Dec 2018

B.Tech. IIIrd SEMESTER (Reappear)

Mechanics of Solids (ME-201C)

Time: 3 Hours **Max. Marks:75**

Instructions:
1. *It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.*
2. *Answer any four questions from Part -B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*
4. *Assume suitable value for missing data.*

PART -A

Q1 (a) What is complimentary shear stress? (1.5)

(b) State the first Moment-area thoerem. (1.5)

(c) Define the terms for a beam, i) neutral axis ii) moment of resistance. (1.5)

(d) Draw typical stress-strain diagrams for high tensile steel and cast iron? (1.5)

(e) What is meant by equivalent length of columns? What are its values for different end conditions? (1.5)

(f) Define in various prominent theories of failure. (1.5)

(g) Why is it necessary to use the minimum radius of gyration of section to calculate the crippling load? Explain briefly (1.5)

(h) Derive the fundamental torsion equation. (1.5)

(i) What is slenderness ratio of a column? (1.5)

(j) Define torsional rigidity of a shaft and express it in terms of angle of twist per unit length. (1.5)

PART -B

Q2 (a) Derive expressions for principal stresses and maximum shear stress when a body is subjected to a simple stresses in two mutually perpendicular directions. (5)

(b) At a point in a material, the stresses on two mutually perpendicular planes are 50N/mm^2 (tensile) and 30 N/mm^2 (tensile). The shear stress across these planes is 12N/mm^2. Using Mohr circle, find magnitude and direction of the resultant stress on a plane making an angle of 350 with the plane of the first stress. Find also, the normal and tangential stresses on this plane. (10)

Q3 A circular shaft 100 mm diameter is subjected to combined bending and twisting of moments the B.M being 3 times the twisting moment. If the direct tensile yield point of the material is 350 N/mm^2, and the factor of safety is 4, calculate the allowable twisting moment according to the following theories of failures. (15)

(i) Maximum principle stress theory,

(ii) Shear strain energy theory, if the simple shear is not to exceed 60 N/mm^2.

Q4 (a) A solid round bar 3 m long and 5 cm in diameter is used as a strut with one end is fixed and other is hinged. Determine the crippling load. Take E = 2x10^5 N/mm^2. (10)

(b) Derive Euler's buckling load formula of a long column pinned at both ends. (5)

Q5 (a) A beam of 10m length is acted upon by forces and a couple as shown in figure 5(a). Draw the shear force and bending moment diagram. (8)

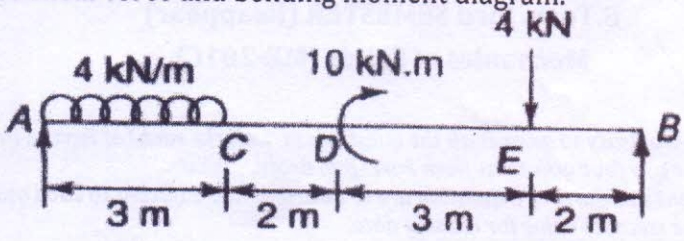

Figure 5(a)

(b) A beam of 8m span is hinged at each end. It carries a uniformly distributed load of 2kN/m on the left half of the beam along with a 25kN load at 6m from the left-hand end. In addition the beam is also subjected to couples of 20kNm in counter clockwise direction at left-hand support and 30kNm in the clockwise direction at the right hand support. Determine the reactions at the ends and draw the sheer force and bending moment diagrams indicating the principal values. (7)

Q6 (a) A beam of length 8m is simply supported at its ends. It carries a uniform distributed load of 40kN/m as shown in figure 6(a). Determine the deflection of beam at its mid-point and also the maximum deflection and its position. Take E=2X10^5 N/mm^2 and I=4.3×10^8 mm^4. (7)

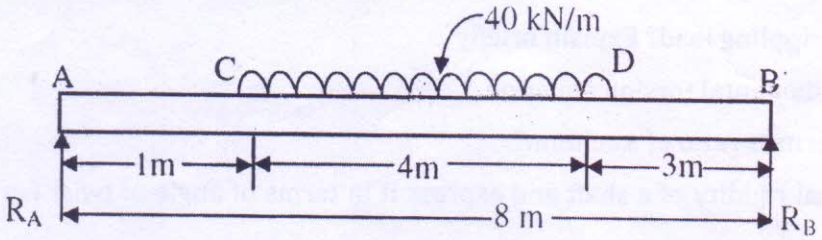

Figure 6(a).

(b) A horizontal beam AB is simply supported at A and B, 6m apart. The beam is subjected to a clockwise couple of 300kNm at a distance of 4m from the left end. If E=2×10^5 N/mm^2 and I=2×10^8 mm^4. Determine (8)
(i) Deflection at the point where couple is acting.
(ii) The maximum deflection.

Q7 (a) Two shafts of same material and same lengths are subjected to same torque; if the first shaft is a solid circular section and the second shaft is hallow circular section whose internal diameter is 2/3 of the outside diameter. And the maximum shear stress developed in each shaft is the same; compare the weights of the shafts. (8)

(b) A hollow steel shaft transmits 250 kW of power at 160 r.p.m. The total angle of twist in a length of 5 m of the shaft is 3 degrees. Determine the inner and outer diameters of the shaft if the permissible shear stress is 60 MPa. Take modulus of rigidity as 80 GPa. (7)

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