OR

VIII An open - link chain is obtained by bending low-carbon steel rods of 12mm diameter in the shape shown (Fig.10). Knowing that the chain carries a load of 800N, determine a) the largest tensile and compressive streses in the straight portion of a link b) the distance between the centroidal and the neutral axis of a cross section. (20)

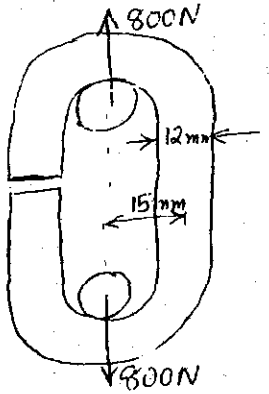

Fig.10

IX a) Derive the Euler's formula for a slender column for one end hinged and another end fixed. (10)

b) A spherical gas container mode of steel has a 5m outside diameter and a 10mm uniform wall thickness. Knowing that the internal pressure is 400 KPa, determine the maximum normal stress and the maixmum shearing stress in the container (10)

OR

X a) Explain the yield criteria for ductile materials under plane stress. (8)

b) The state of plane stress shown occurs at a critical point of steel machine component. As a result of several tensile tests, it has been found that the tensile yield strength is $\sigma_y^* = 250 MPa$ for the grade of steel used. Determine the factor of safety with respect to yield using a) the maximum shearing-stress criterion and b) the maximum-distortion energy criterion. (12)

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BTS 118(D)

ME

B.Tech. Degree III Semester (Supplementary) Examination in Mechanical Engineering , June 2001

ME 304 MECHANICS OF SOLIDS

(1998 admissions)

Time: 3 Hours *Max. Marks: 100*

I a) Sketch the stress-strain diagrams for (i) Low - carbon steel (ii) Aluminium alloy. (5)

b) Determine the deformation of the steel rod shown in Fig.1 under the given load. (E = 200 GPa). (15)

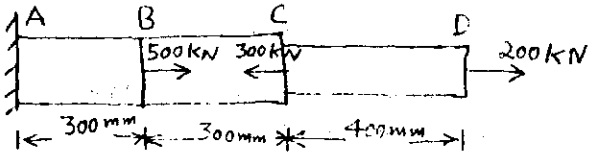

Fig.1

OR

II a) Determine the change in volume ΔV of the steel block shown in Fig.2, when it is subjected to the hydrostatic pressure p = 180 MPa. Use E = 200 GPa and poisson ratio, V = 0.29. (8)

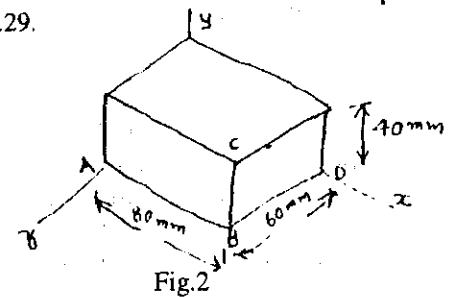

Fig.2

b) Derive an expression for temperature stress in a rod of temperature change ΔV (6)

c) Sketch the Mohr's circle for the state of plane stress shown in Fig.3. (6)

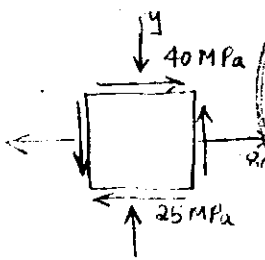

Fig.3

III Draw the Shear Force and Bending Moment diagrams for the loaded beam shown in Fig.4. (20)

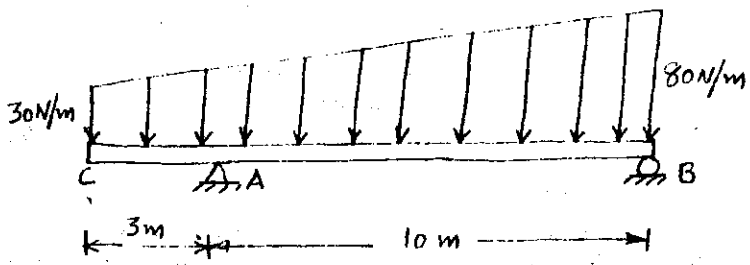

Fig.4.

OR

IV a) Draw the Shear Force and Bending Moment diagrams for the loaded beam shown in Fig.5. (10)

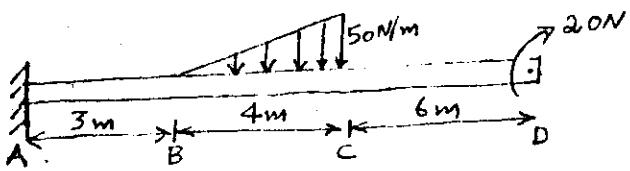

Fig.5

b) An aluminium rod with a semicircular cross section of radius r = 12mm (Fig.6) is bent into the shape of a circular arc of mean radius ρ = 2.5m. Knowing that the flat face of the rod is turned towards the center of curvature of the arc, determine the maximum tensile and compressive stress in the rod. Use E = 70 GPa. (10)

Fig.6

Contd. 3

V The cantilever beam AB supports a uniformly distributed load 'w' and a concentrated load 'p' as shown (Fig.7). Knowing that L = 2m, w = 4 KN/m, P = 6 KN and EI = 5 MNm^2, determine the deflection at A using Castigliano's theorem. (20)

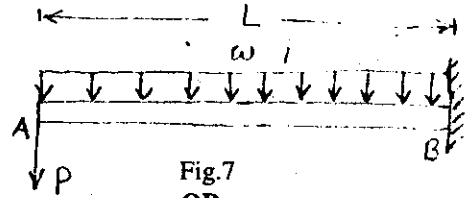

Fig.7

OR

VI The overhanging steel beam ABC shown in Fig.8 carries a concentrated load P at end C. For portion AB of the beam. a) derive, the equation of the elastic curve, b) determine the maximum deflection, c) evaluate y_{max} for the following data:

I = 301 x 10^6 mm^4, E = 200 GPa

P = 250 KN, L = 5m, a = 1.2 m (20)

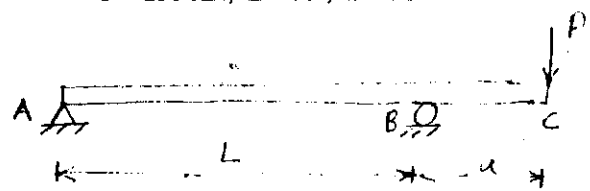

Fig.8

VII A torque 'T' is applied as shown in Fig.9 to a solid tapered shaft AB. Show by integration that the angle of twist at A is $\phi_A = \frac{7TL}{12\pi GC^4}$ (20)

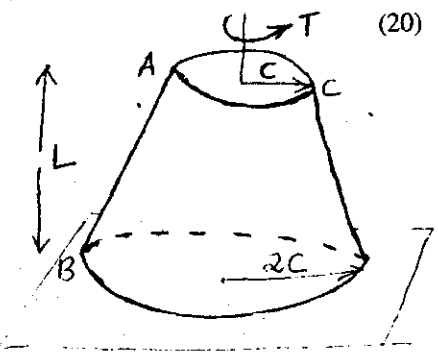

Fig.9

Contd..4