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.

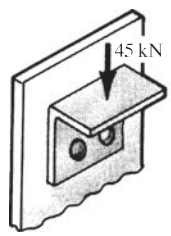
5 A solid circular steel rod 6 mm in diameter and 500 mm long is rigidly fastened to the end of a circular aluminum rod 25 mm in diameter and 400 mm long, the geometric axes of the bars lying along the same line. An axial tensile force of 5 kN is applied at each of the extreme ends. Determine the total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

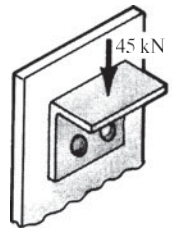
7. Determine the normal stress of a hollow circular cylinder with outside diameter of 77 mm and an inside diameter of 62 mm subjected to an axial compressive force of 61 kN, Take the modulus of elasticity to be 100 GPa.

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 20 mm 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 diameter of the bolt in order that this value is not exceeded.



10. 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 the angle 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 shaft can 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.

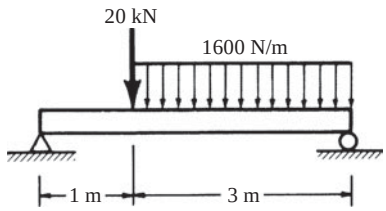
16. Determine the maximum shearing stress in a 15-cm-diameter solid shaft carrying a torque of 23 kN · m. What is the angle of twist per unit length if the material is steel for which $G = 83$ GPa?

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 shaft can transmit.

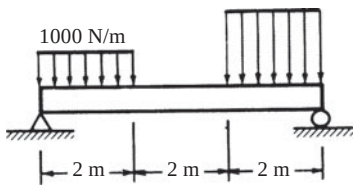
18. A compound shaft is composed of a 75-cm length of solid copper 12 cm in diameter, joined to 92-cm length of solid steel 15 cm in diameter. A torque of 15 kN · m

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.

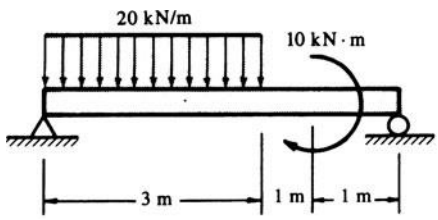
19. Draw the shear diagram for the beam shown below.



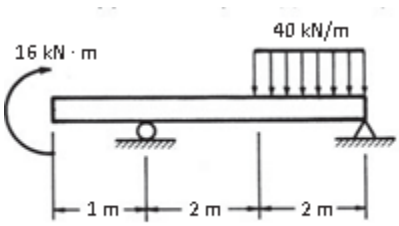
20. Draw the shear diagram for the beam shown below.



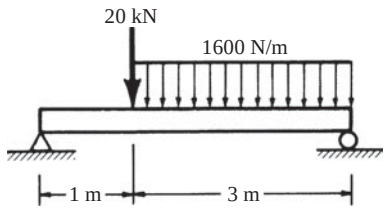
21. Draw the shear diagram for the beam shown below.



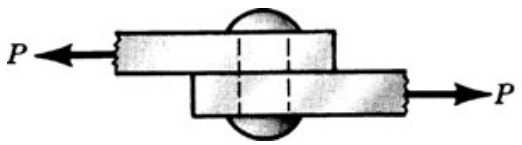
22. Draw the shear diagram for the beam shown below.



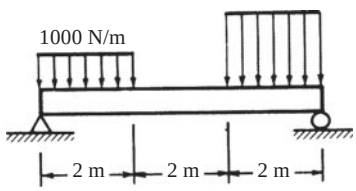
23. Draw the moment diagram for the beam shown below.



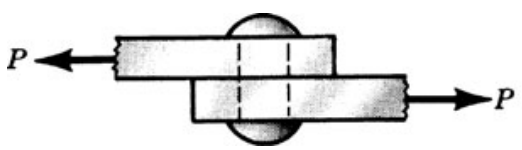
24. A single rivet is used to join two plates as shown. If the diameter of the rivet is 25 mm and the load P is 40 kN, what is the average shearing stress developed in the rivet?



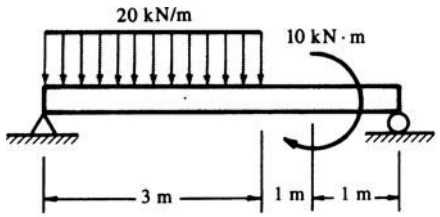
25. Draw the moment diagram for the beam shown below.



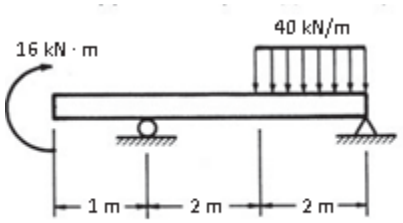
26. A single rivet is used to join two plates as shown. If the diameter of the rivet is 30 mm and the load P is 50 kN, what is the average shearing stress developed in the rivet?



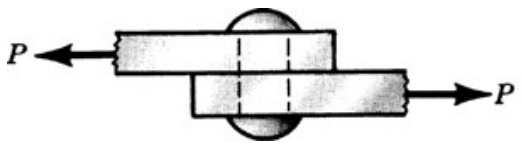
27. Draw the moment diagram for the beam shown below.



28. Draw the moment diagram for the beam shown below.



29. A single rivet is used to join two plates as shown in Fig. 2-6. If the diameter of the rivet is 20 mm and the load *P* is 30 kN, what is the average shearing stress developed in the rivet?



