D 51417 (Pages : 2) Name.....

Reg. No.....

THIRD SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION DECEMBER 2008

CE 2K 302—MECHANICS OF SOLIDS

(2004 admissions)

Time : Three Hours Maximum : 100 Marks

Assume missing data may suitably.

Answer **all** *questions.*

I. (a) State and explain Hooke's law.

(b) Write a note on Mohr's circle of stresses.

(c) Draw the shear force and bending moment diagrams for a cantilever of length L carrying a uniformly distributed load of w per m length over its entire length.

(d) Define the terms : (i) bending stress in a beam ; (ii) neutral axis ; and (iii) section modulus.

(e) Differentiate between Macaulay's method and successive integration method.

(f) Find the slope and deflection of a simply supported beam carrying a (i) point load at the centre ; and (ii) uniformly distributed load over the entire length using moment area method.

(g) What is Rankine's constant ? What is the approximate value of Rankine's constant for area cast-iron column ?

(h) Define the term 'polar modulus'. Find the expressions for polar modulus for a solid shaft and for a hollow shaft.

(8 × 5 = 40 marks)

II. (a) A copper bar 30 mm diameter, is completely enclosed in a steel tube, 30 mm internal diameter and 50 mm external diameter. A pin, 10 mm in diameter is fitted transversely to the axis of the bar near each end, to secure the bar to the tube. Calculate the intensity of shear stress induced in the pins when the temperature of the whole is raised by 60 K.

(15 marks)

Or

(b) The normal stress in two neutrally perpendicular directions are 650 N/mm^2 and 350 N/mm^2 both tensile. The complimentary shear stresses in these directions are of intensity 400 N/mm^2. Find the normal and tangential stresses on the two planes which are equally inclined to the planes carrying the normal stresses mentioned above.

(15 marks)

Turn over

III. (a) Draw the shear force and bending moment diagrams for the beam which is loaded as shown in Fig. 1. Determine the points of contraflexure within the span AB.

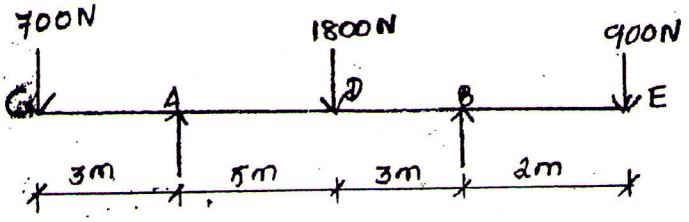

Fig. 1

(15 marks)

Or

(b) A cast-iron water pipe has 60 cm bore and 3 cm metal thickness and is supported at two points 10 m apart. Find the maximum stress in the metal when it is running full. Take unit weight of cast-iron as 70 kN/m^3 and that of water 10 kN/m^3.

(15 marks)

IV. (a) A beam of length 5 m and of uniform rectangular section is supported at its ends and carries uniformly distributed load over the entire length. Calculate the depth of the section if the maximum permissible bending stress is 10 N/mm^2 and central deflection is not exceed 12 mm. Take the value of E = 1.2 × 10^4 N/mm^2.

(15 marks)

Or

(b) Using Macaulay's method, find the deflection under each load, maximum deflection and the point at which maximum deflection occurs for the beam shown in Fig. 2.

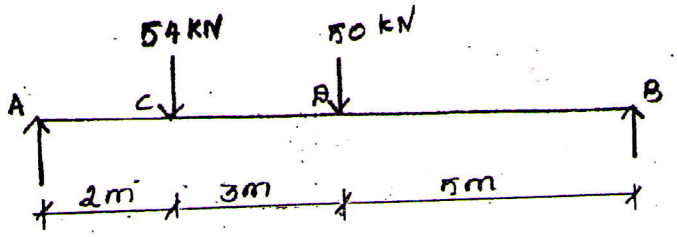

Fig. 2

(15 marks)

V. (a) Determine the diameter of a solid steel shaft which will transmit 80 kN at 150 r.p.m. Also determine the length of the shaft if the twist must not exceed 1° over the entire length. The maximum shear stress is limited to 60 N/mm^2. Take the value of modulus of rigidity = 8 × 10^4 N/mm^2.

(15 marks)

Or

(b) Determine the maximum and minimum hoop stress across the section of a pipe of 450 mm internal diameter and 100 mm thick, when the pipe contains a fluid at a pressure of 9 N/mm^2. Also sketch the radial pressure distribution and hoop stress distribution across the section.

(15 marks)

[4 × 15 = 60 marks]