



Allowed Tables and Charts: (None or e.g. Steam Tables)

Answer all the following Questions

Q(1) [20]

- Explain the formation of the plastic hinge in a simple-supported beam.
- Define the nonlinear analysis, define the shape factor and identify the shape factor for a rectangular cross-section.
- Explain the process of yielding of a section
- Determine the lower bound (Safe) theorem
- Explain the difference between
 - The mechanical hinge and the plastic hinge
 - The elastic and plastic material
 - Working bending moment, yielding bending moment and plastic bending moment.

Q2[20]

Find the ultimate load for the beam presented in Fig. 1 using the equilibrium method and virtual work method ($M_p = 30 \text{ t.m}$).

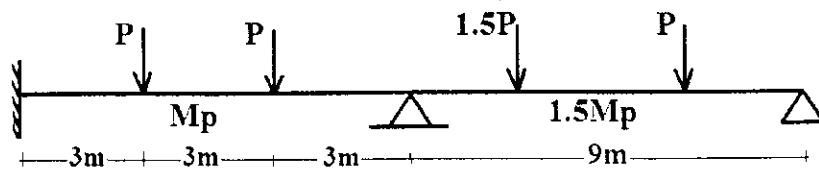


Fig. 1

Q2[20]

Find the plastic moment for the beam presented in Fig. 2 using the equilibrium method and virtual work method.

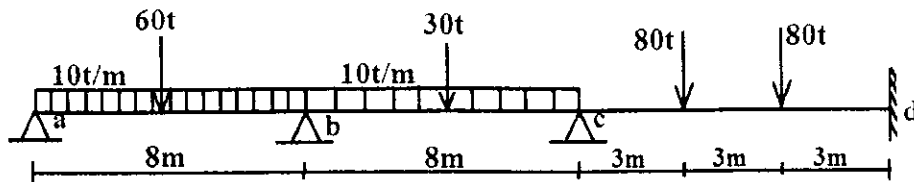


Fig. 2

Q4/20/

Find the plastic moment for the beam presented in Fig. 2 using the equilibrium method and virtual work method.

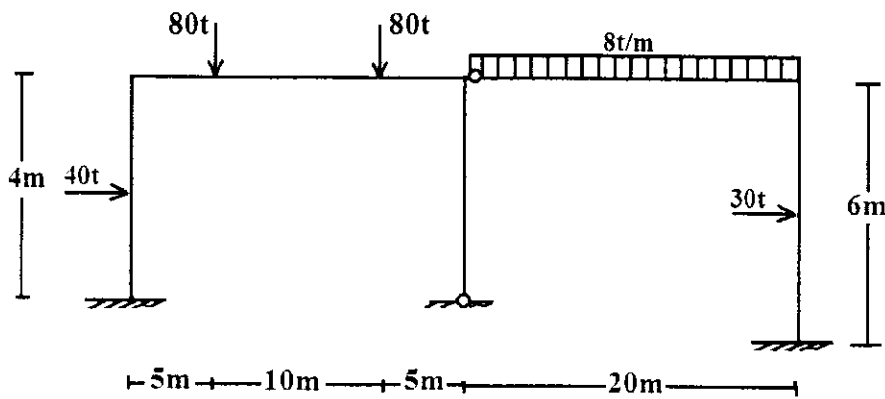


Fig. 4

Q5/20/

If the base shear force was distributed to lateral forces at the two stories and the three stories frames presented in Fig. 5, find the plastic moment of the two frames.