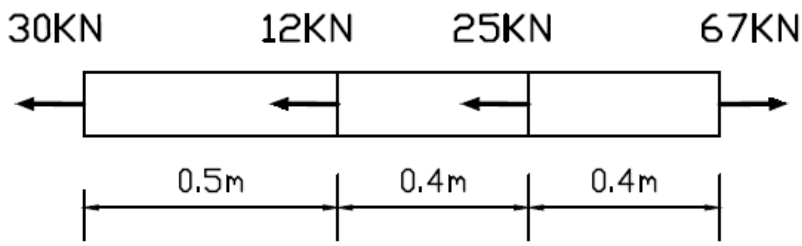
30. A hollow circular cylinder is made of iron and has an outside diameter of 85 mm and an inside diameter of 60 mm. If the cylinder is loaded by an axial compressive force of 60 kN, determine the total shortening in length. Take the modulus of elasticity to be 98 GPa.

31. Determine the normal stress of a hollow circular cylinder with outside diameter of 74 mm and an inside diameter of 62 mm subjected to an axial compressive force of 55 kN, Take the modulus of elasticity to be 88 GPa.

32. A solid circular shaft of 4cm diameter and 2m length is subject to a torque T of 333 N · m. Determine the angle of rotation between the ends. Use $G = 71$ GPa.

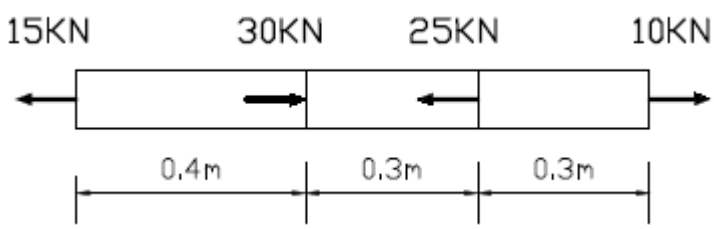
33. A solid circular shaft of 3cm diameter and 2m length is subject to a torque T of 400 N · m. Determine the maximum shear stress developed. Use $G = 80$ GPa.

34. Compute the total deformation of the bar. Cross-section area = 160mm^2, E = 70GPa.

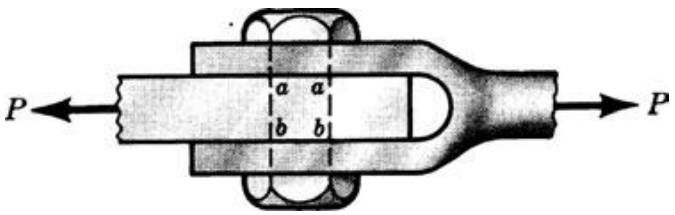


35. A solid circular steel rod 7 mm in diameter and 600 mm long is rigidly fastened to the end of a circular aluminum rod 22 mm in diameter and 450 mm long, the geometric axes of the bars lying along the same line. An axial tensile force of 6 kN is applied at each of the extreme ends. Determine the total elongation of the assembly. For steel, E = 205 GPa and for brass, $E = 95$ GPa.

36 Compute the deformation of the bar shown below. Cross-Section area is 300mm^2 and E = 70GPa.

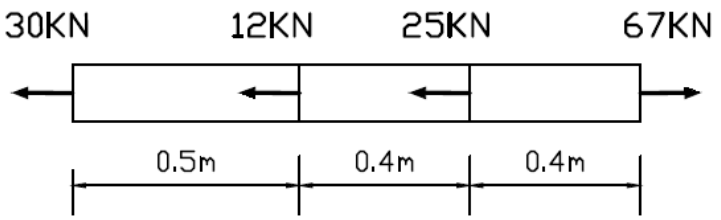


37. Consider the bolted joint shown. The force *P* is 30 kN and the diameter of the bolt is 10 mm. Determine the average value of the shearing stress existing across either of the planes *a-a* or *b-b*.

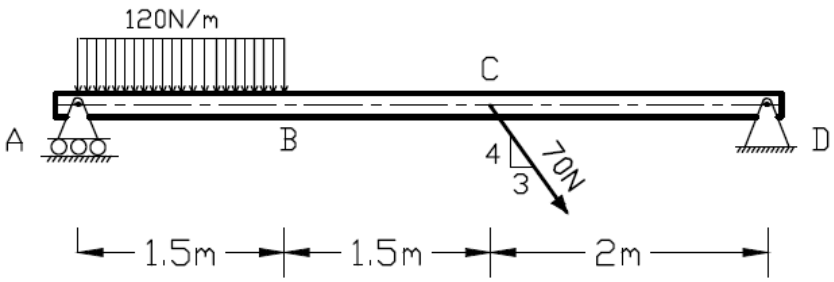


38. Low-carbon structural steel has a shearing ultimate strength of approximately 300 MPa. Determine the force *P* necessary to punch a 2.5-cm-diameter hole through a plate of this steel 1 cm thick.

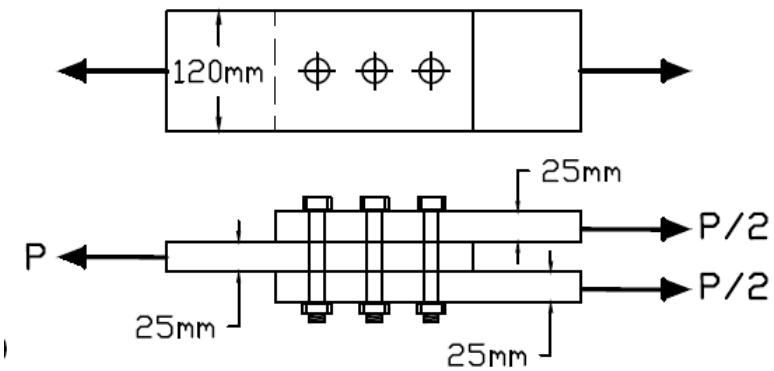
39. Compute the total deformation of the bar. Cross-section area = $200mm^2$, E = 200GPa.



