Uva Wellassa University, Sri Lanka
End Semester Examination – June/July 2009
ENG 307-1 Strength of Materials II

Time: One (01) hour

Total 03 Questions
Answer **Two** questions only

1.

a. A cast-iron column of inside and outside diameters 8 cm and 6.5 cm respectively carries a central load of 100000 kg and a load of W at 13 cm from the axis. If the allowable compressive and tensile stresses are 1200 kg/cm^2 and 300 kg/cm^{2}respectively, find the value of W.

b. A beam of symmetrical I-section shown in Figure Q1b is simply supported over a span of 9 mm. If the maximum permissible stress is 75 N/mm^2 what concentrated load can be carried at a distance of 3 m from one support?

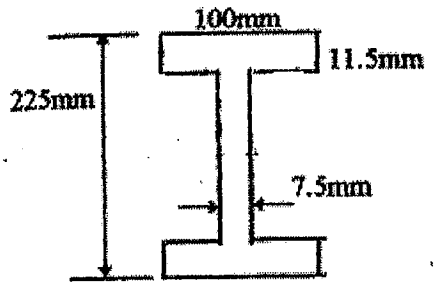

Figure Q1b

2.

a. Show that the Euler critical load P_{cr} of an axially loaded pin jointed column can be expresses as:

$$P_{cr} = \frac{\pi^2 EI}{L^2}$$

Where E is Young's modulus, I is second moment of area of the cross section about the nuetral axis and L is the length of the column.

b. A pin jointed column of rectangular section is subjected to an axial load of 500 N. The dimensions of the colum is shown in Figure Q2b. The colum is made of Mild steel with E = 210 GPa. Is the column safe under this loading?.

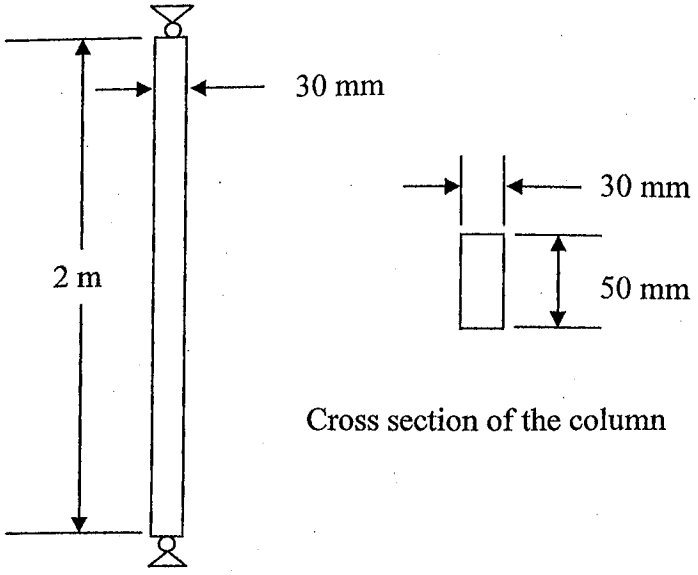

Figure Q2b

3.

c. Consider the stress element shown in Figure Q 3a.

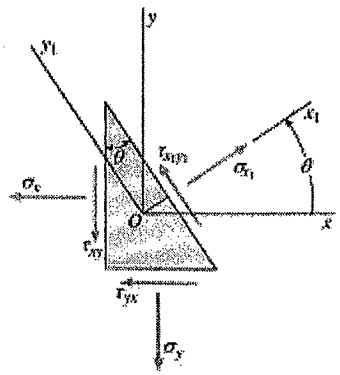

Figure Q3a

Show that the normal stress σ_{x_1} and shear stress $\tau_{x_1y_1}$ at the inclined plane can be expresses as

$$\sigma_{x_1} = \frac{\sigma_x + \sigma_y}{2} + \frac{\sigma_x - \sigma_y}{2}\cos 2\theta + \tau_{xy}\sin 2\theta,$$

$$\tau_{x_1y_1} = -\frac{\sigma_x - \sigma_y}{2}\sin 2\theta + \tau_{xy}\cos 2\theta.$$

Show that the orientation of the principal plane is given by

$$\tan 2\theta_p = \frac{2\tau_{xy}}{\sigma_x - \sigma_y}$$

d. The stresses at a point in a structural element which is subjected to plane stress is shown in Figure Q3b.
   i. Find the Principal Stresses, Maximum Shearing Stress, and the Planes on which they act.
   ii. Represent the stresses (found in *i* above) in a Mohr's circle.

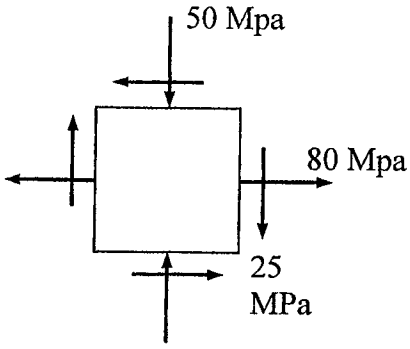

Figure Q3b