C 59100 (Pages 2) Name.....

Reg. No.....

THIRD SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2009

CE 04 303—MECHANICS OF SOLIDS

(2004 Admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*
Assume additional data if required.

Part A

I. (a) State and explain Hooke's law. What is Poisson's ratio ?

(b) What do you understand by principal planes and principal stresses ?

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

(d) Obtain relationship for strain energy due to bending.

(e) Briefly explain moment area method.

(f) What are the rules to be followed in using successive integration method for more than one load on the beam ?

(g) What is Pure Shear ? Discuss on strain energy in pure shear.

(h) Discuss on Secant formula.

(8 × 5 = 40 marks)

Part B

II. (a) A steel rod 18 mm in diameter passes centrally through a steel tube 25 mm in internal diameter and 30 mm external diameter. The tube is 750 mm long and is closed by a rigid washers of negligible thickness, which are fastened by nuts threaded on the rod. The nuts are tightened until the compressive load on the tube is 22 kN. Calculate the stresses in the tube and the rod. Find also increase in the stresses when one nut is tightened by one quarter of a turn relative to the other. There are 4 threads per cm. Take $E = 2 \times 10^5$ N/mm^2.

Or

(b) A rectangular block of material is subjected to a tensile stress of 100 N/mm^2 on one plane and tensile stress of 45 N/mm^2 on a plane at right angles, together with a shear stresses of 65 N/mm^2 on the same planes. Find

(i) The direction of the principal planes.

(ii) Magnitudes of the principal stresses.

(iii) The magnitude of greatest shear stress.

(15 marks)

[redacted]

Turn over

III. (a) A beam ABC 5 m long has one support at end A and other support at B 3 m from A. It carries a point load of 40 kN at mid-point of AB and a point load of 30 kN at C. Draw shear force and bending moment diagram.

Or

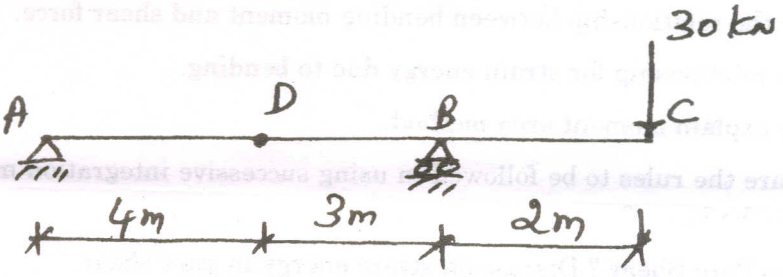
(b) A timber beam is freely supported on supports 6 m apart. It carries a uniformly distributed load of 14 kN/m run and concentrated load of 10 kN at 2.5 m from left support. If the stress in timber is not to exceed 8 N/mm^2, design suitable section making the depth twice the width.

(15 marks)

IV. (a) A cantilever beam of span l is fixed at A and free at B. At B, a point load of w is acting. Find slope and deflection at free end B. Use Moment area method.

Or

(b) Using conjugate beam method, find deflection at D of overhanging beam shown in Figure below. Use E = 2×10^5 N/mm^2 and I = 100×10^6 mm^4.



(15 marks)

V. (a) (i) A column of timber section 150 mm × 200 mm is 7 m long both ends being hinged. Find safe load for the column. Use Euler's formula and factor of safety of 3. Take E = 1.75×10^4 N/mm^2.

(8 marks)

(ii) In a compression test on a short length of a tube of 60 mm external diameter and 5 mm thickness, it failed at a load of 350 kN. When the same is tested as a strut with both ends hinged, 2 m long, it failed at a load of 170 kN. Find value of α in Rankine's formula.

(7 marks)

Or

(b) The maximum stress permitted in a thick cylinder of internal and external diameters 400 mm and 600 mm respectively is 15 N/mm^2. If the external pressure is 5 N/mm^2, find the internal pressure that can be applied. What will be the change in thickness of the cylinder ?

Take E = 2.1×10^5 N/mm^2 and $\mu \left(= \frac{1}{m} \right) = 0.3$.

(15 marks)

[4 × 15 = 60 marks]