# MURANG'A UNIVERSITY OF TECHNOLOGY

## SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

UNIVERSITY ORDINARY EXAMINATION

2018/2019 ACADEMIC YEAR

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

**SEB1233: STRUCTURES III**

DURATION: 2 HOURS

DATE: 17/12/2018

TIME: 9.00 - 11.00 A.M

**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.

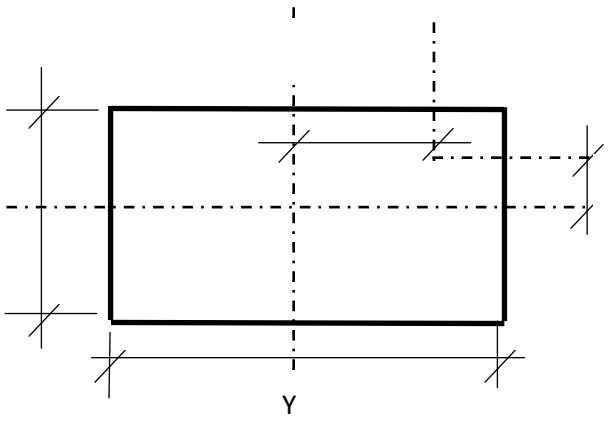
## SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

## QUESTION ONE (30 MARKS)

a) Define the following terms
   i. Slenderness ratio of a column
   ii. Radius of gyration
   iii. Buckling length
   iv. Perfect frame **(8mrks)**

b) Outline four assumptions made in derivation of Euler's' buckling load formula **(4mrks)**

c) A rectangular column of width 20mm and of thickness of 150mm carries a point load of 240KN at a point P at an eccentricity of 30mm from the X-X axis and 50mm from the Y-Y axis as shown below. Determine the stress at the corners A,B,C,D ( All dimensions are in mm) **(8mrks)**




d) A frame ABCD carries loads of 10KN and 12KN as shown below. Using the method of section calculate
   i. The reactions at supports A and B **(4mks)**
   ii. The forces in the members marked 4, 5, and 7 and state their nature **(6mrks)**

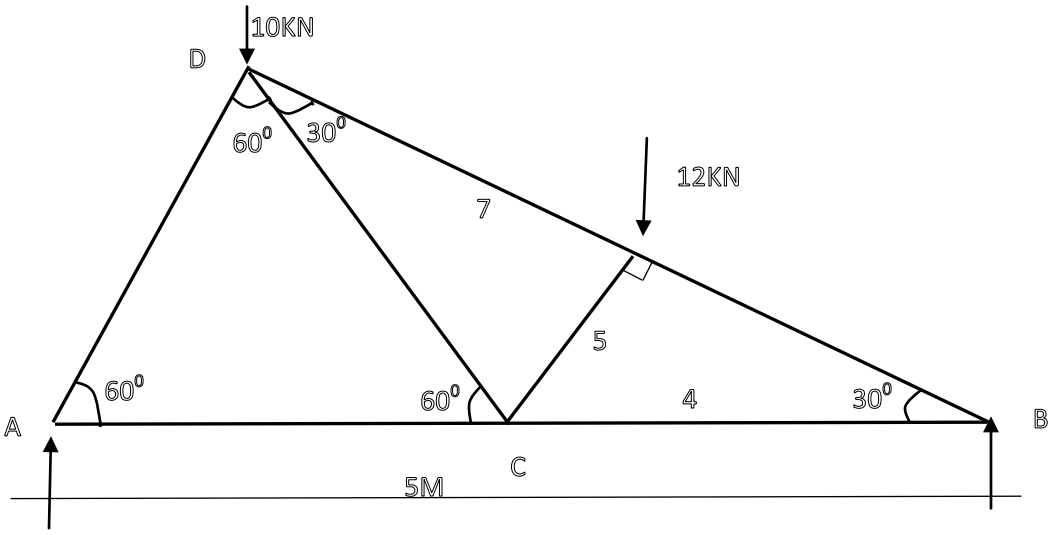



Fig. 2

**SECTION B: ANSWER ANY TWO QUESTIONS IN THIS SECTION**

## QUESTION TWO (20 MARKS)

a) Rectangular beam 100mm wide and 150mm deep is subject to a shear force of 30KN
Determine:
   i. Average shear force **(5mrks)**
   ii. Maximum shear force **(5mrks)**

b) Proof that the deflected load over the whole length is given by $Y=\frac{WL^4}{8EI}$

Y= deflection at the end
L= effective length of beam
W= uniformly distributed load
E= modulus of electricity
I= moment of inertia of the section **(10mks)**

## QUESTION THREE (20 MARKS)

a) A column of timber section 10mm by 150mm is 6m long both end being fixed. If the young's modules of elasticity for timber is 175KN/mm$^2$ determine using Euler'sformula
   i. The crippling load **(7mrks)**
   ii. Safe load for the column if factor of safety is 3 **(3mrks)**

b) A hollow cast iron column whose outside diameter is 200mm and the thickness of 20mm is 4.5m long and is fixed at both ends. Calculate the safe load by Rankins' formula using a factor of safety of 4.

c) Given
$f_c$= 550N/mm$^2$
A=$\frac{1}{1600}$ in Rankine's formula
E= 9.4x104KN/mm$^2$ **(10mrks)**

## QUESTION FOUR (20 MARKS)

a) A cantilever frame shown below carries a load of 10KN at C. Determine the forces on the parameters. **(10mrks)**

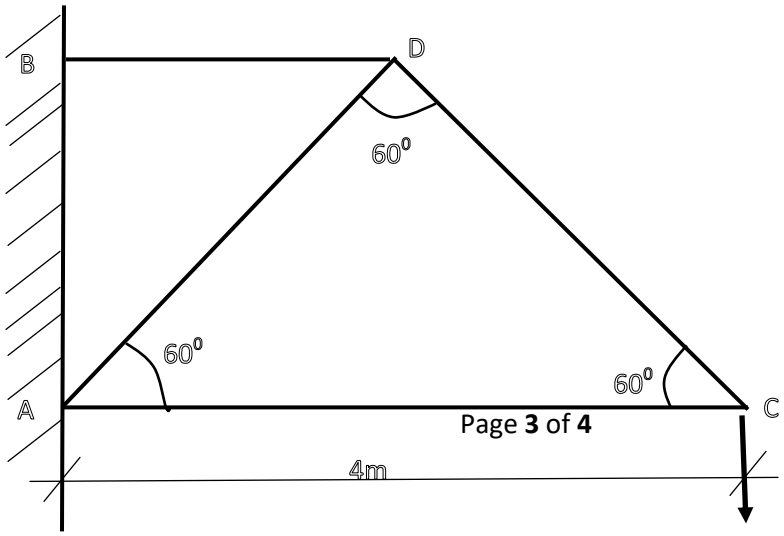



Fig. 3

b) Show the central deflection of a beam which bends in a circular are given by **(10mrks)**

$y=\frac{mL^2}{8EI}$

Where
y= central deflection
L= effective length of the beam
M= bending moment
E= module of elasticity
I= moment of inertia