

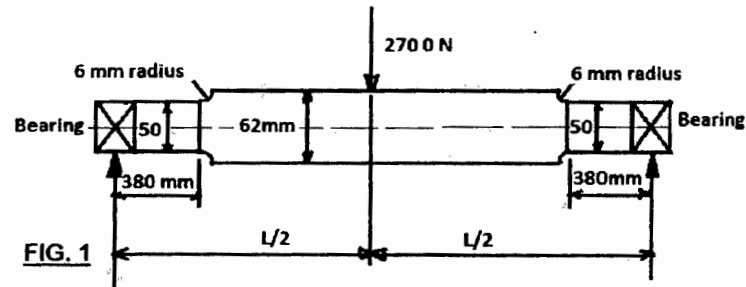
Date of Examination: 18. 02. 2013(AN)
Mid Semester Examination (Spring)
Subject No. ME30602
No. of students: 172

Time: 2hrs
Full Marks: 60

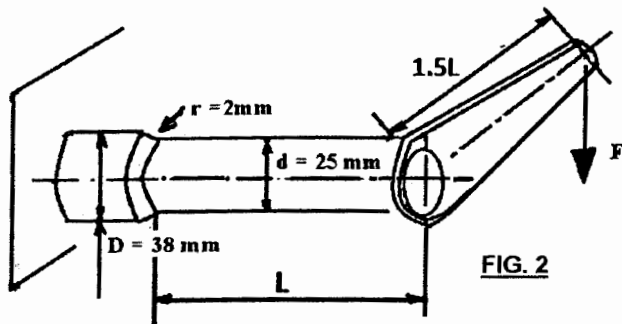
Subject Name: DESIGN OF MACHINE ELEMENTS

Instructions: Answer all FIVE questions which are of equal credits. Any data, if not furnished, may be assumed.

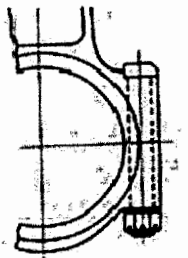
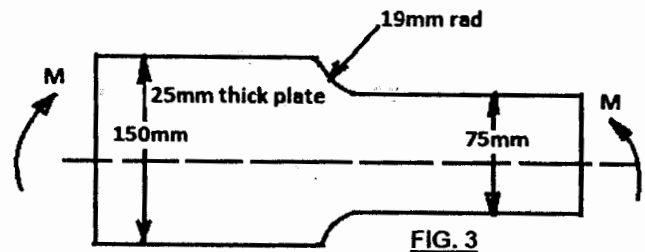
1. The shaft in the Fig.1 rotates. Find the length of the shaft if the bending stress at the fillet equals to the bending stress at the centre.



2. The cantilever beam is to be designed for 90% reliability with the dimensions shown in Fig.2. How large can L be if the force F fluctuates between 800N to 1900N? The shaft material is an alloy steel with $\sigma_u = 1.26$ GPa and $\sigma_y = 1.17$ GPa and the shaft has a machined finish.



3. The machine part shown in Fig.3 is made of C45 steel with $\sigma_u = 825$ MPa, $\sigma_y = 620$ MPa. The bending moment varies between 1.04 kNm to 5 kNm. The part has a machine finish. Is the machine part safe? If it is not what changes in design will you recommend.



4. The connecting rod bolt shown in Fig.4 is M20x2.5. The bolt material tests give $\sigma_u = 724$ MPa, $\sigma_y = 621$ MPa and $\sigma_e = 269$ MPa. The load on the bolt varies continuously from 18 kN to 36 kN. The threads are machined and the stress concentration factor is 3.85. The stress area of the bolt is 272 mm². Find the maximum permissible value of the initial tightening load for a safe continuous operation of the bolt with a factor of safety of 2. A soft copper gasket is used in the joint.

5. The bolted joint shown in Fig.5 uses 20 mm diameter bolts ($d_c = 18.16$ mm). Find the maximum permissible value of the load P if the shear yield stress of the bolt material is 100 MPa.

