# MACHAKOS UNIVERSITY

**SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF CIVIL ENGINEERING**

**Second Year Second Semester Special/Supplementary Examination for Diploma in Civil Engineering**

**BCECD 212:**

**STRENGTH OF MATERIALS II**

**Date: 02/08/2019** **Time: 8:30 -11:30 am**

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**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 1 (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)

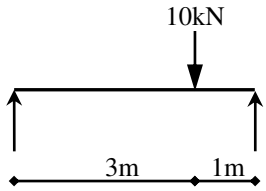


Fig. 1

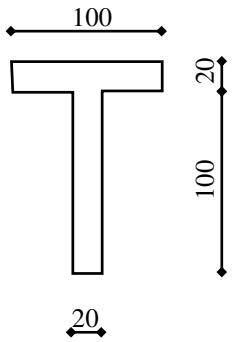


Fig. 2

b) A beam with a cross section as shown in figure 2 is simply supported and carries a bending moment of 6kNm.
Determine:
The maximum tensile stress
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)

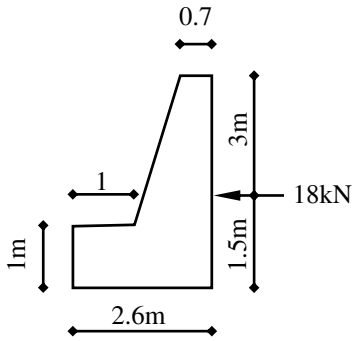


Fig. 3

**Question 2**

A trapezoidal retaining wall having a section as shown in figure 4 weighs 22kN/m$^3$ and retains on its vertical face soil having a density of 16kN/m$^3$ and an angle of repose of $30^0$. The retained soil carries a superimposed vertical load of 9.6kN/m$^3$.

Check the stability of the dam with respect to:

i. Overstressing
ii. Overturning
iii. Sliding

Take μ as 0.6

(20 marks)

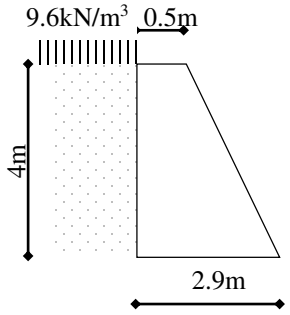


Fig. 4

**Question 3**

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. (20 marks)

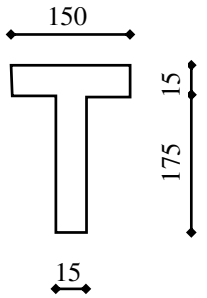


Fig. 2

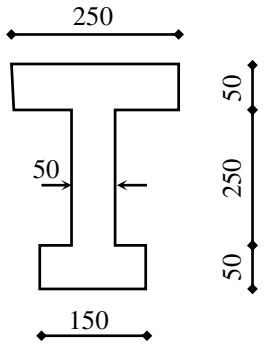


Fig. 3

**Question 4**

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. (20 marks)

**Question 5**

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. (20 marks)