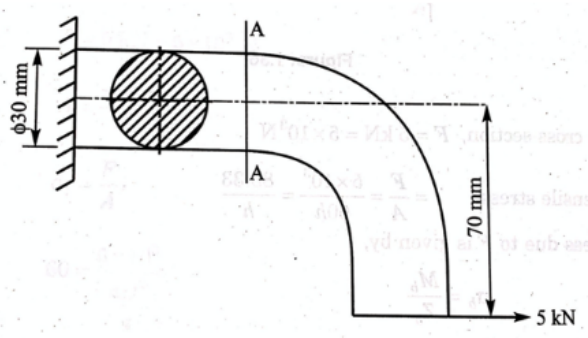
Design of Machine Elements I (18ME52)

IAT 1

Each Question carries 5 marks

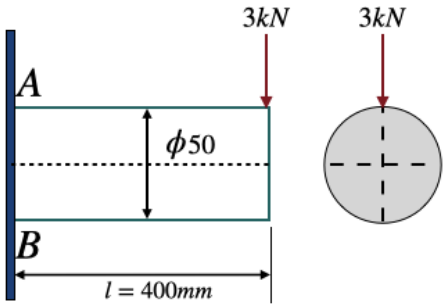
1. A steel bracket shown in figure is subjected to a load of 5 kN. The maximum stress(in MPa) induced in the member at section A-A taking the diameter as 30 mm is:



130 MPa
120 MPa
139 MPa
150 MPa

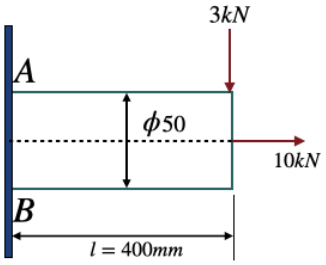
2. A circular rod of diameter 50 mm and length 400 mm is subjected to a point load of 3 kN at its end and other end being fixed, the bending stress (in MPa) induced in the rod at points A and B will be:

+97.78 and - 97.78
-97.78 and +97.78
+3.911 and - 3.911
- 3.911 and + 3.911



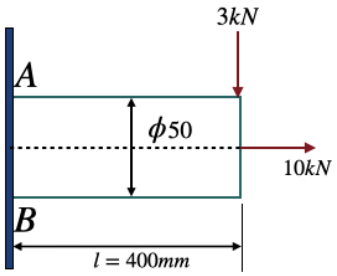
3. For the member shown in the figure, the maximum principal stress induced at point A will be (in MPa)

0
120
115
103



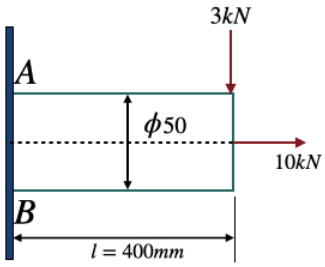
4. For the member shown in figure, the maximum principal stress induced at point B (in MPa) will be:

0
120
115
103



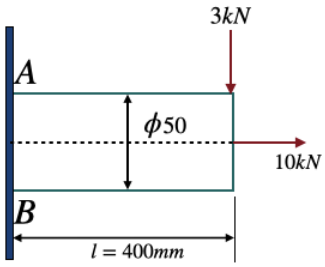
5. For the member shown below, the maximum shear stress induced at point A (in MPa) will be:

26.52
51.43
75.57
46.35



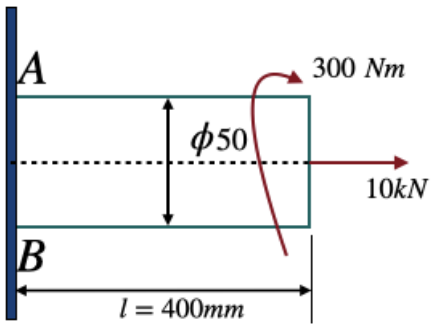
6. For the member shown below, the maximum shear stress induced at point B (in MPa) will be:

26.52
51.43
75.57
46.35



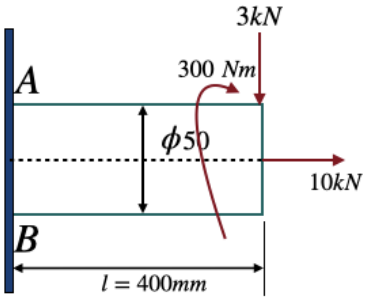
7. For the member shown, the value of maximum and minimum principal stress (in MPa) at point A is:

-15.03 and +9.94
+15.03 and - 9.94
+15.03 and +9.94
-15.03 and - 9.94



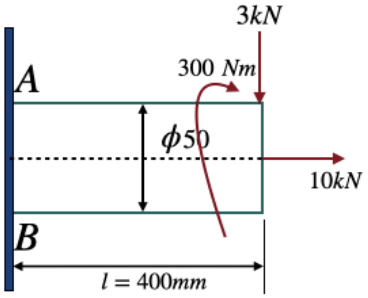
8. For the member shown, the value of maximum and minimum principal stress (in MPa) at point B is:

+104.32 and +102.863
-104.32 and +102.863
-104.32 and - 102.863
None of the above



