Mansoura University,		Final Summer Exam, August- 2018
Faculty of Engineering		Full Marks:50 & Time: 2 Hours
Specific Programs (BME-MTE)		Stress Analysis, L200 – [PDE 281]

Answer all the following THREE QUESTIONS. Assume reasonable values for any missing data.

Question (1): [15 Marks]

A steel column of length (L) and rectangular cross section has a fixed end (B) and supports a centric load at (A) as shown in figure (1). Two smooth and rounded fixed plates restrain end (A) from moving in one of the vertical planes of symmetry of the column, but allow it to move in the other plane.

1. Determine the ratio of (a/b) of the two sides of the cross section corresponding to the most efficient design against buckling.
2. Design the most efficient cross section for the column (find a and b), knowing that a factor of safety of 2 is required. Take L=2000 mm, E=210 GPa and F=10 KN.

Question (2): [15 Marks]

For the 3D stress element shown in figure (2), given that σ_x=100 MPa, σ_y= -80 MPa, σ_z=40 MPa, τ_{xy}=60 MPa, τ_{xz}= -30 MPa and τ_{yz}=50 MPa. (a) Find the three principle stresses. (b) Draw the three Mohr Circles. (c) Determine the maximum shear stress. (d) Prove that:

$$\sigma_y = \frac{E}{(1+\nu)(1-2\nu)}\left[(1-\nu)\varepsilon_y + \nu(\varepsilon_x + \varepsilon_z)\right]$$

Question (3): [20 Marks]

An element on the wall of a thin walled pressure vessel as shown in Figure (3) is subjected to the following stresses: σ_x=160 MPa, σ_y=80 MPa and τ_{xy}=30 MPa. Given: ν=0.35 and E=216 MPa, determine the followings:

a) Planes and Values of Principle Stresses.
b) Planes and Values of Maximum and Minimum Shear Stresses.
c) Planes at which (τ/σ)=max, and find its values of τ and σ.
d) Planes at which (σ/τ)=max, and find its values of τ and σ.
e) Bulk Modulus, Shear Modulus and Maximum and Minimum Shear Strains.

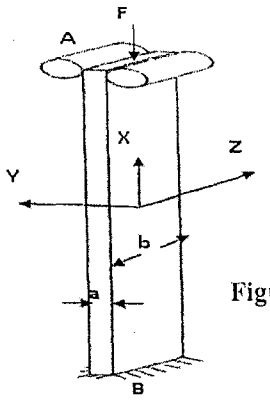

Figure (1)

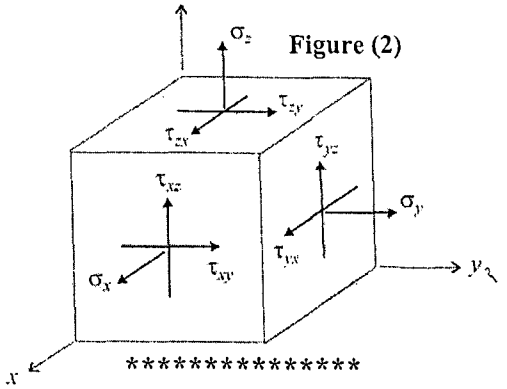

Figure (2)

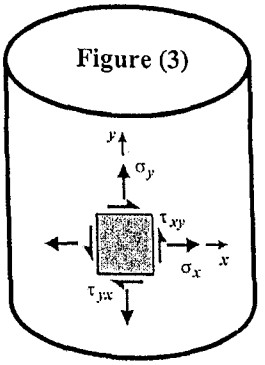

Figure (3)

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The END

Good Luck,
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