DEPARTMENT OF CIVIL ENGINEERING, IIT BOMBAY

CE 201 Solid Mechanics

Tutorial Sheet = 11 Instructor : Siddhartha Ghosh

1. Determine the strain energy stored in the pin-jointed frame shown in Fig. 1. The area of cross-section of member BD is twice of that for AC and CD. E is constant for all members.
2. Determine the strain energy stored in a uniform simply supported beam subjected to uniformly distributed load, **w** over the entire span due to bending and shear. The span of the beam is L and have the rectangular cross-section (width = **b** and depth = **d**). Compare the strain energy due to shear with that for bending.
3. A solid tapered circular shaft of length **L** is fixed at one end and free on the other. The diameter of shaft at free end is **d** and increases linearly to **2d** at fixed end. The shaft is subjected to a torque **T** at the free end. Determine the strain energy stored in the shaft. Also determine the angle of twist at the free end.
4. A tapered bar of length **L** is fixed at one end and free on the other. The area of cross-section of the bar at free end is **A** and increases linearly to **2A** at fixed end. The bar is subjected to an axial load P at the free end. The modules of elasticity of the bar material is **E**. Determine the deflection of the free end using strain energy method.
5. A uniform simple beam of span L is subjected to a point load at mid-span. Using energy method, determine the deflection of the beam at mid-span. Take the effect of bending only.
6. Using strain energy method, determine the displacement in the direction of applied load of the space structure shown in Fig. 2. The area of cross-section of the member is circular with diameter ***d***. Ignore the strain energy due to shear.
7. Using the strain energy method determine the prop reaction in a uniform propped cantilever beam shown in Fig. 3.
8. A uniform cantilever beam is propped by a spring at the free end as shown in Fig. 4. The beam is subjected to a uniformly distributed load over the entire length. Using the strain energy method, determine the force in the spring.

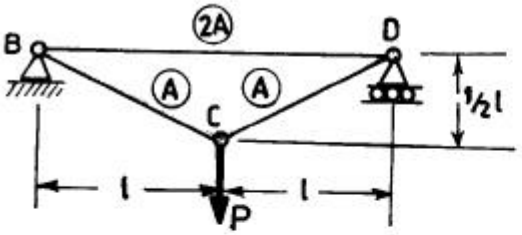

fig. 1

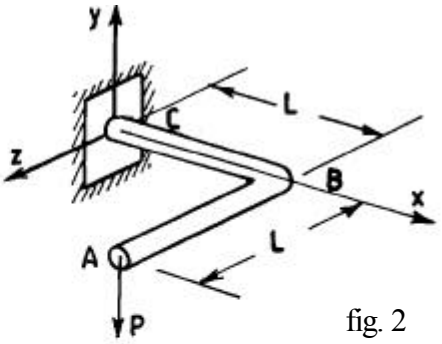

fig. 2

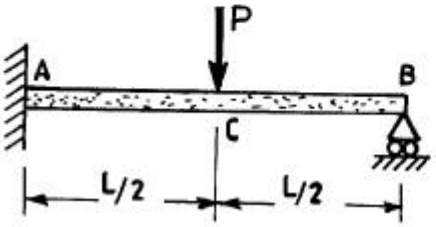

fig. 3

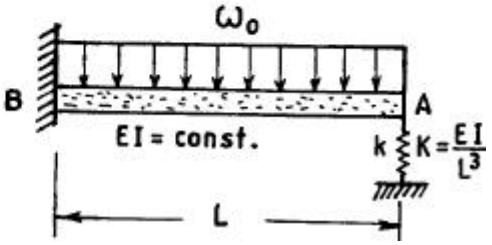

fig. 4