D 51471 (Pages 2) Name.....

Reg. No.....

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

CE 04 303—MECHANICS OF SOLIDS

(2004 admissions.)

Time : Three Hours Maximum : 100 Marks

Part A

I. (a) Define strain energy. Derive expression for strain energy due to axial load.

(b) Discuss on strain Rosette.

(c) Mention assumptions made in theory of pure (simple) bending.

(d) Write short note on shear centre.

(e) Discuss on method of superposition.

(f) Compare moment area method and conjugate beam method.

(g) Discuss on Slenderness ratio.

(h) Discuss on Lame's equation for analysing cylinders.

(8 × 5 = 40 marks)

Part B

II. (a) A copper rod 30 mm diameter is surrounded tightly by a cast iron tube of 60 mm outside diameter, the ends being firmly fastened together. When put to a compressive load of 15 kN, what will be the load shared by each ? Also estimate the amount by which the compound bar shortens in a length of 500 mm. Assume E of cast iron = 1.2×10^5 N/mm^2 and E of copper = 1×10^5 N/mm^2.

Or

(b) (i) The principal stresses at a certain point in a strained material are 120 N/mm^2 and 48 N/mm^2, both tensile. Find normal and tangential stresses on a plane inclined at 20° with the major princplal plane.

(9 marks)

(ii) At a point in two dimensional system, the normal stresses on two mutually perpendicular planes are P and P^1 (both alike) and shear stress is q. Show that one of the principal stresses is Zero if $q^2 = pp^1$.

(6 marks)

Turn over

III. (a) A simply supported beam AB of span 9 m is subjected to uniformly distributed load of 25kN/m for a length of 4m from A. There is a point load of 15 kN at a distance of 2 m from B. Draw shear force and bending moment diagrams.

(15 marks)

Or

(b) Define section modulus. Derive section modules for (i) rectangular section of width b and depth d (ii) circular section of diameter d.

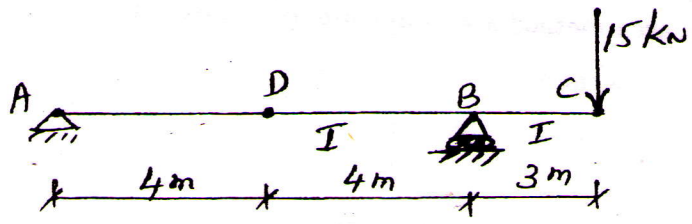
(2 + 6 + 7 = 15 marks)

IV. (a) A cantilever beam of length l carries a uniformly distributed load of w/mt. run over its entire span. Find slope and deflection at its free end using moment area method.

(15 marks)

Or

(b) Using conjugate beam method, final deflection at D of the overhanging beam shown in Fig 1. $E = 2 \times 10^5$ N/mm^2 and $I = 120 \times 10^6$mm^4.



(15 marks)

V. (a) (i) A hollow circular column 2 m long has one of its end fixed and other end free and has to support an axial load of 520 kN. The internal diameter is 0.8 times the external diameter. Allowing a factor of safety of 4, calculate the external diameter and thickness of the metal.

Use Rankine's formula. Take $f_c = 330$ N/mm^2 and $\alpha = \frac{1}{7500.}$

(8 marks)

(ii) A mild steel tube 8 m long, 30 mm internal diameter and 4 mm thick is used as strut with both ends fixed. Find collapsing load by Euler's formula. Take $E = 2.1 \times 10^5$ N/mm^2.

(7 marks)

Or

(b) Find thickness of metal necessary for a steel cylindrical shell of internal diameter 150 mm to withstand an internal pressure of 50 N/mm^2. The maximum hoop stress in the section not to exceed 150 N/mm^2.

(15 marks)

[4 × 15 = 60 marks]