MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ENGINEERING AND TECHNOLOGY

UNIVERSITY ORDINARY EXAMINATION

2020/2021 ACADEMIC YEAR

SECOND YEAR **SECOND** SEMESTER EXAMINATION FOR DIPLOMA IN CIVIL ENGINEERING

UNIT CODE -SEB 1233

UNIT TITLE-STRUCTURES III

DURATION: 2 HOURS

Instructions to candidates:

1. Answer question One and Any Other Two questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

i. Define the following terms:
   a) Slenderness ratio of a column
   b) Modular ratio
   c) Bucking length (6marks)

ii. Outline FOUR assumptions made in Euler's theory of buckling. (4marks)

iii. A beam of length 6m is simply supported at its ends and carries a load of 40kn at a distance of 4m from the left support, find:
   a) The deflection under the load (3marks)
   b) Maximum deflection (3marks)
   c) Point at which this takes place. (4marks)

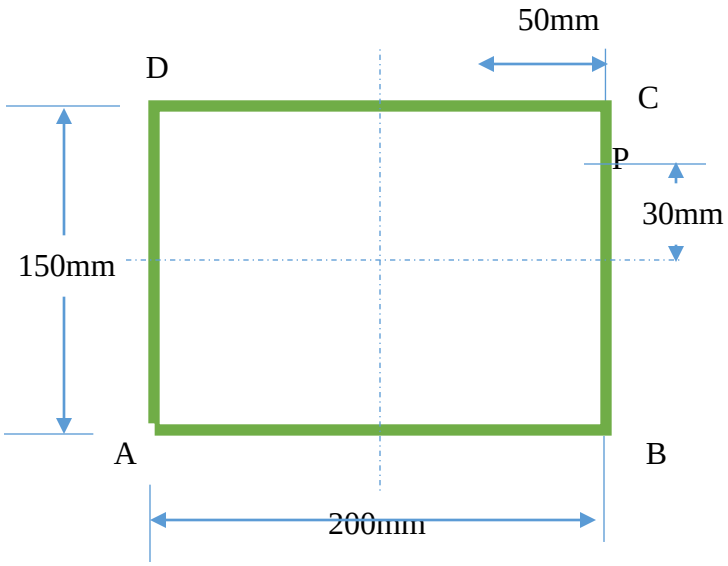
   Given the following

   M.O.I of the beam=$7.33x10^7$ mm^4

   Modulus of elasticity of the beam E=$2x10^5$ kN/mm^2

iv. A rectangular column of width 200mm and of thickness 150mm carries a point load of 240kN at an eccentricity of 30mm from the x-x axis and 50mm from y-y axis as shown below.

Determine the stresses at the corners A, B, C and D.



(10marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

a) A rectangular beam 100mm wide and 200mm deep is subjected to a shear force of 60kn.determine:
   i. Average shear stress (5marks)
   ii. Maximum shear stress. (5marks)

b) Proof that the deflection a cantilever carrying a uniformly distributed load over the whole length is given by:

$$y_b=\frac{wl^4}{8EI}$$

Where y=deflection at the end
l=effective length of the beam
w=uniformly distributed load.
E=modulus of elasticity
I=moment of inertia. (10marks)

QUESTION THREE (20 MARKS)

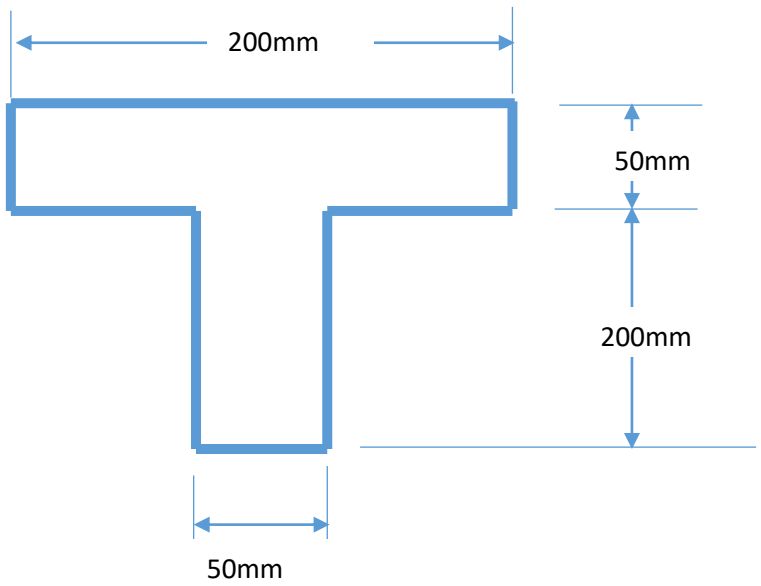
a) A column of timber section 15mmx20mm is 6m long both ends being fixed. If the young's modulus for timber is 17.5 kN/mm^2 , determine using Euler's formula
   i. The crippling load.
   ii. Safe load for the column if factor of safety is 3. (10marks)

b) A hollow cast iron column whose outside diameter is 200mm and a thickness of 20mm is 4.5m long and is fixed at both ends. Calculate the safe working load by Rankins Gordons formula using a factor of safety of 4.
Take f_c=550n/mm^2, a=$1/1600$ in Rankine's formula and E=9.4x10^{4}kN/mm^2
(10marks)

QUESTION FOUR (20 MARKS)

a) Proof that the shear distribution in a rectangular section of a beam which is subjected to shear force F is given by
$q=\frac{F}{2J}(\frac{d^2}{4}-y^2)$ where:
q=stress distribution
I=moment of inertia
d=depth of the section
y= distance from the neutral axis of the point considered. (8marks)

b) Plot the horizontal shear stress distribution diagram for the T- beam shown in fig 2 under a shear stress force of 100kN.
(Dimensions in mm) fig 2



(12marks)