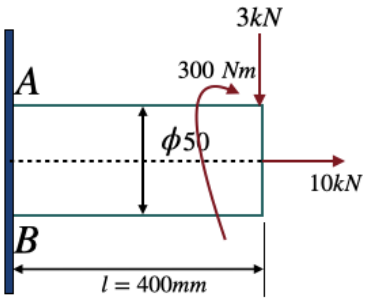
9. For the member shown, the value of maximum shear stress (in MPa) at point A is:

32.88
62.88
52.88
42.88



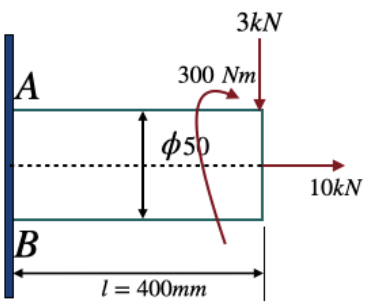
10 . For the member shown, the value of maximum shear stress (in MPa) at point B is:

47.94
37.94
57.94
67.94



11. For the member shown, the value of maximum and minimum principal stress (in MPa) at point B is:

+15.84 and +188.59
-1.584 and -188.59
-1.584 and - 18.859
+158.4 and +18.859



12. At a point in a material having $\sigma_{yt} = 600$ MPa, the principal stresses (in MPa) $\sigma_1, \sigma_2, and\ \sigma_3$ are 0, -180 and 420. The factor of safety assessed by Distortion energy theory will be :
1.25
1.64
2.64
2.25

13. The value of factor of safety for the following stress system computed using maximum shear stress theory and distortion energy theory will be:
$\sigma_1, \sigma_2, and\ \sigma_3$ (in MPa) is 225, 225 and 0.

1.733 and 1.733
1.733 and 2
1.13 and 1.13
2 and 2

14. A member is subjected to pure shear such that the shear stress in the member is 50 MPa. The factor of safety assessed according to maximum shear stress theory and distortion energy theory will be: (take yield stress as 300 MPa)

2 and 3
3 and 4.364
3 and 3.364
3.364 and 3

15. A round rod of diameter 30 mm is to sustain an axial compression of 20 kN and a twisting moment of 1.5 kNm. The rod is made of 40C8 steel whose yield stress in tension is 328.6 MPa. The factor of safety according to maximum principal strain theory and maximum elastic strain energy theory is:

0.917 and 0.719
0.719 and 0.917
0.179 and 0.197
0.917 and 0.917

16. A mild steel shaft having yield stress of 232 MPa is subjected to the following stresses(in MPa).$\sigma_x, \sigma_y, and\ \tau_{xy}$ as 120, -60 and 36. The factor of safety according to Rankine's theory and Guest's theory of failure is:

1.197 and 1.828
1.828 and 1.197
2.197 and 2.828
2.828 and 2.197

17. The diameter of a rod (in mm) subjected to a bending moment of 3 kNm and a twisting moment of 1.8 kNm according to Normal stress theory is: Assume yield stress as 420 MPa and FOS as 3.

61.834
51.834
71.834
41.834

18. The diameter of a rod (in mm) subjected to a bending moment of 3 kNm and a twisting moment of 1.8 kNm according to maximum shear stress theory is: Assume yield stress as 420 MPa and FOS as 3.

63.376
53.376
73.376
43.376

19. A rectangular plate 80 mm wide and 12 mm thick with a central hole of diameter 16 mm is subjected to a tensile load of 30 kN. Taking stress concentration into account, the maximum stress induced (in MPa) is:

87.65
107.65
77.65
97.65

20. A stepped shaft stepped down from 60 mm diameter to 40 mm diameter with a fillet radius of 8 mm is subjected to a twisting moment of 120 kNm. Taking stress concentration into effect, the maximum stress induced (in MPa) is :

11.94
21.94
31.94
41.94

21. The load carrying capacity of a plate of rectangular cross section 90 mm wide, 15 mm thick with a central hole of 9 mm dia and limiting stress of 90 MPa, taking stress concentration into effect (in kN) is:

50.5
40.5
30.5
20.5

22. A rectangular plate 70 mm wide with a semi-circular groove of 12 mm radius is subjected to a tensile load of 10 kN. Taking stress concentration into account and the allowable stress as 120 MPa, the thickness of the plate(in mm) is:

3.62
3.39
3.26
3.72

23. A rectangular plate 70 mm wide with a semi-circular groove of 12 mm radius is subjected to a bending moment of 15 N-m. Taking stress concentration into account and the allowable stress as 120 MPa, the thickness of the plate(in mm) is:

0.349
0.449
0.549
0.649

24. A plate of rectangular cross section 60 mm wide carries a tensile load of 54 kN. For some reason, a circular hole of 10 mm diameter is to be drilled exactly at the centre of the plate. Taking stress concentration into effect and assuming yields stress as 328.6 MPa, the thickness of the plate (in mm) is :

21
11
31
41

25. A rectangular plate of size 50 mm x 80 mm with a hole of 10 mm diameter drilled at the centre is loaded in axial tension of 10 kN. The thickness of the plate is 10 mm. The maximum stress (in MPa) induced in the plate, taking stress concentration into effect is:

52.5
62.5
72.5
82.5

26. A circular shaft of 45 mm diameter stepped down to 30 mm diameter with fillet radius of 6 mm subjected to a twisting moment of 150 Nm. Taking the stress concentration into effect, the maximum stress (in MPa) induced in the plate is:

35.085
42.085
45.085
27.085