THE UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TUTORIALS QUESTIONS

APRIL 2023

CEE 3211– MECHANICS OF MATERIALS

Q1. Figure Q1 shows a beam with an inverted tee-shaped cross section is subjected to positive bending moments of $M_Z = 5$ kN·m. The cross-section of the beam is shown to the right of the figure with dimensions as shown. Determine:

a. The location of the centroid, the moment of inertia about the z axis, and the controlling section modulus about the z axis.
b. The bending stress at points H and K. State whether the stress is tension or compression.

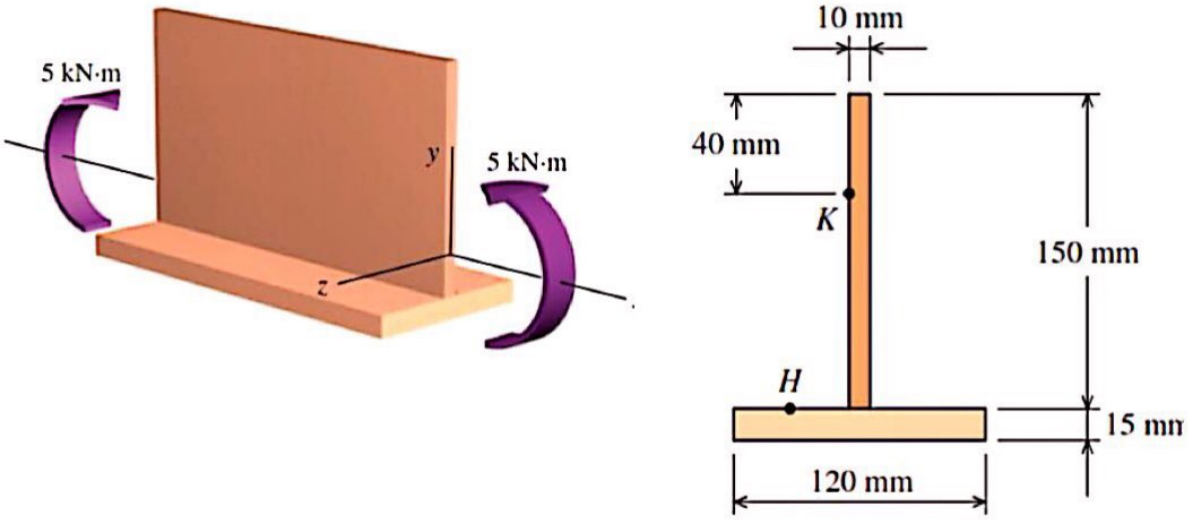

Figure Q1

Q2 An 8-m long simply supported timber beam shown in Fig Q2 carries a uniformly distributed load of 4 kN/m. The beam has a rectangular cross-section (400mm deep and 250mm wide).

Determine the maximum compression bending stress that occurs in the beam at any location within the 8-m span length.

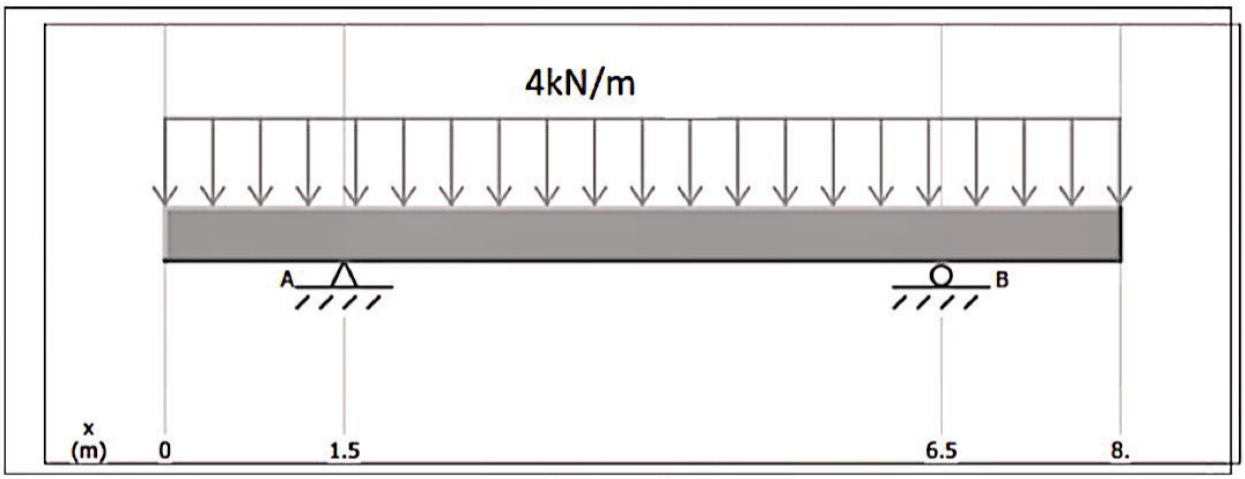

Figure Q2

Q3. Figure Q3 shows a steel T – beam that has been strengthened by securely bolting to it the two oak timbers shown. The modulus of elasticity is 12.5 GPa for the wood and 200 GPa for the steel. Knowing that a bending moment $M = 50$ kN.m is applied to the composite beam'

a. Sketch the transformed section and obtain the centroidal moment of inertia
b. Determine the maximum stress in the wood
c. Determine the stress in the steel along the top edge.

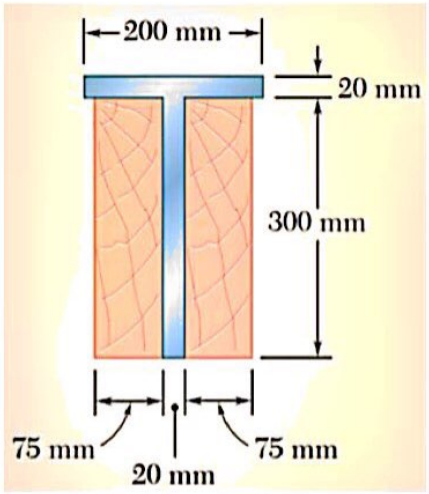

Figure Q3

Q4 A bar, shown in Fig Q4, having the cross section shown has been formed by securely bonding brass and aluminum stock. Using the data given below, determine the largest permissible bending moment when the composite bar is bent about a horizontal axis.

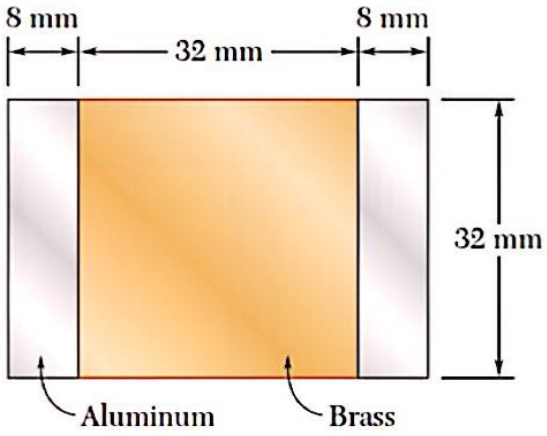

Fig Q 4