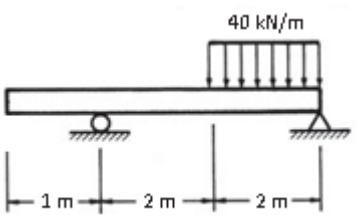
40. Draw the shear diagram for the beam shown below.



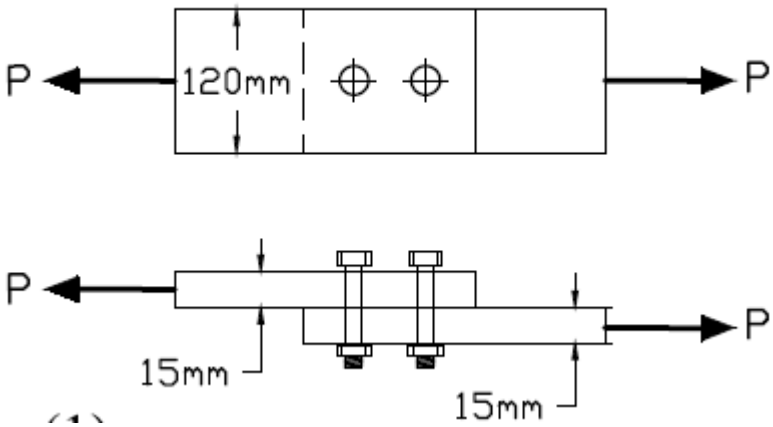
41. Compute the maximum (P) if the allowable shear stress in the bolt is 80MPa. The bolt diameter is 25 mm.



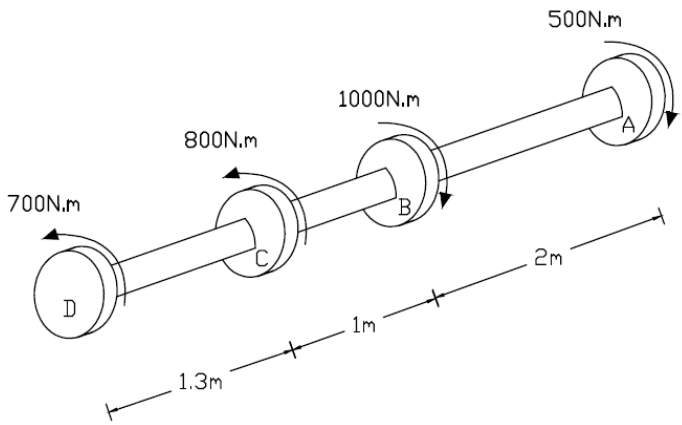
42. Draw the shear diagram for the beam shown below.



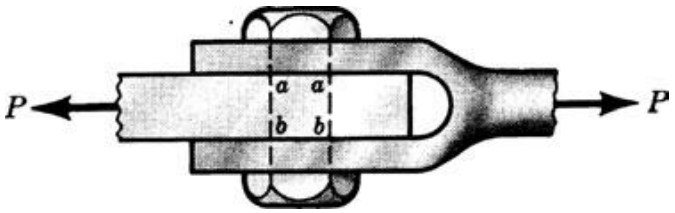
43. Compute the maximum (P) if the allowable shear stress in the bolt is 90MPa. The bolt diameter is 20 mm.



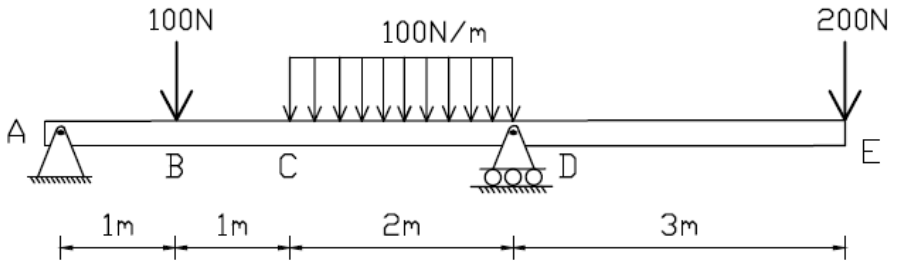
44. The solid shaft shown below has a diameter of 50mm. Determine the shear stress in each part



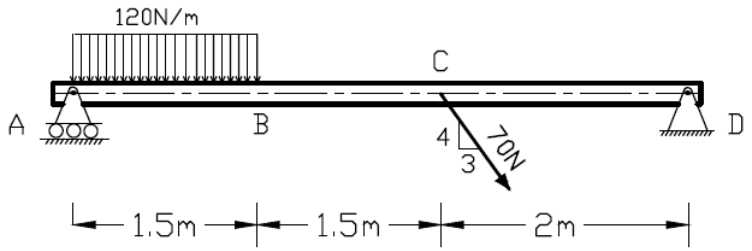
45. Consider the bolted joint shown. The force *P* is 40 kN and the diameter of the bolt is 12 mm. Determine the average value of the shearing stress existing across either of the planes *a-a* or *b-b*.



