UNIVERSITY of RWANDA

COLLEGE OF SCIENCE AND TECHNOLOGY

SCHOOL OF ENGINEERING (SoE)

DEPARTMENT OF CIVIL, ENVIRONEMNTAL AND GEOMATICS ENGINEERING (CEGE)

TRE1262 MECHANICS OF MATERIALS

Assignment 2

Date: 31/03/2025 **Total Marks: 280**

Deadline of submission is on 05/05/2025 at 10:59 AM at phabimana@ur.ac.rw for soft copies and handing in the hard copies to the lecturer in class.

QUESTION 1 [50 Marks]

A flanged-shaped flexural member is subjected to an internal axial force (P) of 18 kN, an internal shear force (V) of 32 kN, and an internal bending moment (M) of 7.2 kNm as shown in **Figure 1** below. The cross-sectional dimensions of the shape as shown in **Figure 1** are d = 106 mm, b_1 = 90 mm, b_2 = 48 mm, t_f = 8 mm, t_w = 8 mm, c = 32 mm and a = 24 mm. Determine the principal stresses and the maximum shear stress acting at points H and K. Show these stresses on an appropriate sketch for each point.

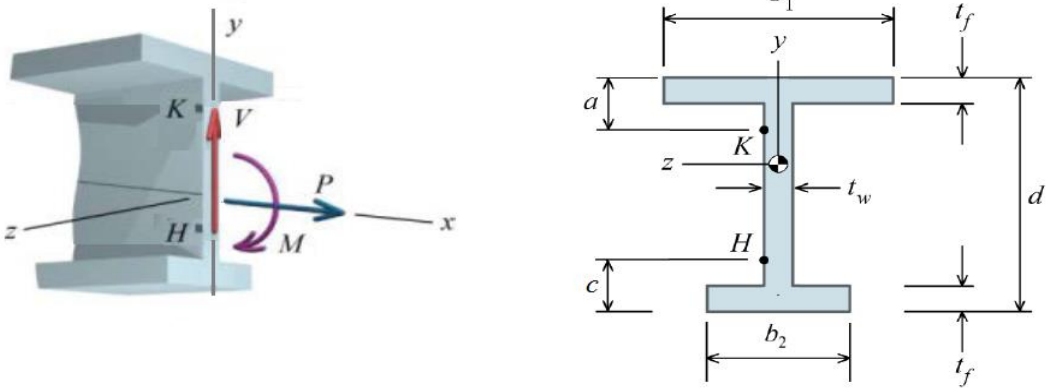


Figure 1.

QUESTION 2 [70 Marks]

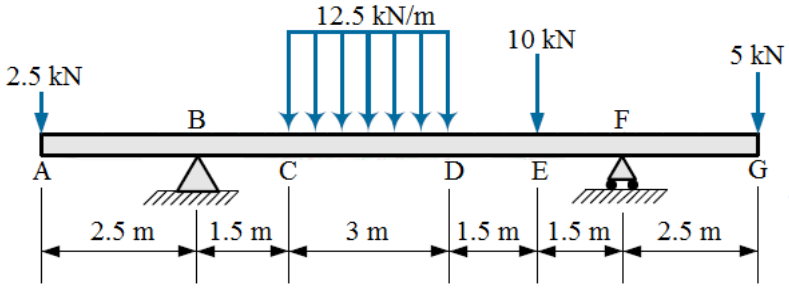
a. Referring to the beam shown in **Figure 2** below, do the following tasks:

By the method of section, draw the shear force and the bending moment diagrams. Mark the **silent points** on SFD and BMD (determine the **contra-flexure points**), if any.

Determine the bending and shear stresses at points H and K horizontally located at C and D, and vertically located at c above the bottom edge of the beam and a below the edge of the beam respectively.

The cross-sectional dimensions of the shape as shown in **Figure 2** are d = 106 mm, b_1 = 90 mm, b_2 = 48 mm, t_f = 8 mm, t_w = 8 mm, c = 32 mm and a = 24 mm.

