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 212: STRENGTH OF MATERIALS II

Date: 3/8/2016 **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) A T-shaped steel section of dimensions 100mm x 100mm x 20mm carries load of 50kN and has a moment of inertia about is horizontal neutral axis is 3.142 x 10^6 mm^4. If the beam section is as shown in figure 1 below, calculate the shear stresses at;
   i. The neutral axis
   ii. The junction of the web and the flange
   iii. Also plot the stress distribution diagram showing values at critical points

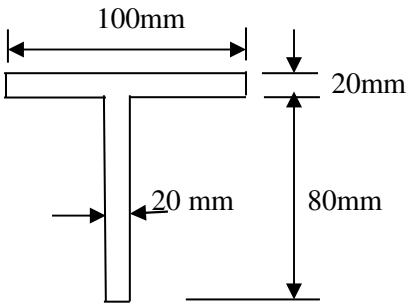


FIGURE 1

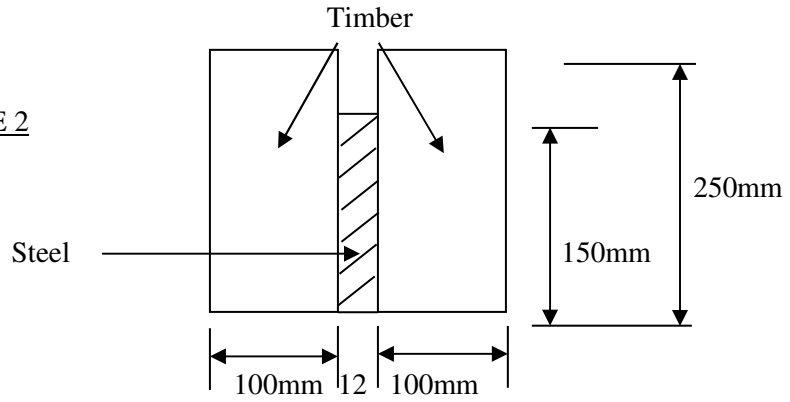
(20 marks)

b) A simply supported beam carries a uniformly distributed load of 40kN/m over the entire span. The section of the beam is rectangular and has a depth of 500mm. if the maximum stress in the material of the beam is 120N/mm^2 and the moment of inertia of the section is 7 x 10^8 mm^4, determine the span of the beam. (10 marks)

2 a) Using timber and steel as relevant examples, show that the total moment of resistance for a composite beam section is given by $M = \left[\frac{f_t}{y}(MI_s + I_t)\right]$ (8 marks)

b) A flitched beam is simply supported over a span of 5 m and carries a uniformly distributed load of 2 kN/m over the entire span. If the beam cross-section is as shown in figure 2 below, determine the maximum tensile and compressive stresses developed in both the materials due to the loading. (Take E_s = 210 kN/mm^2 and E_t = 10 kN/mm^2).

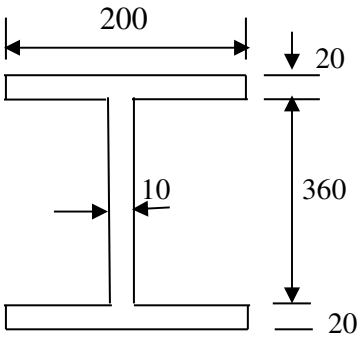
FIGURE 2



(12 marks)

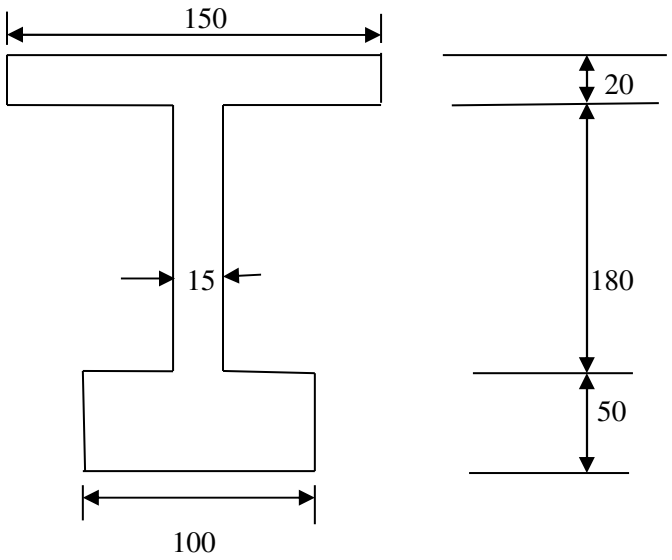
3 A rolled steel joist of I - section has dimensions as shown in figure 3 below and carries a uniformly distributed load of 40kN/m run on a span of 10m, calculate the maximum stress produced due to bending.

FIGURE 3



(20 marks)

4. a) Calculate the stresses, bending and shear for the beam shown below if the beam is simply supported 6m long and carries a uniformly distributed load of 40 kN/m over its entire span. Also sketch the shear stress variation diagram for the section. (14 marks)



b) Calculate the safe moment of resistance of the beam section shown in the figure in 4 (a) 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) Explain four assumptions made in the theory of simple bending (8 marks)

b) A 406mm x 152mm x 60kg U.B section used as a simply supported beam has an effective span of 6m and carries a total uniformly distributed load of 176.6 kN.

i. Calculate the stress in the beam at a point 102 mm beneath the top of the compression flange at a beam section 1m from the left support

ii. Draw a stress variation diagram of the beam at the given section (take Z_{xx} for the given U.B = 1011cm^3) (12 marks)