46. Draw the shear diagram for the beam shown below.

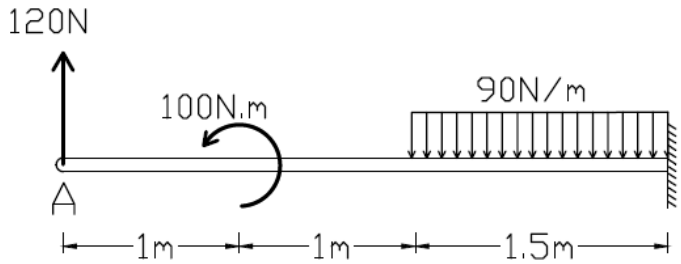


47. Draw the moment diagram for the beam shown below.

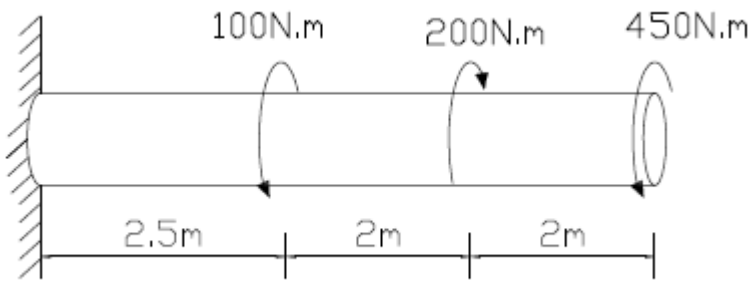


48. Low-carbon structural steel has a shearing ultimate strength of approximately 300 MPa. Determine the force *P* necessary to punch a 3-cm-diameter hole through a plate of this steel 2 cm thick.

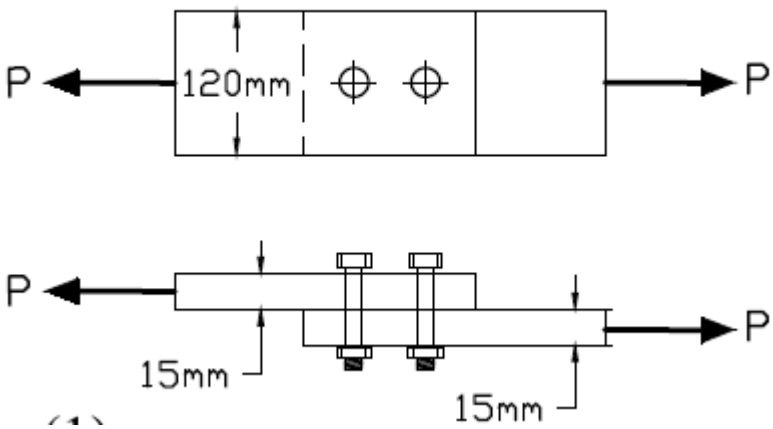
49. Draw the shear diagram for the beam shown below.



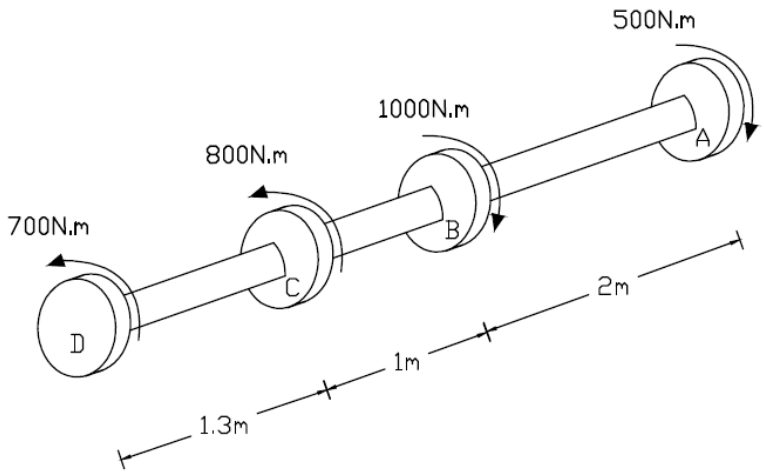
50. Compute the shear stress in each part of the shaft in the figure below. The diameter of the shaft is 50mm, G=85GPa.



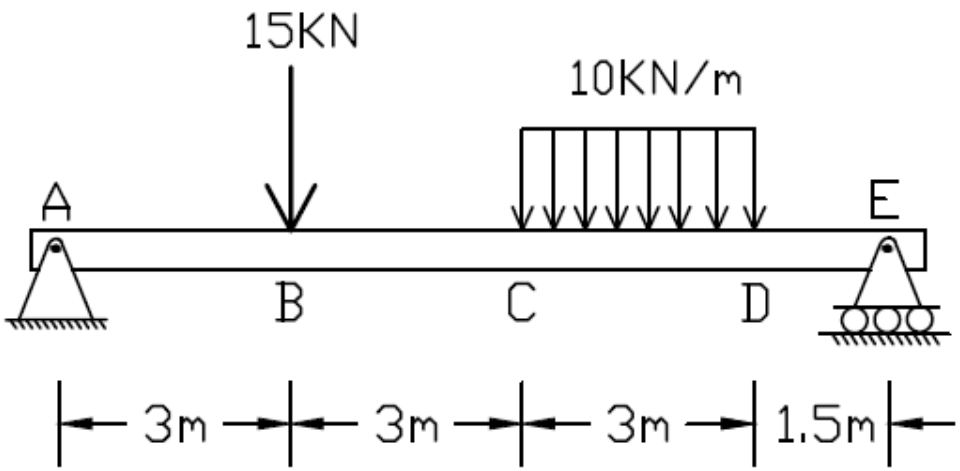
51. Compute the maximum (P) if the allowable bearing stress in the plate is 100MPa. The bolt diameter is 20 mm.



