UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING

MEC 3351 – STRENGTH OF MATERIALS I
Assignment – Columns & Struts **Due Date: 3rd May 2024**

Answer **ALL** questions but only two will be attempted and submitted on the due date upon advice by the course lecturer.

1. Two brass rods used as compression members, each of 3m effective length, have the cross section shown in Figure Q1.
   a. Determine the wall thickness of the hollow square rod for which the rods have the same cross-section area.
   b. Using E=105 GPa, determine the critical load of each rod.

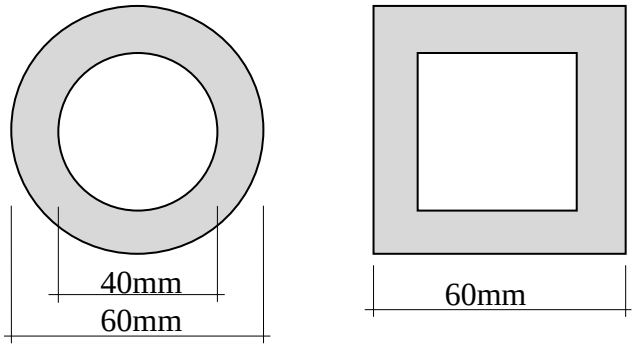

Figure Q1

2. A compression member of 7m effective length is made by welding together two L152x102x12.7 angles as shown in Figure Q2. Using E=200 GPa, determine the allowable centric load for the member if a factor of safety of 2.2 is required. (You may check for undefined standard specification for the given section)

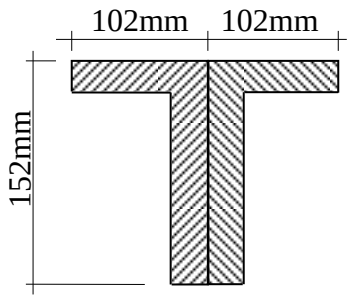

Figure Q2

3. Each of the five columns consists of an aluminium tube that has a 32mm outer diameter and a 4mm wall thickness. Using E=70GPs and a factor of safety of 2.3, determine the allowable load P_{all} for each support condition shown in Figure Q3.

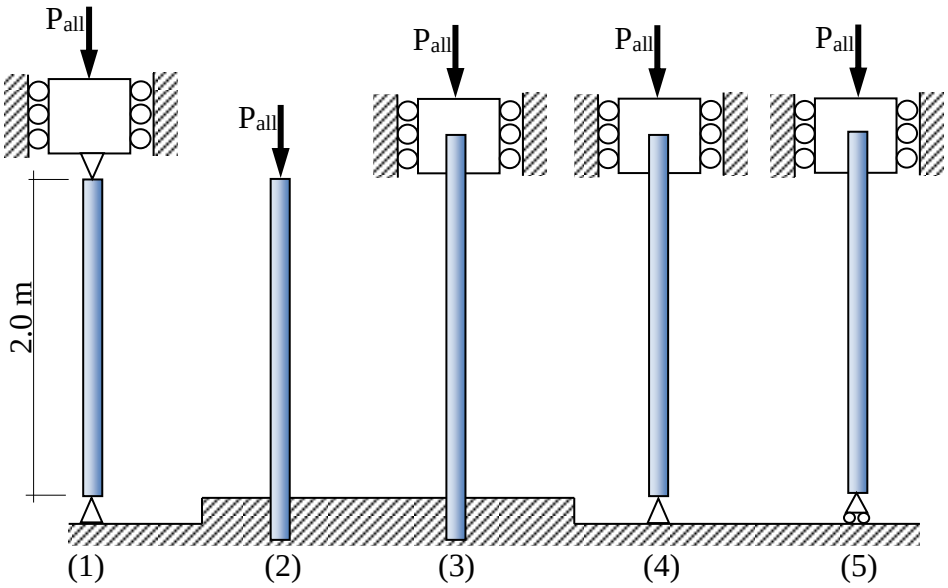

Figure Q3

4. Knowing that P = 5.2kN, determine the factor of safety for the structure shown in Figure 4. Use E=200GPa and consider only buckling in the plane of the structure.

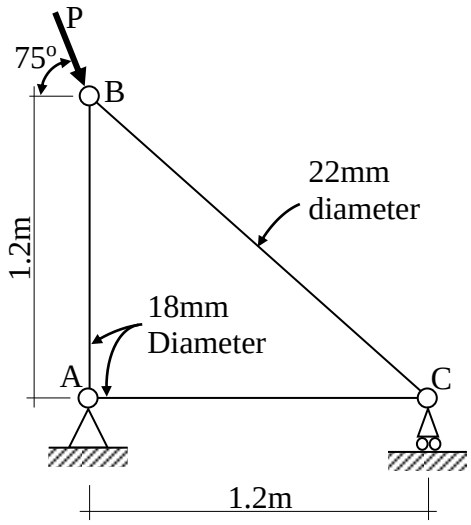

Figure Q4

5. Prove that the crippling load for a column of length *l*, with both ends fixed, is equal to

$$P_{cr} = \frac{4\pi^2 EI}{l^2}$$