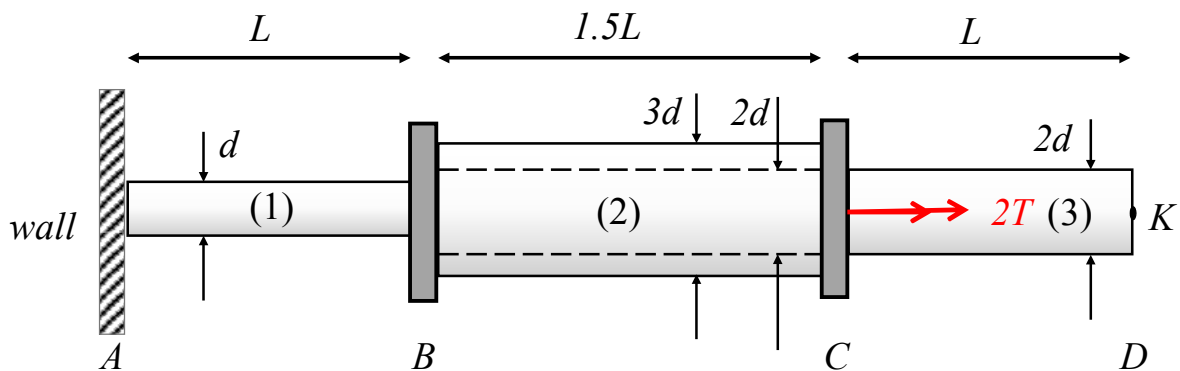
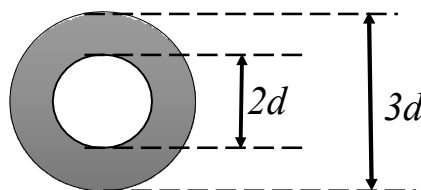


Consider the stepped shaft shown in figure (a). Shafts (1) and (2) are joined by rigid connector B, while shaft (2) and (3) are joined by rigid connector C. The stepped shaft is fixed to a rigid wall at end A. Connector C is acted upon by torque $2T$ as shown. Hollow shaft (2) is of length $1.5L$ with inner diameter $2d$ and outer diameter $3d$ (cross-section shown in figure (b)). Shafts (1) and (3) are solid, each having length L , and diameters d and $2d$ respectively. Shear modulus of the entire shaft is G . The length of the connectors is negligible.

- What are the torques carried by each shaft, (1), (2), and (3)? (25%)
- Determine the magnitude of the maximum shear stress in this structure. (25%)
- Determine the angular rotation of connectors B and C relative to the location A. (25%)
- Consider a point K on the outer radius of shaft (3) at D. What is the total length of the arc through which this point has travelled? (25%)



(a)



(b)