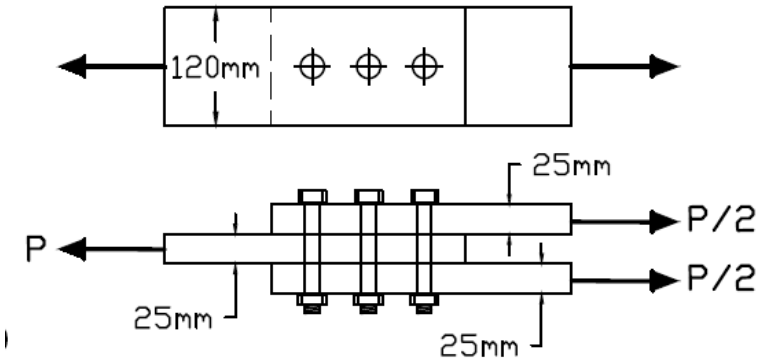
52. The solid shaft shown below has a diameter of 70mm. Determine the shear stress in each part



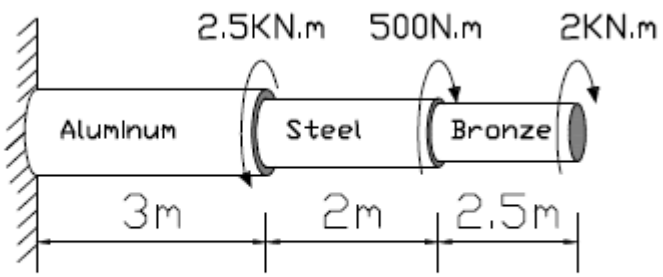
53. Draw the shear diagram for the beam shown below.



54. Compute the maximum (P) if the allowable bearing stress in the bolt is 85MPa. The bolt diameter is 22 mm.

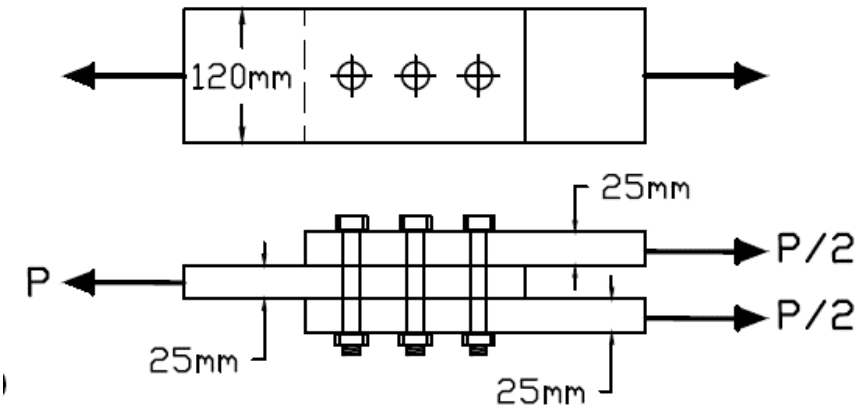


55. Compute the shear stress in each part of the shaft in the figure below. The diameter of the shaft is 50mm, G=85GPa.

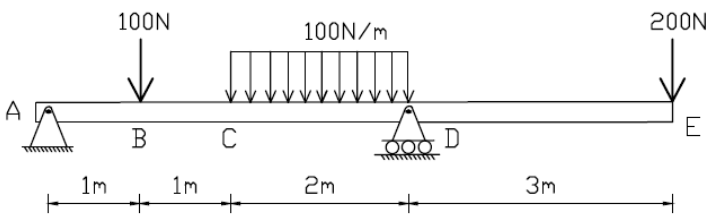


diameter(mm):	100	85	70
G (Gpa):	27	83	34

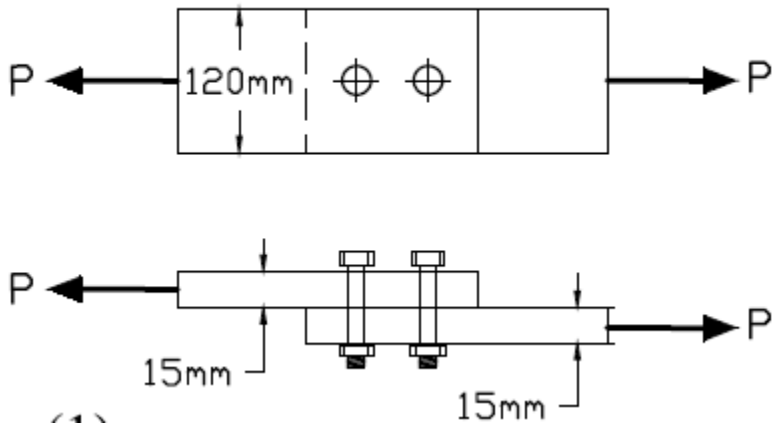
56. Compute the maximum (P) if the allowable tensile stress in the plate is 110MPa. The bolt diameter is 24 mm.



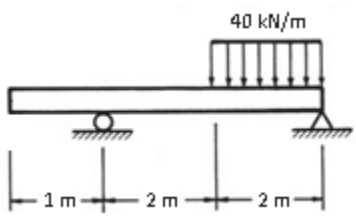
57. Determine the values of shear and moment at point C for the beam shoen below.



