Uva Wellassa University, Sri Lanka
End Semester Examination – July 2010
ENG 307-1 Strength of Materials II - Repeat

Time: One (01) hour

Total 05 Questions
Answer **Three (03)** questions only

1. A rectangular column with cross-sectional dimensions *b* and *h* is pin-supported at ends *A* and *C* (see Fig.Q01). At mid-height, the column is restrained in the plane of the figure but is free to deflect perpendicular to the plane of the figure. Determine the ratio *h/b* such that the critical load is the same for buckling in the two principal planes of the column.

(100 marks)

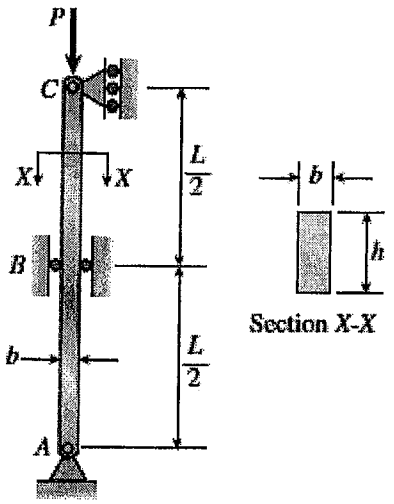

Fig.Q01

2. A propeller shaft subjected to combined torsion and axial thrust is designed to resist a shear stress of 56 MPa and a compressive stress of 85 MPa (see Fig.Q02).
   (a) Determine the principal stresses and show them on a sketch of a properly oriented element.
   (b) Determine the maximum shear stresses and associated normal stresses, and show them on a sketch of a properly oriented element.

(100 marks)

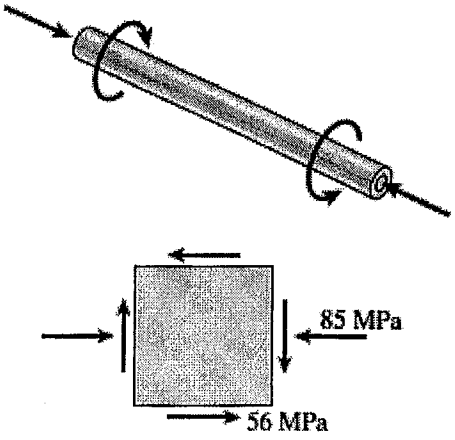

Fig.Q02

3. An element in *uniaxial stress* is subjected to tensile stresses σ_x = 49 MPa, as shown in the Fig.Q03. Using Mohr's circle, determine:
   (a) The stresses acting on an element oriented at an angle ϑ = -27° from the *x* axis (minus means clockwise).
   (b) The maximum shear stresses and associated normal stresses.
   Show all results on sketches of properly oriented elements.

(100 marks)

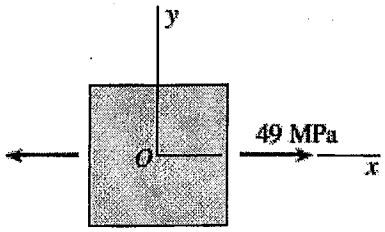

Fig.Q03

4. A wood beam with cross-sectional dimensions 200 mm x 300 mm is reinforced on its sides by steel plates 12 mm thick (see Fig.Q04). The moduli of elasticity for the steel and wood are E_s = 190 GPa and E_w = 11 GPa, respectively. Also, the corresponding allowable stresses are σ_s = 110 MPa and σ_w = 7.5 MPa.
   (a) Calculate the maximum permissible bending moment M_{max} when the beam is bent about the *z* axis.
   (b) Repeat part (a) if the beam is now bent about its *y* axis.

(100 marks)

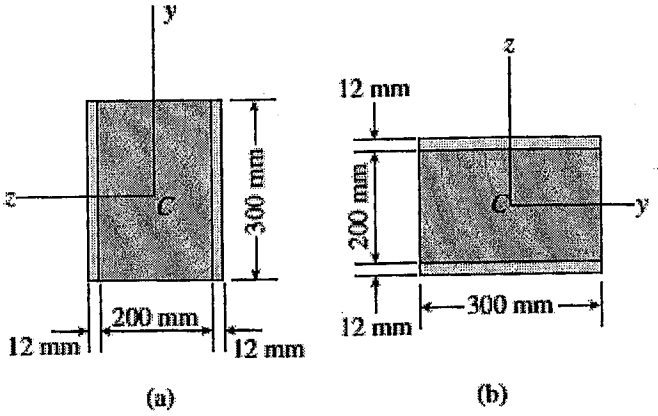

Fig.Q04

5. A cantilever beam of length L = 2 m supports a load P = 8.0 kN (see Fig.Q05). The beam is made of wood with cross-sectional dimensions 120 mm x 200 mm. Calculate the shear stresses due to the load P at points located 25 mm, 75 mm and 100 mm from the top surface of the beam. From these results, plot a graph showing the distribution of shear stresses from top to bottom of the beam.

(100 marks)

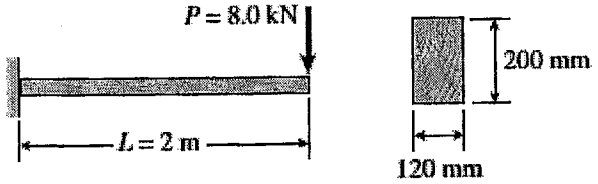

Fig.Q05

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