Exam.Code:0939
Sub. Code: 6702

2063
B.E. (Mechanical Engineering)
Third Semester
MEC-302: Mechanics of Materials

Time allowed: 3 Hours | Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Unit. Assume suitably the missing data, if any. Supplement your answer with neat and labeled sketches wherever required.

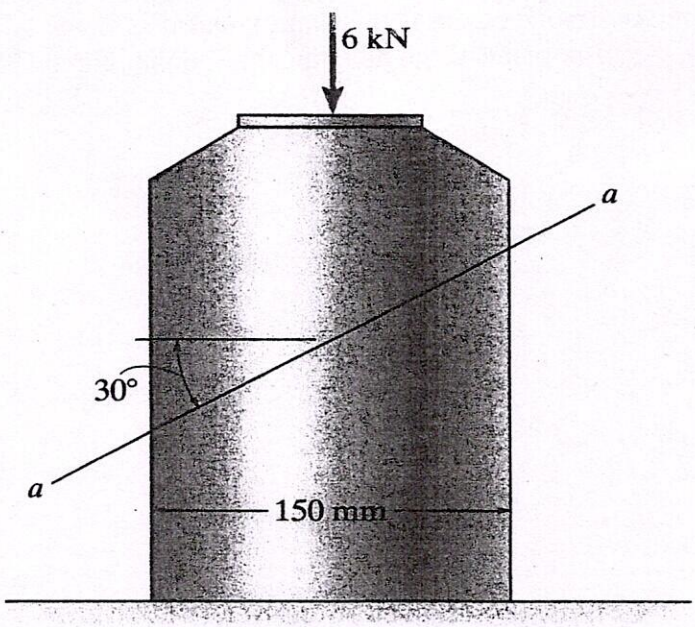
x-x-x

Part-A

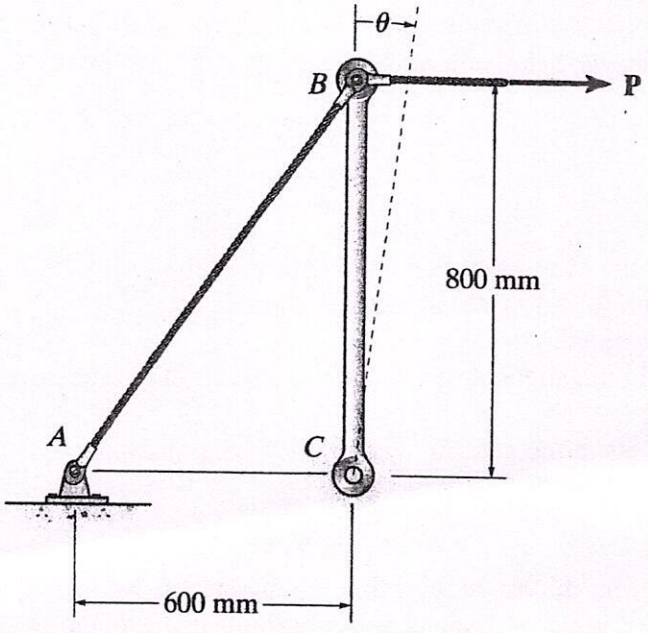
1. (i) Define and explain the Maximum Principal Stress Theory.
(ii) Derive an expression for hoop stress in a thin cylinder.
(iii) Define the term Torsional Rigidity.
(iv) Prove that the maximum shear stress in a circular section of a beam 1.3 times the average shear stress.
(v) Will there be no stress at the neutral axis? Justify your answer. (10 Marks)

Part-B

2. The 150 mm by 150 mm block of aluminum supports a compressive load of 6 kN. Determine the average normal and shear stress acting on the plane through section *a–a*. Show the results on a differential volume element located on the plane. (10 Marks)



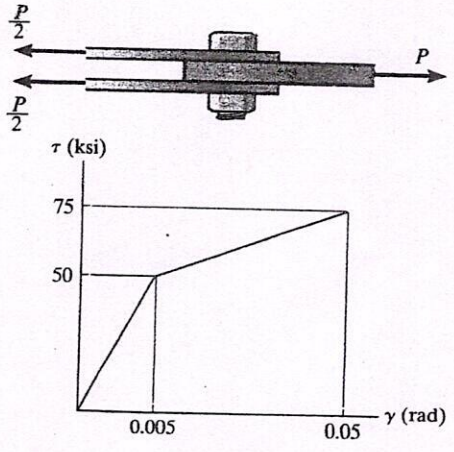
3. Part of a control linkage for an airplane consists of a rigid member CB and a flexible cable AB. If a force is applied to the end B of the member and causes a normal strain in the cable of 0.004 mm/mm, determine the displacement of point B. Originally the cable is unstretched.



(10 Marks)

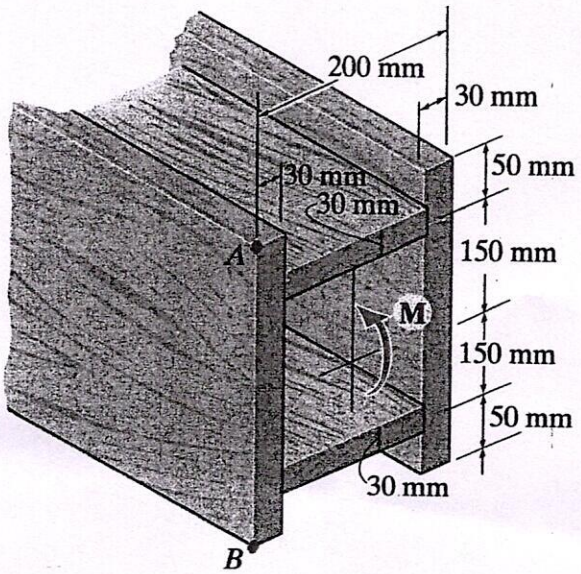
4. The lap joint is connected together using a 1.25 in. diameter bolt. If the bolt is made from a material having a shear stress–strain diagram that is approximated as shown, determine the permanent shear strain in the shear plane of the bolt when the applied force $P = 150$ kip is removed.

(10 Marks)



Part- C

5. If the beam is subjected to a bending moment of $M = 10$ kNm, determine the bending stress in the beam at points A and B, and sketch the results on a differential element at each of these points.



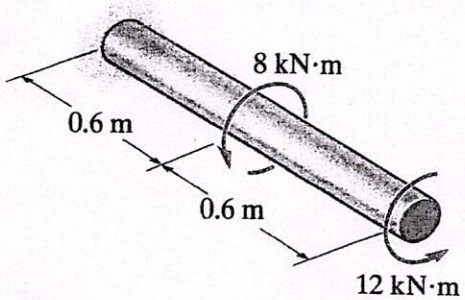
(10 Marks)

6. A pressurized spherical tank is made of 0.5-in.-thick steel. If it is subjected to an internal pressure of $p = 200$ psi, determine its outer radius if the maximum normal stress is not to exceed 15 ksi.

(10 Marks)

7. Determine the torsional strain energy in the A992 steel shaft. The shaft has a radius of 50 mm.

(10 Marks)



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