



UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

FIRST SEMESTER EXAMINATIONS, DEC 2014

COURSE NO : PE 277

COURSE NAME: STRUCTURES

CLASS : PE II

TIME: 3 HOURS

Name: _____

Index Number: _____

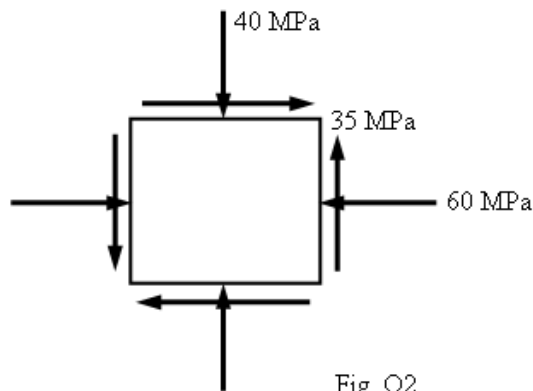
Attempt **THREE** questions in all. Question **ONE** and any other **TWO**.

QUE 1

- (a) What is a structure? [3 Marks]
- (b) Name the ways in which structures are classified. [5 Marks]
- (c) Give the requirements of a good structure. [4 Marks]
- (d) What constitute(s) a live load on a structure? [4 Marks]
- (e) As a structural engineer, what do you think will determine whether or not a structural member is under direct shear? [4 Marks]

QUE 2

Figure Q2 shows a plane-stress element taken from a beam of a temporal wooden structure.



Using Mohr's stress circle, determine:

- (a) The principal stresses on the element and the planes on which they occur. [12 Marks]
- (b) The normal and shearing stresses after the element has been rotated through 25° clockwise. [8 Marks]

QUE 3

- (a) Show, from first principles, that for a closed long cylindrical vessel of internal radius r and wall thickness t subjected to internal pressure p , the hoop and longitudinal stresses are given respectively as;

$$\frac{pr}{t} \quad \text{and} \quad \frac{pr}{2t}$$

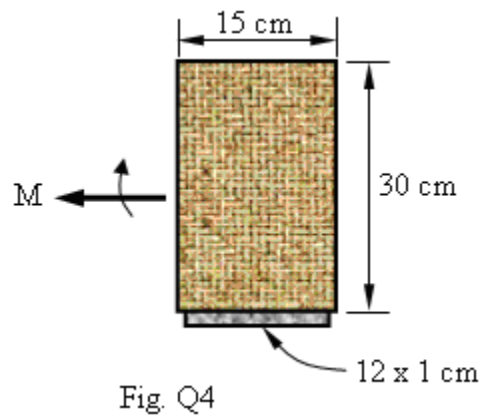
State all the assumptions made.

[10 Marks]

- (b) A cylindrical gas container having an outer diameter of 2.5 m and a wall thickness of 0.025 m is made of steel for which $E = 200 \times 10^3 \text{ N/mm}^2$ and $\nu = 0.3$. If the gauge pressure inside the container increased from 0 to 15 bars, determine:
- (i) The maximum normal stress in the container. [5 Marks]
- (ii) The increase in the diameter of the container. [5 Marks]

QUE 4

The 15×50-cm timber beam (Fig. Q4) has been strengthened by bolting to it the steel reinforcement shown at the bottom. The modulus of elasticity of wood is 12 GPa and for steel is 200 GPa.



- (a) Transform the section into an equivalent timber section and show the appropriate dimensions on your sketch. [3 Marks]
- (b) If the beam is bent about a horizontal axis by a couple of moment $M = 60 \text{ Nm}$, determine;
- (i) The maximum stress in the wood. [12 Marks]
- (ii) The maximum stress in the steel. [5 Marks]

E. M. Seckley / A. Simons