Show clearly each step of the work up to the final solution. **[50]**



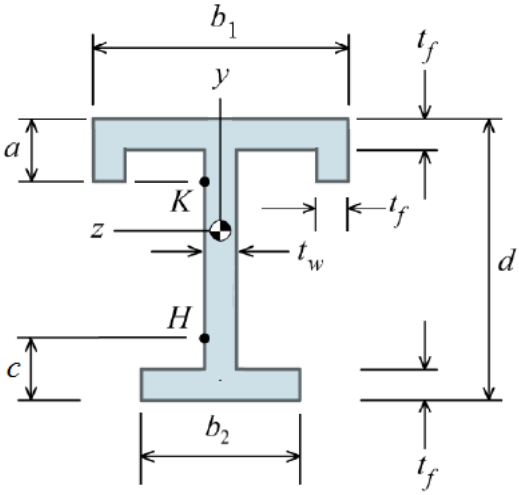
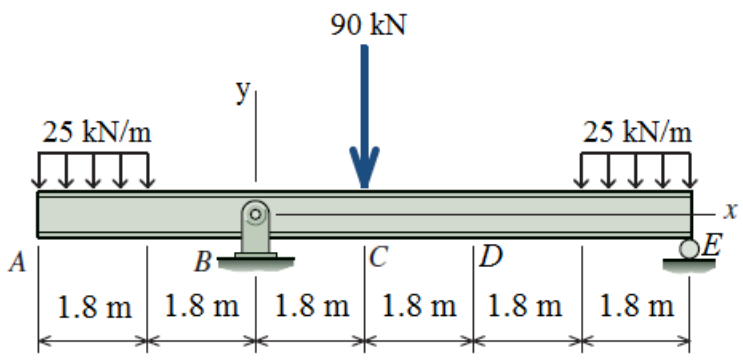


Figure 2.

b. Determine the principal stresses and the maximum shear stress acting at points H and K. Show these stresses on an appropriate sketch for each point. **[20]**

QUESTION 3 **[95 Marks]**

Referring to the beam shown in **Figure 3** below, do the following tasks:



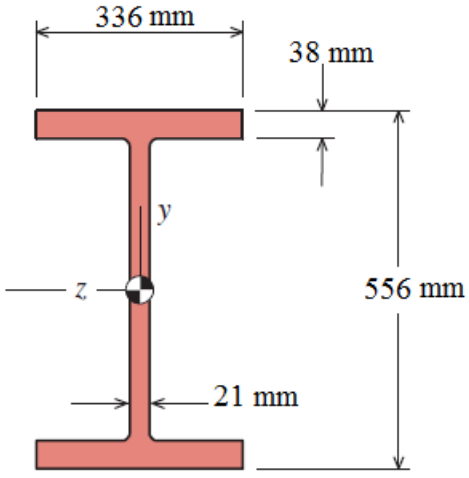


Figure 3.

i. By the method of section, draw the shear force and the bending moment diagrams. Mark the **silent points** on SFD and BMD (determine the **contra-flexure points**), if any. **[18]**

ii. Determine the **bending** and **shear stresses** at points H and K horizontally located at C and at to 2 m from A , and vertically located 78 mm below the top edge of the beam (on C point) and 58 mm above the bottom edge of the beam (at 2 m from A). **[24.5]**

iii. Draw the **shear stress profile** at 1 m from C, considering at least six (6) equal intervals in the entire web and two (2) equal intervals in each flange of the cross section beam shown on the **Figure 3** above. **[15]**

iv. By **discontinuity functions method**, determine the **deflection** under point A, C and D. Also determine the maximum deflection. Take E = 2.1 x 10^5 MPa. **[37.5]**

Note: Show clearly each step of the work up to the final solution.

QUESTION 4 [65 Marks]

Referring to the beam shown in **Figure 4** below. By the method of section, draw the shear force and the bending moment diagrams.

Mark the **silent points** on SFD and BMD (determine the **contra-flexure points**), if any.

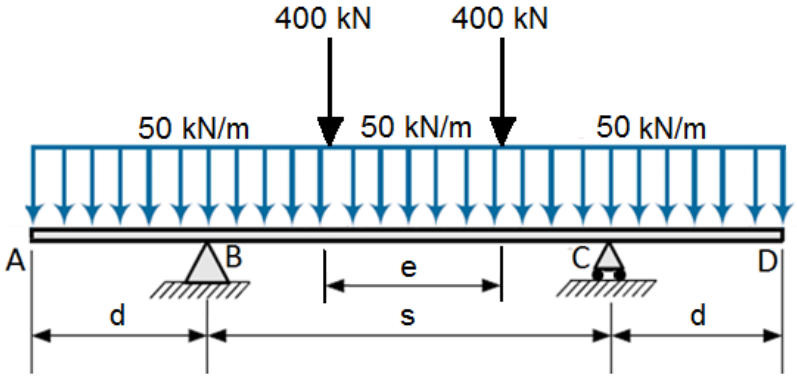


Figure 4.

i. If d = 2.4 m, e = 2 m and s = 4 m
ii. If d = 2 m, e = 2 m and s = 4 m
iii. If d = 1.6 m, e = 2 m and s = 4 m
iv. Comment on results obtained in (**i**), (**ii**) and (**iii**). Deduce similarities and differences. What can you say about supports positioning?

Instructions:

1. ***You should work in small groups of students, and please do not exceed the maximum number of 7 students for each group.***
2. ***The report should be simple, concise and clean.***
3. ***Present your work in a legible writing and organized format.***
4. ***Submit the soft copies at UR E-learning platform by 10:59 AM on 05/05/2025.***
5. ***Under no circumstances a late submission can be accepted.***
6. ***Submit the hard copies by 10:59 AM in class (Muhazi – 0R05).***

BREAK A LEG!!!!!!!!!!!!!!!!!!