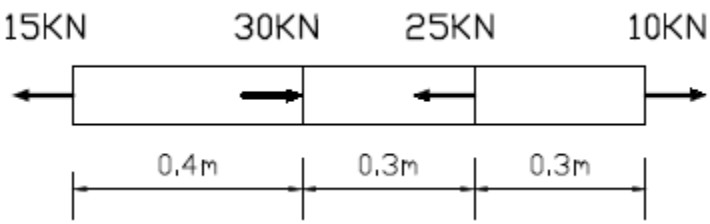
58. Compute the maximum (P) if the allowable tensile stress in the plate70MPa. The bolt diameter is 25 mm.



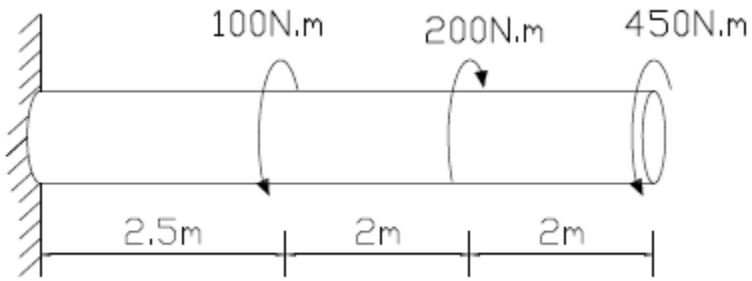
59. Draw the moment diagram for the beam shown below.



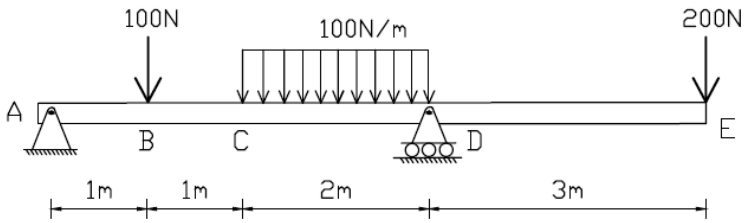
60 Compute the deformation of the bar shown below. Cross-Section area is 400mm^2 and E = 80GPa.



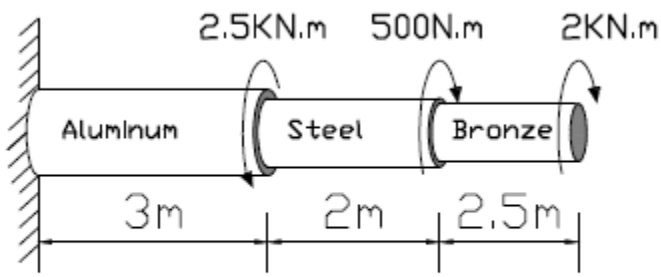
61. Compute the angle of rotation at the free end in the figure below. The diameter of the shaft is 60mm, G=80GPa.



62. Draw the moment diagram for the beam shown below.

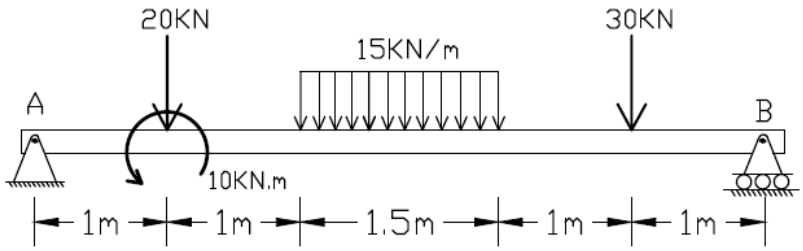


63. Compute the shear stress in each part of the shaft in the figure below. The diameter of the shaft is 55mm, G=95GPa.

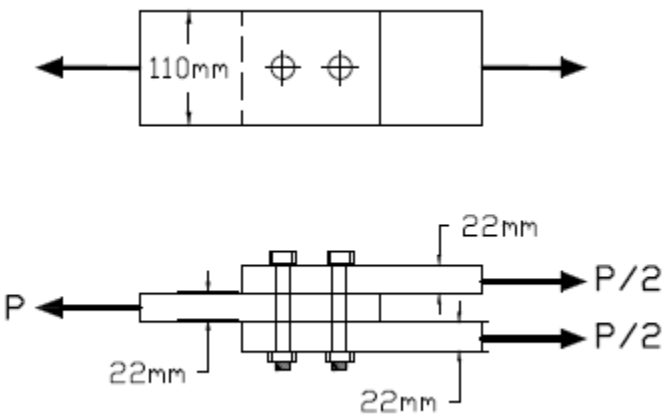


diameter(mm):	100	85	70
G (Gpa):	27	83	34

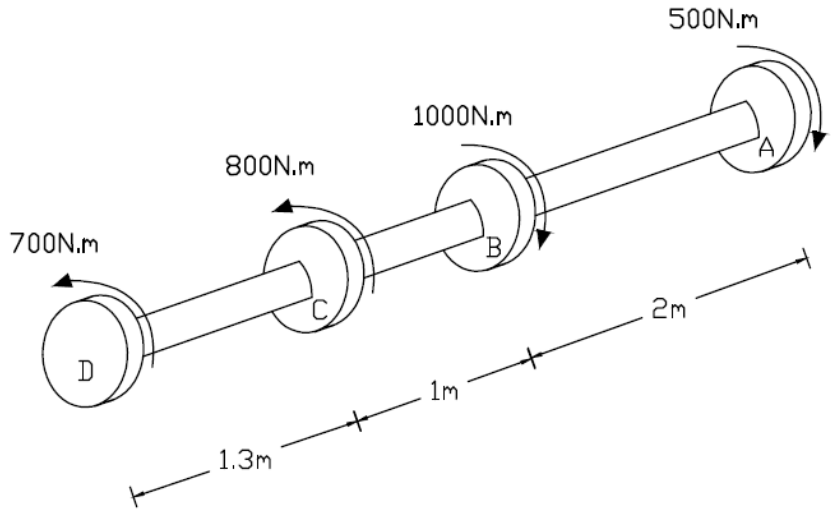
64. Draw the shear diagram for the beam shown below.



