MACHAKOS UNIVERSITY

University Examinations for 2021/2022 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

SECOND YEAR SPECIAL / SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE (CIVIL ENGINEERING)

ECV 208: STRENGTH OF MATERIALS II

DATE: 30/8/2022 **TIME: 8.30-10.30 AM**

INSTRUCTIONS:

- *This paper comprises of FIVE questions. Answer **THREE** questions*
- *Question one is **compulsory** and carry 30 marks*
- *Answer any other **TWO** questions*

QUESTION ONE (30 MARKS)

a) A 3 mm thick aluminum sheet is cut with a 4cm diameter round punch. If the punch exerts a force of 6kN, what is the shear stress in the sheet (2 marks)

b) A 70kN compressive load is applied to a 5cm diameter ,3 cm tall steel cylinder. Calculate stress, strain and deflection in the cylinder (3 marks)

c) Differentiate between young's modulus and modulus of rigidity (3 marks)

d) An aluminum rod has a cross-sectional area of 0.19635 cm^2 · an axial load of 6kN causes the rod to stretch along its length and shrink across its diameter. What is the diameter before and after loading (3 marks)

e) State the assumptions made while deriving the bending moment equation (4 marks)

f) The state of two-dimensional stress acting on a concrete lamina consists of a direct tensile stress 1.5 N/mm^2 and shear stress 1.20N/mm^2 which causes cracking of concrete. Calculate the tensile strength of the concrete. (3 marks)

g) For the given state of stress σ_x =80MPA σ_y _ -20=MPA and □ =80 MPA,by how much angle (Θ) the stress element should be rotated in order to get the planes of maximum shear stress (3 marks)

h) Differentiate between principal planes and principal stresses (2 marks)

i) Explain why it is not possible to design a structural component permitting stressing up to ultimate stress (3 marks)

j) Write the equation to find out volumetric strain of a rectangular block subjected to external tensional forces (4 marks)

QUESTION TWO (20 MARKS)

a) Define and explain the following terms Bending stress ii) Section modulus (4 marks)

b) Calculate the shear stress at the neutral axis in a beam of triangular section with a base of 40mm and height 20 mm, subjected to a shear force of 3kN (10 marks)

c) A circular steel pipe is of external diameter 60mm and thickness 8mm is used as a simply supported beam over an effective span of 2m. if permissible stress in steel is 150 N/mm2, determine the maximum centroidal load that can be carried by it at mid span (6 marks)

QUESTION THREE (20 MARKS)

a) The state of plane stress at a point is represented by the stress element below.

Determine the stresses acting on an element oriented 30^o clockwise with respect to the original element (8 marks)

$\sigma x = -80$

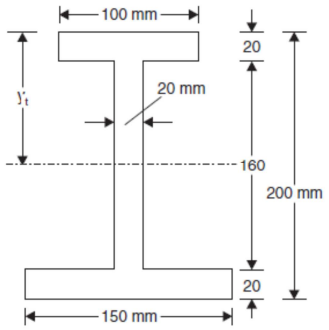
$\sigma y = 50$

shear stress = -25

b) Draw the mohrs circle of the stresses element shown above. Determine the principal stresses and maximum shear stress (12 marks)

QUESTION FOUR (20 MARKS)

The unsymmetric I-section shown in Fig. 21(a) is the cross-section of a beam, which is subjected to a shear force of 60 kN. Draw the shear stress variation diagram across the depth.



QUESTION FIVE (20 MARKS)

A masonry retaining wall of trapezoidal section is 1.5m wide at the top, 3.5m wide at the base and 6m high. The face of the wall retaining earth is vertical and the earth level is upto the top of the wall. The density of the earth is 1600 kg/m^3 for the top 3m and 1800 kg/m^3 below this level. The

density of masonry is 2300 kg/m3. Find the total lateral pressure on the retaining wall per m run and maximum and minimum normal pressure intensities at the base. Take the angle of repose as 30^{o} for both types of earth