**Exam Code: 0939**
**Sub. Code: 7042**

**1078**
**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. 1 which is compulsory and selecting two questions from each Part. Use usual notations and symbols for derivations. Assume suitably missing data if any.*

x-x-x

I. Provide short and clear answers to the following:-

a) What do you understand by compatibility conditions?

b) What is the Bauschinger Effect?

c) Does a pin connected truss element carry bending loads?

d) At what angle to the central axis is the failure plane of *a* shaft made of ductile material under torsion?

e) How will you write G in terms of E and v?

f) What is the expression for strain for 3 beam in pure bending?

g) What are singularity functions?

h) What is anticlastic curvature?

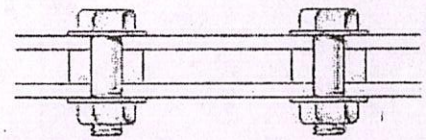
i) What is shear flow?

j) What is the shear center for a thin walled beam? (10x1)

P.T.O.

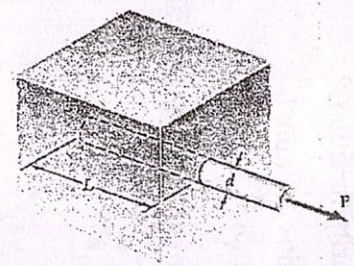
Part A

Q2. Two steel plates are to be held together by means of 16-mm diameter high-strength steel bolts fitting snugly inside cylindrical brass spacers.

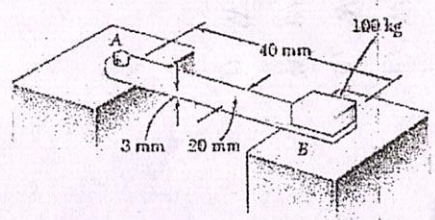


Knowing that the average normal stress must not exceed 200 MPa in the bolts and 130 MPa in the spacers, determine the outer diameter of the spacers that yields the most economical and safe design.

Q3. A force P is applied as shown to a steel reinforcing bar that has been embedded in a block of concrete. Determine the smallest length L for which the full allowable normal stress in the bar can be developed. Express the result in terms of the diameter d of the bar, the allowable normal stress $\sigma_{all}$ in the steel, and the average allowable bond stress $\tau_{all}$ between the concrete and the cylindrical surface of the bar. (Neglect the normal stresses between the concrete and the end of the bar.)



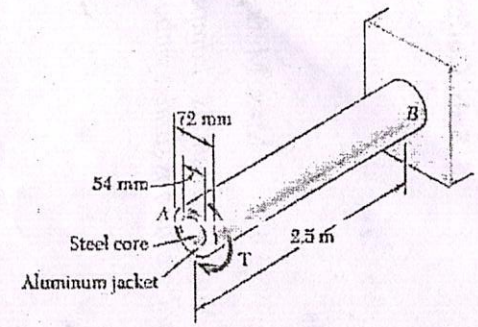

Q4. The brass strip AB (E=105 GPa, α=20E-6/°C) has been attached to a fixed support at A and rests on a rough support at B. Knowing that the coefficient of friction is 0.60 between the strip and the support at B, determine the decrease in temperature for which slipping will impend.



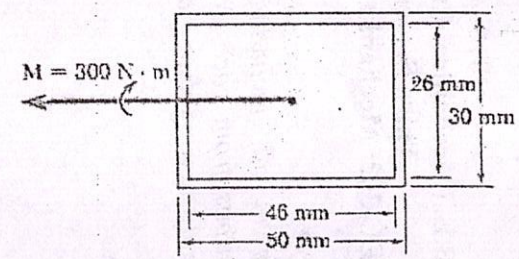



PART-B

Q5. A torque T of magnitude 4 kNm is applied at end A of the composite shaft shown. Knowing that the modulus of rigidity is 77.2 GPa for the steel and 27 GPa for the aluminum, determine (a) the maximum shearing stress in the steel core, (b) the maximum shearing stress in the aluminum jacket, (c) the angle of twist at A.




Q6. In order to increase corrosion resistance, a 2-mm-thick cladding of aluminum has been added to a steel bar as shown. The modulus of elasticity is 200 GPa for steel and 70 GPa for aluminum. For a bending moment of 300 Nm, determine (a) the maximum stress in the steel, (b) the maximum stress in the aluminum, (c) the radius of curvature of the bar.




Q7. Determine the location of the shear center O of a thin-walled beam of uniform thickness having the cross section shown.