NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF SCIENCE AND TECHNOLOGY EDUCATION

DEPARTMENT OF MECHANICAL ENGINEERING

STRENGTH OF MATERIALS II

PTE 2247

Second Semester Examination Paper

May 2019

This examination paper consists of 6 pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: None

Examiner's Name: **Eng E Murena**

INSTRUCTIONS AND INFORMATION TO CANDIDATE

1. Answer any five (5) questions.
2. Each question carries 20 marks.
3. Use of calculators is permissible.

Question 1

At a point on the surface of a cylinder, loaded by internal pressure, the material is subjected to biaxial stresses σx = 90MPa and σy = 20MPa, as shown on the stress element of figure (a). Using Mohr's circle, determine the stresses acting on an element inclined at an angle θ = 30°. (Consider only the in-plane stresses, and show the results on a sketch of a properly oriented element). **[20Marks]**

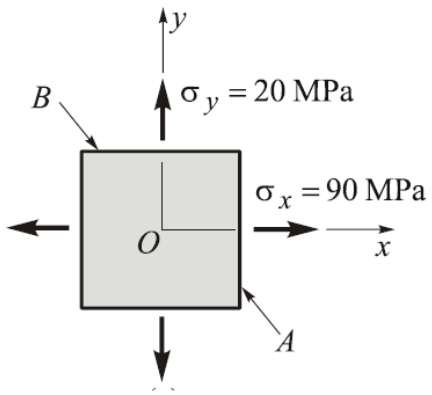

Figure Q1

Question 2

A thin cylinder 60mm internal diameter, 225mm long with walls 2.7mm thick is subjected to an internal pressure of 6MN/m^2 . You may assume that E=200GN/m^2 . Calculate:

i. The hoop stress. **[5Marks]**
ii. The longitudinal stress. **[5Marks]**
iii. The change in length. **[5Marks]**
iv. The change in diameter. **[5Marks]**

Question 3

A cylinder is 150mm mean diameter and 750mm long with a wall 2mm thick. It has an internal pressure of 0.8MPa greater than the outside pressure. Calculate the following:

i. The circumferential strain. **[4Marks]**
ii. The longitudinal strain. **[4Marks]**
iii. The change in cross sectional area. **[4Marks]**
iv. The change in length. **[4Marks]**
v. The change in volume. **[4Marks]**

Question 4

A shaft 50mm diameter with internal diameter 30mm and 0.7 long is subjected to a tourque of 1200Nm. Calculate the shear stress and the angle of twist. If G is 90Gpa. **[20Marks]**

Question 5

A cantilever beam is 6m long and has a point load of 20kN at the free end. The flexural stiffness is 110MNm^2. Calculate the slope and deflection at the free end. **[20Marks]**

Question 6

Determine the shear force *V* and bending moment *M* at the midpoint *C* of the simple beam *AB* shown in the Figure Q6. [**20Marks**]

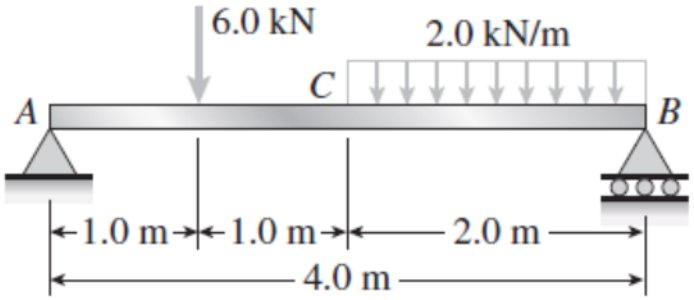

Figure Q6