Mid semester exam

Course: MEC 302 Design, materials and manufacturing

6 October 2021
11.00 AM to 12.00 PM (60 min)
Platform: Google classroom

Answer all five questions
Maximum marks: 25 (5 marks for every question's fully correct answer)

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Q1. Explain the maximum principal strain theory of failure. (2)

A 10 kN-m torque is applied to a shaft of material having its yield point 350 MPa. Find the required diameter of shaft using maximum shear stress theory and maximum distortion energy theory. Consider a factor of safety 2.5. (3)

Q2. What is factor of safety? What is the procedure to find the allowable stress for ductile parts and brittle parts using factor of safety? (2)

A piston rod of diameter 20 mm and length 700 mm in a hydraulic cylinder is subjected to a compressive force of 10 kN due to the internal pressure. The end conditions of the rod may be assumed as guided at the piston end and hinged at the other end. The Young's modulus is 200 GPa. Find the factor of safety for the piston rod. (3)

Q3. What is stress amplitude and mean stress in fatigue loading? Plot Soderberg, Goodman and Gerber design criteria with respect to these stresses. (2)

A rotating bar which is made of steel ($0.9\sigma_{ultimate} = 567\ N/mm^2$) is subjected to a completely reversed bending stress. The corrected endurance limit of the bar is $315\ N/mm^2$. Calculate the fatigue strength of the bar for a life of $90{,}000$ cycles. (3)

Q4. Show that for transverse fillet weld the allowable load is 1.17 times of parallel fillet weld. (5)

Q5. A bracket is supported by means of 4 rivets of same size, as shown in Figure. Determine the diameter of the rivet if the maximum shear stress is 140 MPa. (5)

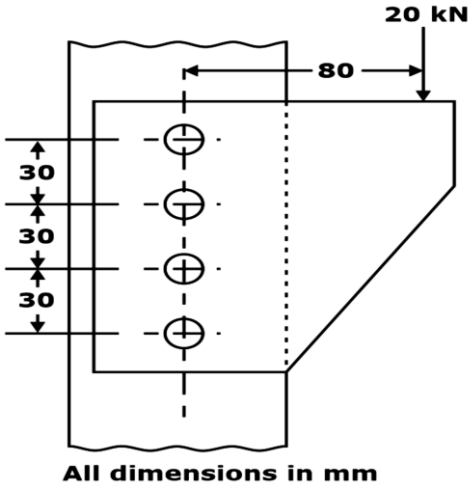


Fig. Eccentric loading on rivets

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