



**ME-233 (Mechanics of Materials-I)**  
**Problem Sheet #7 (Theory of Columns)**

**Pb.1** A hollow alloy tube 4m long with outer and inner diameters of 40mm & 25mm respectively, was found to be extend 4.8mm under the tensile load of 60KN. Find the buckling load for the tube with both ends pinned. Also find the safe load for the tube using factor of safety 5. **(4.29 KN, 0.858 KN)**

**Pb.2** A T-Section 150mm \* 120mm \* 20mm as shown in Fig. is used as a strut of 4m long with hinged at its both ends. Calculate the crippling load, if  $E= 200$  GPa. **(702 KN)**

**Pb.3** A square bar is made from PVC plastic that has  $E = 9$ GPa & a yield strain of 0.001 mm/mm. Determine its smallest dimensions 'a' so it does not fail from elastic buckling. It is pinned at its ends & has a length of 1250 mm. **(43.59mm)**

**Pb.4** A rod is made from Polyurethane has a stress – strain diagram as shown. If the rod is pinned at its ends & 1m long, determine the smallest diameter so it does not fail from elastic buckling. Also Solve considering that the rod is pinned from one end & fixed from other end. **(69.74mm) (48.82mm)**

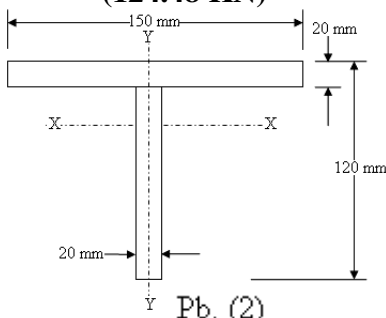
**Pb.5** A steel column has a length of 5m & is fixed at both ends. If the X-sectional area has dimensions shown, determine the critical load. Take  $E= 200$  GPa. **(272.138 KN)**

**Pb.6** Determine the maximum force  $P$  as shown that can be applied to the handle so that steel control rod AB does not buckle. The rod has a diameter of 1.2 inch. It is pinned connected at its ends.  $E= 29$  Ksi **(17.6 Kip)**

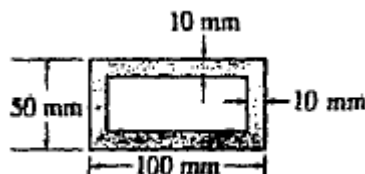
**Pb. 7** The W310 \* 129 structural steel column has a length of 4m. If its bottom end is fixed while top is free, and is subjected to an axial load of  $P= 1800$  KN. Determine the factor of safety with respect to buckling.  $E= 210$ GPa.

**Pb. 8** The W310 \* 129 structural steel column has a length of 4m. If its bottom end is fixed while top is free, determine the largest value of axial load it can support. Use factor of safety of 1.75 with respect to buckling.  $E= 210$ GPa. **(1850.44 KN)**

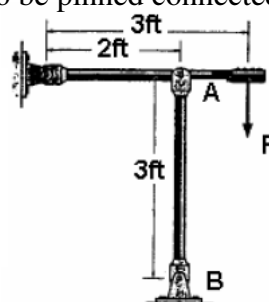
**Pb.9** The 4m steel pipe column has an outer diameter of 80mm & thickness of 6mm. Determine the critical load if the ends are assumed to be pinned connected.  $E= 210$ GPa. **(124.48 KN)**



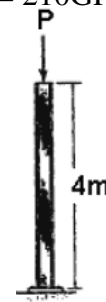
Pb. (2)



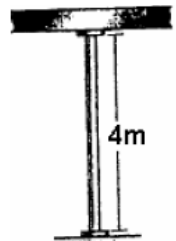
Pb. (5)



Pb. (6)



Pb. (7&8)



Pb. (9)