



# MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF ENGINEERING  
DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

SECOND YEAR FIRST SEMESTER EXAMINATION FOR DIPLOMA IN CIVIL  
ENGINEERING

**BCECD 204: THEORY OF STRUCTURES I**

**DATE: 11/12/2017**

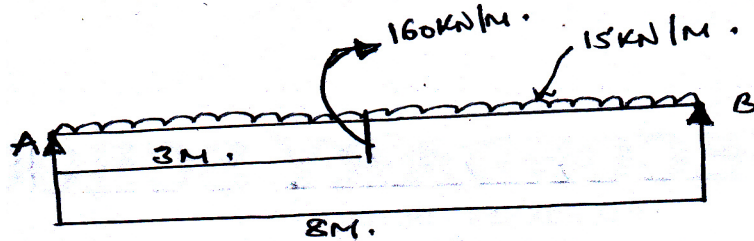
**TIME: 8.30-10.30 AM**

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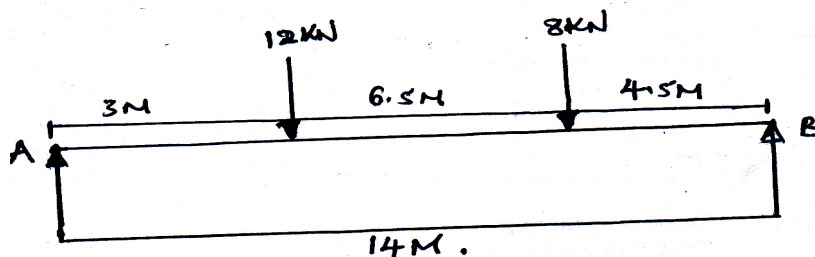
## INSTRUCTIONS

**Answer Question One and Any Other Two Questions**

1.
  - a) Explain the following types of stresses as in columns and struts
    - i. Direct compression stress
    - ii. Buckling stress (4 marks)
  - b) Differentiate the following
    - i. Actual length
    - ii. Effective length (4 marks)
  - c) A solid round bar 3m long and 5m in diameter is used as a strut with both ends hinged. Determine the crippling load take  $E=2.0 \times 10^5 \text{ N/mm}^2$  (7 marks)
  - d) Derive an expression with the aid of a diagram to show that radius of gyration  $r_{xx}=d/4= r_{yy}$  (3 marks)
  - e) A horizontal beam AB is freely supported at A and B 8m apart and carries a uniformly distributed load of 15KN/m. A clockwise moment of 160KN/M is applied to the beam at a point C<sub>1</sub> 3m from the left hand support A. Calculate the slope of the beam at C<sub>1</sub> if  $EI=40 \times 10^3 \text{ KN/M}^2$  (12 marks)



2.
  - a) A circular column of 200mm diameter is subjected to a load of 300kN, which is acting 5mm away from the geometric centre of column. Find the maximum and minimum intensities in the section (5 marks)
  - b) Explain the following elasticities
    - i. Section modulus of elasticity
    - ii. Modulus of elasticity (4 marks)
  - c) State four assumptions of Euler's theory (8 marks)
  - d) Explain the term crippling load (3 marks)
  
3. A short hollow cylindrical cast iron column of outside diameter 300mm and inside diameter 200mm was casted. On inspection, it was found the bore is eccentric in such a way that the thickness on one side is 70mm and 30mm on the other. If the column is subjected to a load of 80kN at the axis of the bore, find the extreme intensities of stresses in the base (20 marks)
  
4. a) A timber beam of rectangular section has a span of 4.8 metres and is simply supported at its ends. It is required to carry a load of 45kN uniformly distributed over the whole span. Find the values of breadth (b) and depth (d) of the beam if maximum bending stress is not to exceed 7Mpa and maximum deflection is limited to 9.5mm. Take E for timber as 10.5 Gpa.
  
5. A horizontal steel girder having uniform cross section is 20m long and simply supported at its ends. It carries two concentrated loads as shown below.



Calculate deflections of the beam under the loads C and D. Take  $E = 200 \times 10^3 \text{ N/mm}^2$  and  $I = 160 \times 10^6 \text{ mm}^4$  (20 marks)