MACHAKOS UNIVERSITY

University Examinations for 2019/2020Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

SECOND YEAR SECOND SEMESTER EXAMINATION FOR

DIPLOMA IN CIVIL ENGINEERING

BCECD 212: STRENGTH OF MATERIALS II

DATE: 11/11/2020 **TIME: 2.00-4.00 PM**

INSTRUCTIONS

- *This paper consists of **Five** questions.*
- *Answer question **ONE** and any other **TWO** questions*
- *Maximum marks for each part of the question are as shown.*

QUESTION ONE (30 MARKS) (COMPULSORY)

a) Figure 1 shows a simply supported rectagular beam 100mm wide X 200mm deep, spanning 4m and carrying a concentrated load of 10kN.

Determine the maximum bending stress induced in the beam. (10 marks)

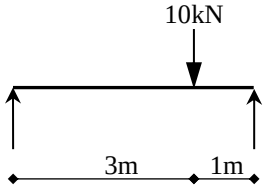

Fig. 1

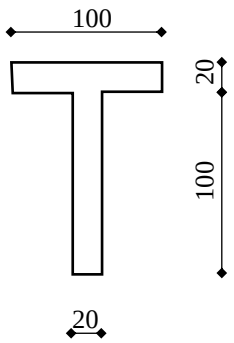

Fig. 2

b) A simply supported beam with a cross section as shown in figure 2 carries a bending moment of 6kNm.

Determine:

i. The maximum tensile stress

ii. The maximum compressive stress (10 marks)

c) The retaining wall shown in figure 3 weighs 22kN/m^3. Calculate the factor of safety against overturning. (10 marks)

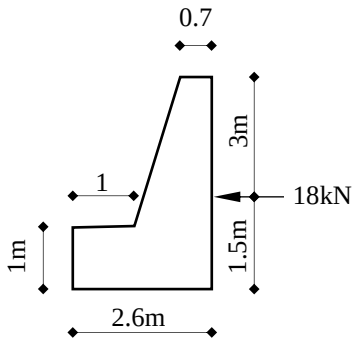

Fig. 3

QUESTION TWO (20 MARKS)

A dam wall having a trapezoidal section retains water as shown in figure 4. Check the stability of the dam with respect to:

a) Tension in the base

b) Overturning

c) Sliding

d) Crushing.

Take unit weight of masonry = 20kN/m^3

Coefficient of friction between dam base and soil = 0.6

Allowable compressive stress = 400kN/m^2

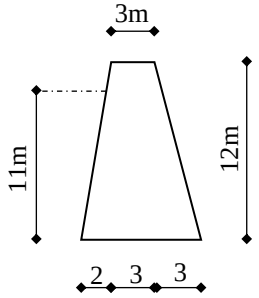

Fig. 4

QUESTION THREE (20 MARKS)

A horizontal cantilever beam 2m long has a T shaped section as shown in figure 2. It carries a uniformly distributed load of 10kN/m along its entire length. Calculate the maximum tensile and compressive stresses.

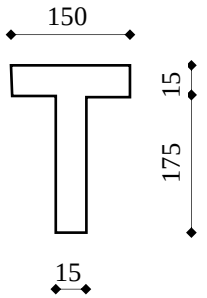

Fig. 2

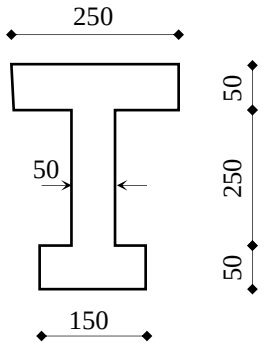

Fig. 3

QUESTION FOUR (20 MARKS)

a) State Four assumptions made in the theory of simple bending. (4 marks)

b) An I - section beam has a cross section as shown in figure 3. It carries a vertical shear force of 100kN. Calculate the shear stress at important points

Draw the shear stress distribution diagram over the depth of the section. (16 marks)

QUESTION FIVE (20 MARKS)

A composite beam consists of a timber section 75mm wide and 150mm deep with a 6mm thick steel plate securely fixed to the bottom face.

a) Calculate the maximum stress in both timber and steel if the section is subjected to a sagging moment of 5kNm.

$E_s = 200kN/mm^2$; $E_t = 12kN/mm^2$

b) If the steel stress must not exceed $120N/mm^2$ and the timber stress must not exceed $14N/mm^2$, determine the maximum moment that the beam can bear.