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320354(20)

B. E. (Third Semester) Examination, Nov.-Dec. 2021

(New Scheme)

(Civil Engg. Branch)

MECHANICS of SOLIDS

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Attempt all questions. Part (a) from each question is compulsory and carry 2 marks. Attempt any* ***two*** *parts (b), (c) & (d) with carries 7 marks each.*

Unit-I

1. (a) What is Hook's law? 2

   (b) Discuss the stress-strain behaviour of an engineering materials with neat sketch showing each point of importance in detail. 7

(c) A steel bar is 800 mm long; its two ends are 50 mm and 60 mm in diameter and the length of each rod is 250 mm. The middle portion of the bar is 20 mm is diameter and 300 mm long. If the bar is subjected to an axial tensile load of 25 kN. Find its total extensions.

Take $E = 2 \times 10^5$ N/mm^2 or 200 GN/m^2. 7

(d) Calculate the values of the stress and strain in portions AC and CB of the steel bar as shown in figure. A close fit exists at both the rigid supports at room temperature and the temperature is raised by 75°C. Take $E = 200$ GPa, $\alpha = 12 \times 10^{-10}$/°C for steel. Areas of cross sections of AC and AB are 400 mm^2 and 800 mm^2 respectively. 7

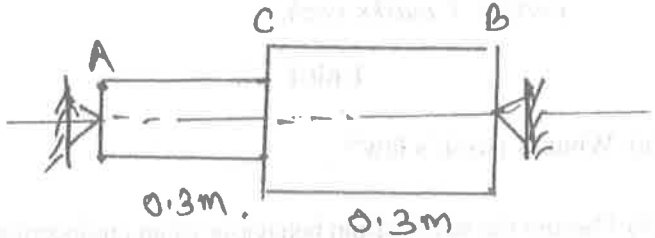


Fig.

Unit-II

2. (a) What do you mean by Mohr's circle? 2

(b) Write the procedure for Mohr's circle construction for principal stresses. 7

(c) The principal stresses at a point access two perpendicular planes are 75 MN/m^2 (tensile) and 35 MN/m^2 (tensile). Find the normal, tangential stress, and resultant stress and its obliquity on a plane at 20° with the major principal planes. 7

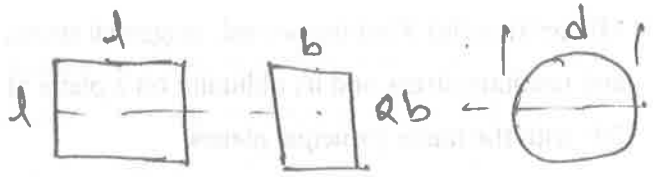
(d) Show that in a strained material subjected to two dimensional stress, the sum of normal components of stresses on any two mutually perpendicular planes is constant. 7

Unit-III

3. (a) Write the value of section modulus of a rectangular section of width b and depth d. 2

(b) Write the assumptions made in the theory of simple bending. Support your answer with neat diagram. 7

(c) Three beams having same length same allowable stress and same bending moment. The cross section of the beams are a square, a rectangle and the depth twice the width and a circle. Determine the ratios of weights of the circular and rectangular beams with respect to the square beam. 7



Fig

(d) An *I* section beam 340 mm × 200 mm has a web thickness of 10 mm and flange thickness of 20 mm. It carries a shearing force of 100 kN. Sketch the shear stress distribution across the section. 7

Unit-IV

4. (a) What will be effective length of a shut or column when : 2

(i) one end is fixed, other is free

(ii) one end is fixed other is pinned.

(b) A solid round bar 60 mm in diameter and 2·5 m long is used a strut. One end the strut is fixed other end is hinged. Find the safe compressive load of this strut using Euler's formula. 7

Take $E = 200$ GN/m^2 and factor of safety = 3

(c) Calculate the maximum value of slenderness ratio of a mild steel column for which Euler's formula is valid. 7

(d) A retaining wall of trapezoidal section is 10 m high and retains earth which is level upto the top. The width of the top is 2 m and at bottom 8 m and exposed face is vertical. Find the bending moment developed due to eccentricity. 7

Take density of earh 16 kN/m^2

Take density of masonary 24 kN/m^2

Angle of repose of each = 30°

Unit-V

5. (a) What is Shear Centre? 2

(b) Evaluate the shear centre expression for a channel section. 7

(c) A hollow circular shaft 20 mm thick transmits 294 kW at 200 r.p.m. Determine the diameter of the shaft if shear strain due to torsion is not is exceed $8{\cdot}6 \times 10^{-4}$. 7

(d) A weight of 200 N is dropped on a helical spring made of 15 mm wire closely coiled to a mean diameter of 120 mm with 20 coils. Determine the height of drop if the instantaeous compression is 80 mm. 7

Take $C = 84$ GN/m^2