MACHAKOS UNIVERSITY

University Examinations for 2021/2022

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

SECOND YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR IN CIVIL ENGINEERING

ECV 208: STRENGTH OF MATERIALS II

DATE: 14/12/2021 **TIME: 11.00-1.00 PM**

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 (COMPULSORY) (30 MARKS)

a) Find the maximum bending stress developed in the steel and wood region of the cross-section in figure 1 (7 marks)

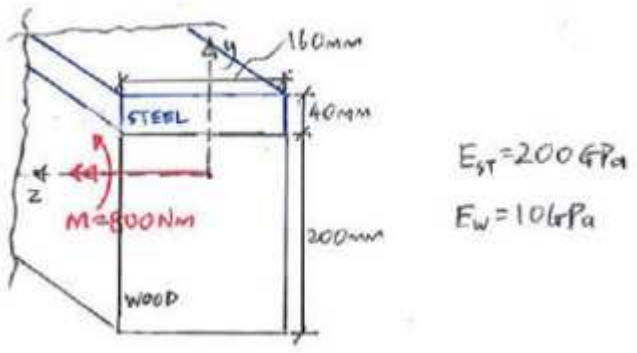

Figure 1

b) Define the term "composite beams" and give three examples. (4 marks)

c) A short column of external diameter 40cm and internal diameter 20cm carries an eccentric load of 80 kN. Find the greatest eccentricity which the load can have without producing tension in the cross- section. (8 marks)

d) Find the maximum shear stress induced in a solid circular shaft of diameter 15cm when the shaft transmits 150 kW power at 180 r.p.m. (5 marks)

e) Discuss three theories of failure. (6 marks)

QUESTION TWO (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.

QUESTION THREE (20 MARKS)

a) A hollow alloy tube 5m long with external and internal diameters 40mm and 25mm respectively was found to extend 6.4mm under a tensile load of 60 kN. Find the buckling load for the tube when used as a column with both ends pinned. Also find the safe load for the tube, taking a factor of safety=4. (10 marks)

b) Determine the crippling load for a T-section of dimensions 10cm*10cm*2cm and of length 5m when it is used as strut with both of its ends hinged. Take Youngs modulus,E=$2.0*10^5$N/mm^2 (10 marks)

QUESTION FOUR (20 MARKS)

A column is rectangular in cross-section of 300mm*400mm in dimensions. The column carries an eccentric point load of 360 kN on one diagonal at a distance of quarter diagonal length from a corner. Calculate the stresses at all four corners. Draw stress distribution diagrams for any two adjacent sides.

QUESTION FIVE (20 MARKS)

a) According to the theory of maximum shear stress, determine the diameter of a bolt which is subjected to an axial pull of 9 kN together with a transverse shear force of 4.5 kN. Elastic limit in tension is 225N/mm2, factor of safety=3 and poisson's ratio=0.3. (10 marks)

b) Determine the diameter of a bolt which is subjected to an axial pull of 9 kN together with a transverse shear force of 4.5 kN using maximum principal stress theory. Elastic limit in tension= 225N/mm^2, factor of safety is 3 and poison's ratio=0.3 (10 marks)