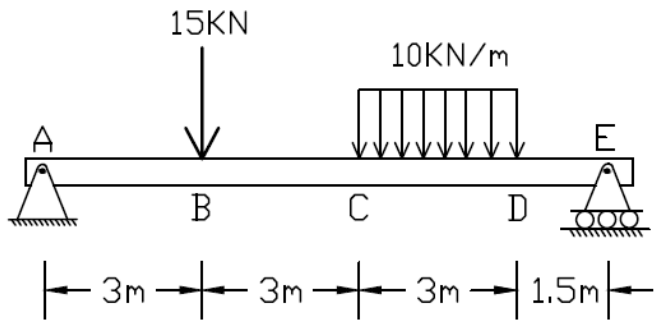
65. Compute the maximum (P) if the allowable shear stress in the bolt is 105MPa. The bolt diameter is 18 mm.



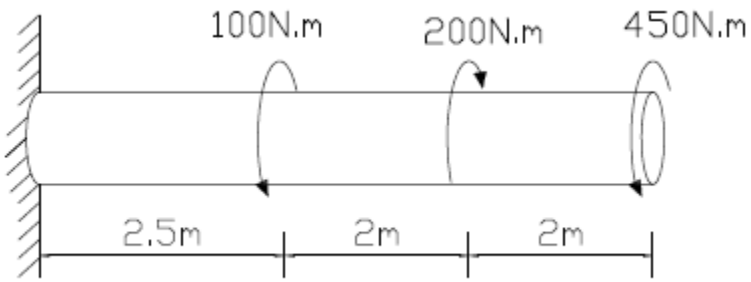
66. The solid shaft shown below has a diameter of 50mm. Determine the angle of rotation between A and D.



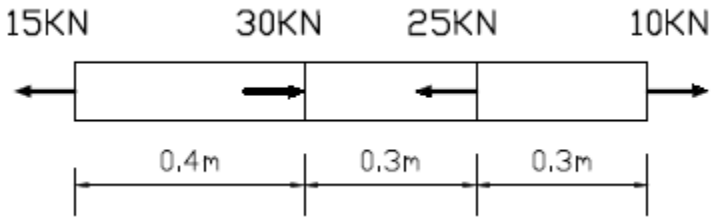
67. Draw the moment diagram for the beam shown below.



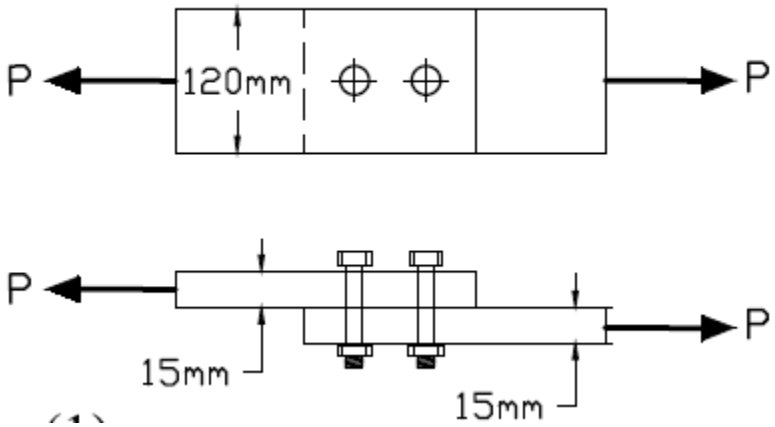
68 Compute the angle of rotation at the free end in the figure below. The diameter of the shaft is 60mm, G=83GPa.



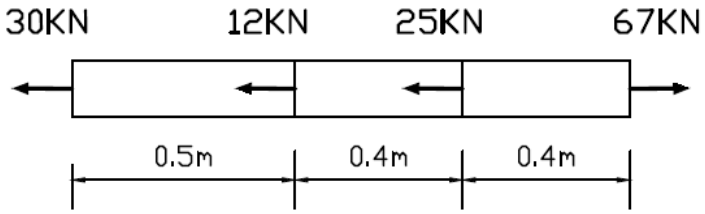
69 Compute the deformation of the bar shown below. Cross-Section area is 235mm^2 and E = 75GPa.



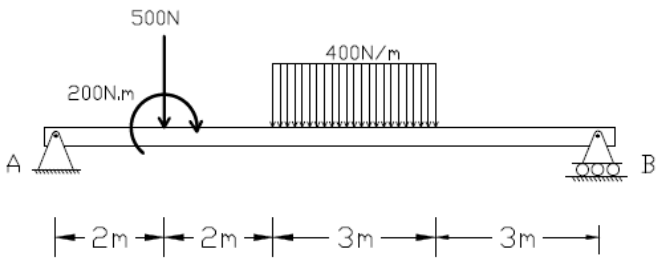
70. Compute the maximum (P) if the allowable bearing stress in the bolt is 76MPa. The bolt diameter is 20 mm.



