



MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2015/2016

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

SECOND SEMESTER EXAMINATION FOR DIPLOMA IN CIVIL ENGINEERING

BCECD 119: STRENGTH OF MATERIALS I

Date: 12/8/2016

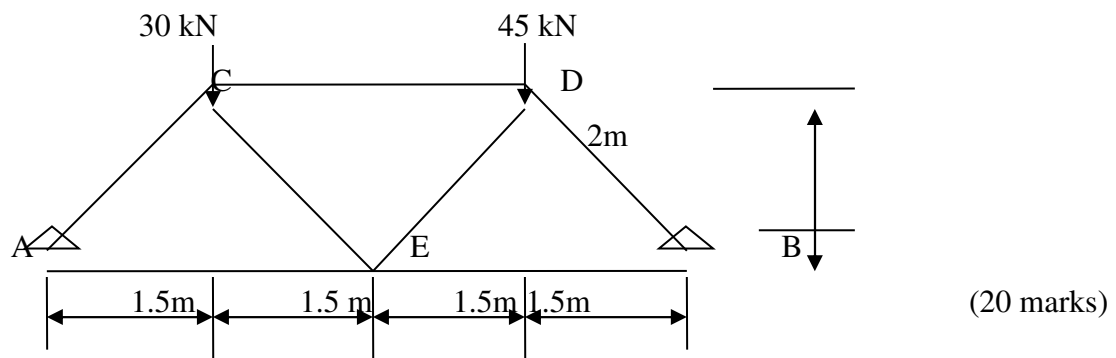
Time: 2:00 – 4:00 PM

INSTRUCTIONS:

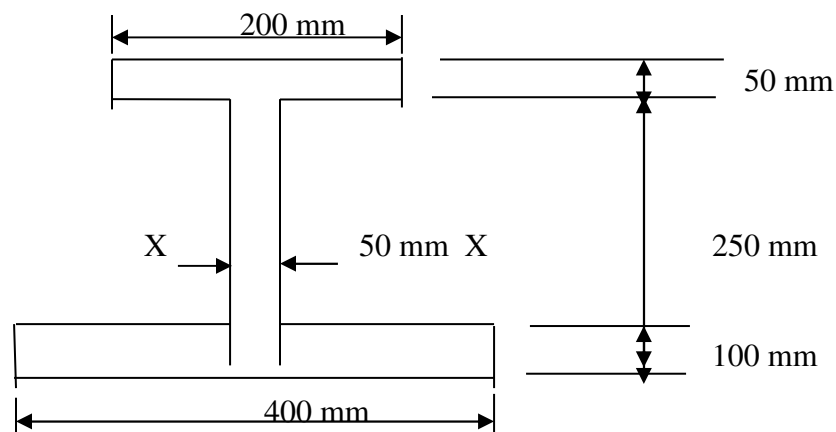
*This paper comprises of **five** questions. Question **one** is **compulsory** and carries 30 marks.
Answer any **other two** questions*

1.
 - a) Illustrate four types of beam supports (4 marks)
 - b) Define the following terms
 - i. Stress
 - ii. Strain
 - iii. Limit of proportionality
 - iv. Elastic limit
 - v. Plastic range (7½marks)
 - c) Plot the graph of stress against strain for a mild steel bar tested to destruction indicating all salient points (6½marks)
 - d) A short concrete column of 350mm square section is reinforced with four 20mm diameter bars and carries an axial load of 800 kN. Calculate the stresses in steel and concrete. Take $E_{\text{steel}} = 210 \text{ kN/mm}^2$ $E_{\text{concrete}} = 14 \text{ kN/mm}^2$ (6 marks)

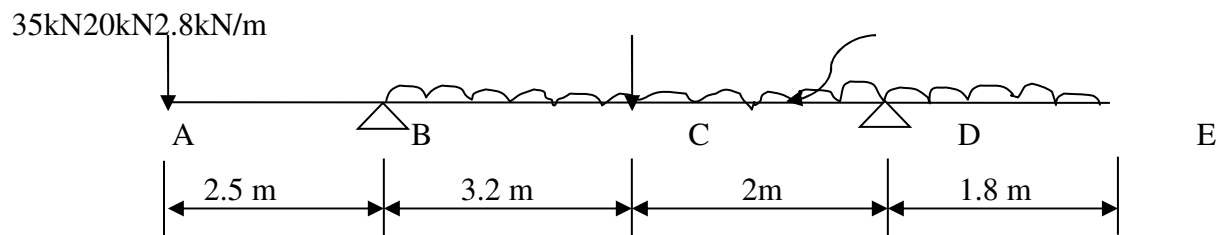
- e) Calculate the cross-sectional dimensions of a square column that is axially loaded with 360 kN given the permissible stress as 7 N/mm^2 (6 marks)
- 2 a) Find the Young's modulus of a brass rod of diameter 25mm and of length 250mm which is subjected to a tensile load of 50kN when the extension of the rod is 0.3mm. (6 marks)
- b) Show that Young's Modulus $E = \frac{PL}{A.\delta L}$ (8 marks)
- 3 Using the method of joint resolution determine the magnitude and nature of forces for each member of the pin-jointed frame shown below.



4. a) The figure below shows the cross-section of a steel member. Determine the following;
- Centre of area
 - Second moment of area about both principal axes
 - Minimum section modulus
 - Least radius of gyration
- (14 marks)



- b) Calculate the safe moment of resistance of the beam section shown in the figure above if the stresses in the upper and lower flanges are limited to 30 N/mm^2 and 20 N/mm^2 respectively. (6 marks)
5. a) Define the following terms
- Shear force
 - Bending moment (2 marks)
- b) The figure below shows details of a loaded beam ABCDE.



- Sketch the shear force and bending moment diagrams for the beam indicating the values at critical points
- Determine the positions of the point of contraflexure (18 marks)