UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING

MEC 3351 – STRENGTH OF MATERIALS I
Assignment – Impact **Due Date: 17th May 2024**

Answer **ALL** questions but you will be advised which solutions to submit on the due date.

1. An unknown weight falls through 1cm on a collar rigidly attached to the lower end of a vertical bar 3m long and 6cm^2 in cross-section. If the maximum instantaneous extension is known to be 2mm, what is the corresponding stress and value of the unknown weight? Take E=2.0x10^{6}kg/cm^2

2. Two round bars *a* and *b* are each 38cm long. Bar *a* is 2.5cm diameter for a length of 13cm and 5cm diameter for the remaining. Bar *b* is 2.5cm diameter for a length of 25cm and 5cm in diameter for the remaining 13cm length. Bar *a* receives a blow which produces a maximum stress of 1574 kg/cm^2. Find the maximum stress produced by the same blow on *b*. Compare the maximum energy that can be stored in these bars with that in a bar of uniform diameter of 3.8cm and height 38cm.

3. A weight W = 500kg falls axially from a height h = 1m upon a vertical wooden pole 6m long and 30cm in diameter, fixed at the lower end as shown in Figure Q3. Determine the maximum stress in the pole assuming the weight of the pole is 400kg and modulus of elasticity E for wood as 1x10^{5}kg/cm^2.

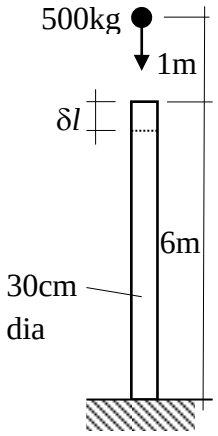

Figure Q3

Dr. C.G. Chizyuka
2024

4. A weight W = 1kg in the form of a ring falls through height h = 5cm on a collar attached at the end of a wire of cross-sectional area of $10mm^2$ as shown in Figure Q4. Neglecting weights of wire and collar, find the maximum stress developed in the wire.

   Show that the maximum stress is less for a wire of greater length. Take E = $2x10^6$ kg/cm^2.

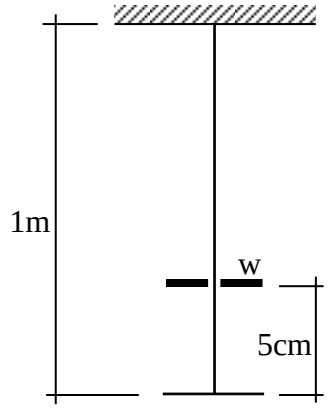

Figure Q4

5. A member is formed by connecting a steel bar to an aluminium bar as shown in Figure Q5. Assuming that the bars are prevented from buckling sidewise, calculate the magnitude of the force *P* that will cause the total length of the member to decrease by 0.25mm. The values of elastic constants for steel and aluminium are 2100 tonnes/cm^2 and 700 tonnes/cm^2 respectively. What is the total work done by force *P*?

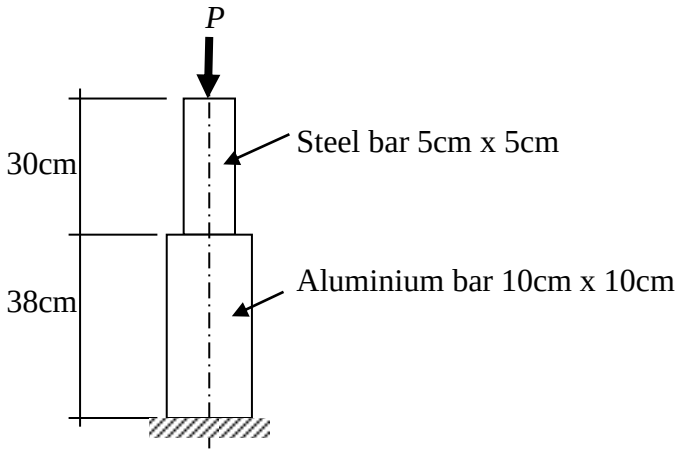

Figure Q5