are also accompanied by shear stresses, those acting along with 120 $N/mm.^2$ Stress being clockwise. The greatest principal stress at the point is 150 $N/mm.^2$ tensile find the (i) the shear stress on the given planes ; (ii) the maximum shear stress ; (iii) The other principal stress ; (iv) The normal stress on the plane of maximum shear stress.

III. (a) Draw the bending moment and shear force the beam shown in Fig. 2.

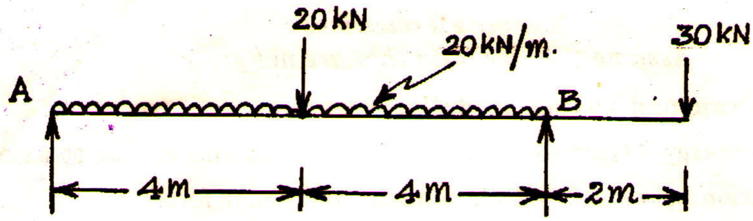


FIG. 2.

*Or*

(b) A simply supported beam of length 3 m. carries a point load of 15 kN at a distance of 2 m. from the left support. The cross-section of the beam is as shown in Fig. 3. Determine the bending stresses at A and B.

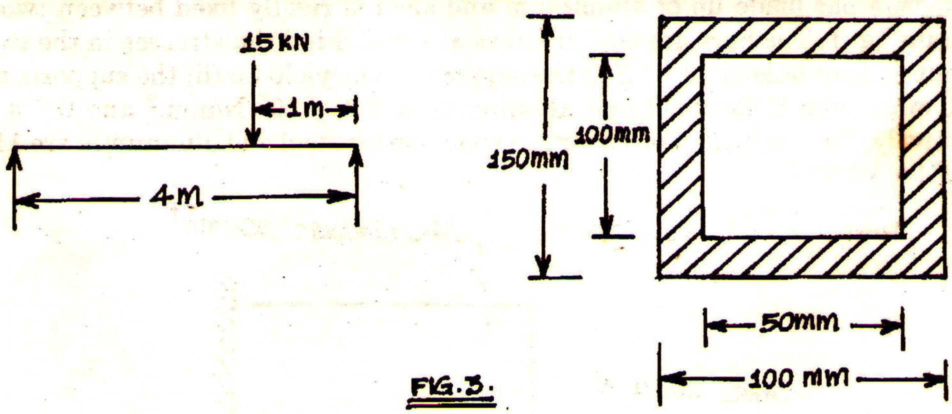


FIG. 3.

IV. (a) A beam ABC is loaded as shown in Fig. 4 if $E = 2 \times 10^5$ $N/mm.^2$ and $I = 9 \times 10^{-5}$ $m.^4$ determine the maximum deflection and the deflection at the free end. Use Mecaulay's method.

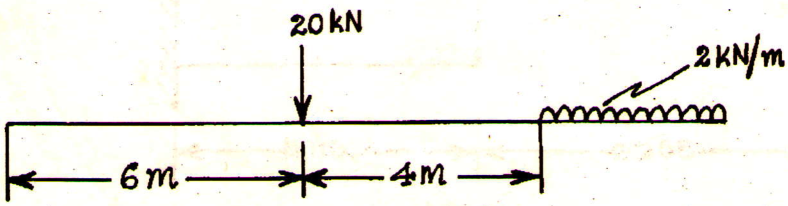


FIG. 4.

*Or*

(b) Using conjugate beam method, calculate the uniformly distributed load W over a beam shown in Fig. 5. So that the deflection at the free end does not exceed 15 mm. Take $E = 2 \times 10^5$ N/mm.$^2$ and $I = 2.72 \times 10^{-4}$ m.$^4$

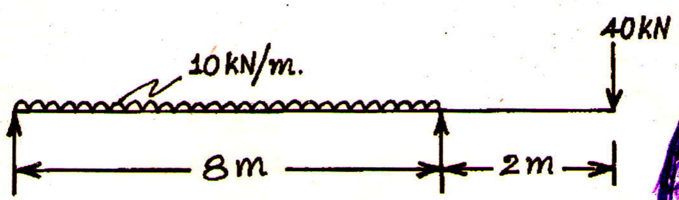


FIG. 5.



V. (a) Find the Euler buckling load for a hallow cylindrical cast–iron column 200 mm. external diameter 20 mm. thick and 5 mm. long and hinged at both ends. E = 120 GN/m.$^2$ Compare the load with the critical load as given by the Rankine formula. Taking $\sigma_c$ = 500 MN/m.$^2$ and $a$ = 1/1600.

*Or*

(b) A compound cylinder formed by shrinking one tube to another is subjected to an internal pressure of 80 MN/m.$^2$ Before the fluid is admitted, the external and internal diameter of the compound cylinder are 300 mm. and 200 mm. respectively and the diameter at the junction is 250 mm. If after shrinking on, the radial pressure at the common surface is 12 MN/m.$^2$, determine the final stresses developed in the compound cylinder.