1. A hollow circular cylinder is made of iron and has an outside diameter of 75 mm and an inside diameter of 60 mm. If the cylinder is loaded by an axial compressive force of 50 kN, determine the total shortening in length. Take the modulus of elasticity to be 100 GPa.

2. Determine the normal stress of a hollow circular cylinder with outside diameter of 75 mm and an inside diameter of 60 mm subjected to an axial compressive force of 50 kN, Take the modulus of elasticity to be 100 GPa.

3. A solid circular shaft of 3cm diameter and 2m length is subject to a torque T of 300 N · m. Determine the angle of rotation between the ends. Use $G = 74$ GPa.

4. A solid circular shaft of 3cm diameter and 2m length is subject to a torque T of 300 N · m. Determine the maximum shear stress developed. Use $G = 74$ GPa.

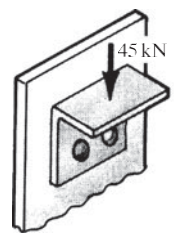
5 A solid circular steel rod 6 mm in diameter and 500 mm long is rigidly fastened to the end of a circular aluminum rod 25mm in diameter and 400 mm long, the geometric axes of the bars lying along the same line. An axial tensile force of 5 kN is applied at each of the extreme ends. Determine the total elongation of the assembly. For steel, $E = 200$ GPa and for brass, $E = 90$ GPa.

6. A hollow circular cylinder is made of iron and has an outside diameter of 70 mm and an inside diameter of 55 mm. If the cylinder is loaded by an axial compressive force of 60 kN, determine the total shortening in length. Take the modulus of elasticity to be 100 GPa.

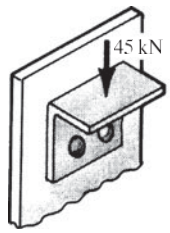
7. Determine the normal stress of a hollow circular cylinder with outside diameter of 77 mm and an inside diameter of 62 mm subjected to an axial compressive force of 61 kN, Take the modulus of elasticity to be 100 GPa.

8 A solid circular steel rod 10 mm in diameter and 400 mm long is rigidly fastened to the end of a circular aluminum rod 20mm in diameter and 300 mm long, the geometric axes of the bars lying along the same line. An axial tensile force of 5 kN is applied at each of the extreme ends. Determine the total elongation of the assembly. For steel, $E = 200$ GPa and for brass, $E = 90$ GPa.

9. For the following figure, the maximum allowable stress in shear for the bolt is 93 MPa, determine the required diameterof the bolt in order that this value is not exceeded.



1 0 . Find the average shearing stress in each of the rivets in the figure bellow.



11. A solid circular shaft of 5cm diameter and 1m length is subject to a torque T of 400 N · m. Determine the angle of rotation between the ends. Use $G = 75$ GPa.

12. A solid circular shaft of 3cm diameter and 1.5m length is subject to a torque T of 500 N · m. Determine the maximum shear stress developed. Use $G = 74$ GPa.

13. Determine the maximum shearing stress in a 10-cm-diameter solid shaft carrying a torque of 25 kN · m. What is theangle of twist per unit length if the material is steel for which $G = 80$ GPa?

14. A propeller shaft in a ship is 350 mm in diameter. The allowable working stress in shear is 50 MPa and the allowable angle of twist is 1° in 15 diameters of length. If $G = 85$ GPa, determine the maximum torque the shaftcan transmit.

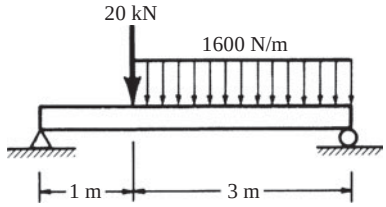
15. A compound shaft is composed of a 70-cm length of solid copper 10 cm in diameter, joined to 90-cm length of solid steel 12 cm in diameter. A torque of 14 kN · m is applied to each end of the shaft. Find the maximum shear stress in each material and the total angle of twist of the entire shaft. For copper $G = 40$ GPa, for steel $G = 80$ GPa.

16. Determine the maximum shearing stress in a 15-cm-diameter solid shaft carrying a torque of 23 kN · m. What is theangle of twist per unit length if the material is steel for which $G = 83$ GPa?

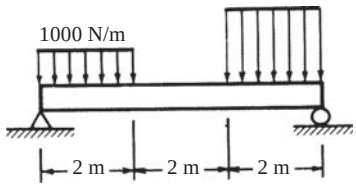
17. A propeller shaft in a ship is 360 mm in diameter. The allowable working stress in shear is 60 MPa and the allowable angle of twist is 1° in 15 diameters of length. If $G = 85$ GPa, determine the maximum torque the shaftcan transmit.

18. A compound shaft is composed of a 75-cm length of solid copper 12 cm in diameter, joined to 92-cm length of solid steel 15 cm in diameter. A torque of 15 kN · m is applied to each end of the shaft. Find the maximum shear stress in each material and the total angle of twist of the entire shaft. For copper $G = 40$ GPa, for steel $G = 80$ GPa.

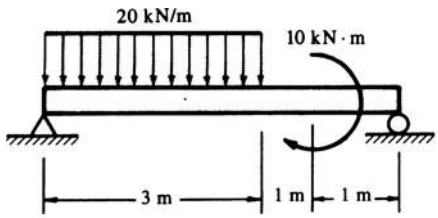
19. Draw the shear and moment diagrams for the bemas shown bellow.



20. Draw the shear and moment diagrams for the beam shown below.



21. Draw the shear and moment diagrams for the beam shown below.



22. Draw the shear and moment diagrams for the beam shown below.