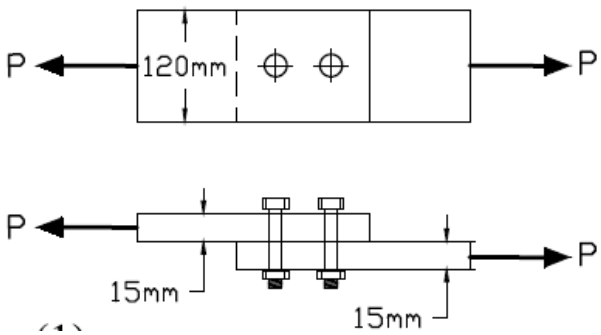
71. Compute the total deformation of the bar. Cross-section area = 170mm^2, E = 80GPa.



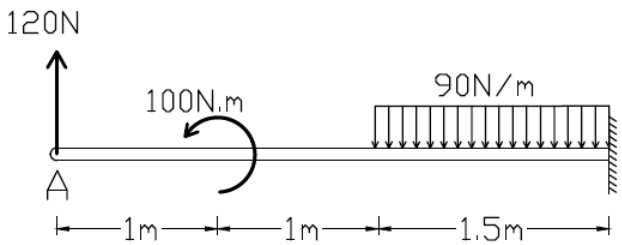
72. Draw the moment diagram for the beam shown below.



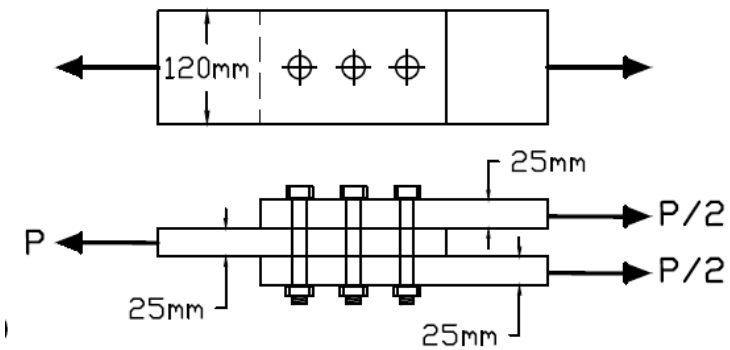
73. Compute the maximum (P) if the allowable tensile stress in the plate 120MPa. The bolt diameter is 15 mm.



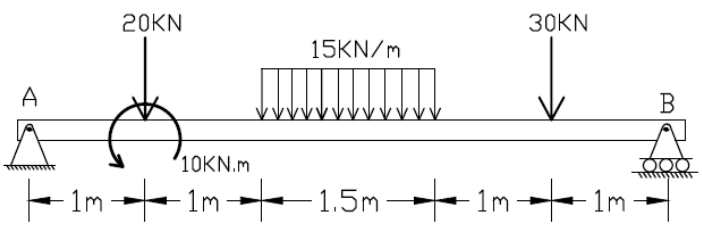
74 Draw the shear diagram for the beam shown below.



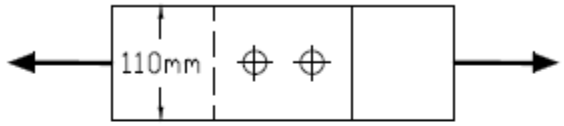
75 Compute the maximum (P) if the allowable shear stress in the bolt is 83MPa. The bolt diameter is 16 mm.

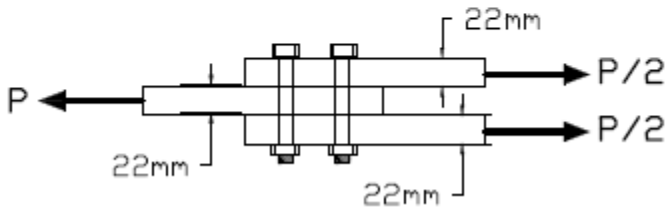


76. Draw the moment diagram for the beam shown below.

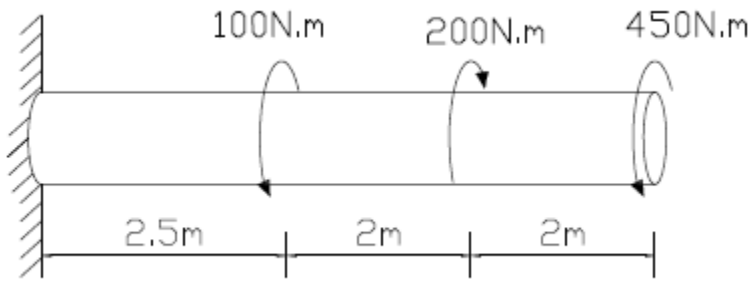


77. Compute the maximum (P) if the allowable bearing stress in the bolt is 75MPa. The bolt diameter is 24 mm.

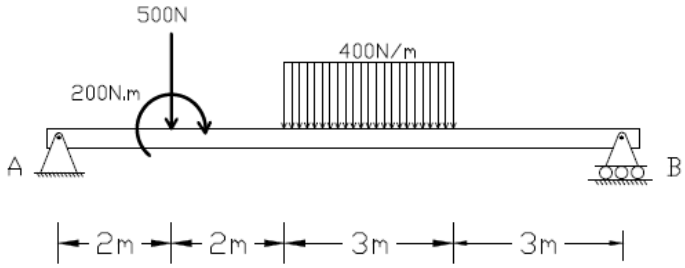




78 Compute the angle of rotation at the free end in the figure below. The diameter of the shaft is 54mm, G=79GPa.



79. Draw the moment diagram for the beam shown below.



80. Compute the maximum (P) if the allowable tensile stress in the plate is 135Mpa. The bolt diameter is 22 mm.