

R09

Code: 9A03504

III B. Tech I Semester (R09) Supplementary Examinations, May 2012

DESIGN OF MACHINE ELEMENTS I

(Mechanical Engineering)

Time: 3 hours

Max Marks: 70

Design books are not permitted in the examination hall.

Answer any FIVE questions
All questions carry equal marks

- 1 (a) What are the important considerations that govern the choice of a material?
(b) What is meant by ductility, malleability and plasticity?
- 2 A cantilever of span 500 mm carries a vertical downward load of 6 kN at its free end. Assume yield strength of 350 MPa and factor of safety as 3. Find the economical cross section for cantilever, among: (i) Circular section of diameter 'd'. (ii) Rectangular cross section with depth twice the width, and (iii) I-section of depth 5t and flange 4t, where t is the thickness. Specify the dimensions and cross-sectional area of the economic section.
- 3 (a) What are the criteria of failure for ductile material subjected to:
(i) Static load and (ii) varying load.
(b) A flat plate subjected to a tensile force of 5 kN is shown in figure-3.1. The plate material is grey cast iron FG 200 and the factor of safety is 2.5. Determine the thickness of the plate. Take the stress concentration factor as 1.8 at the hole and as 2.16 for the fillet radius.
- 4 (a) What are the advantages and disadvantages of riveted joints?
(b) A triple riveted lap joint is to be made between 6.5 mm plates. The allowable stresses are 35 N/mm² in tensile, 29 N/mm² in shear, and 52.5 N/mm² in compression. Calculate the rivet diameter, rivet pitch and back pitch, zig - zag riveting is to be used. Indicate how the joint will fail.
- 5 Several members are bolted together in such a manner that the deflection per unit load for the bolted members is the same as for the bolt. Determine: (i) if the initial tightening load on the bolt is 40 kN, what axial external load has to be applied to the bolt to cause separation of the bolted members? (ii) What is the resultant bolt load for an external load of 50 kN? (iii) What is the resultant bolt load for an external load of 100 kN?
- 6 Two rods having 30 mm x 30 mm square cross-section are connected using a gib and cotter. Calculate the leading dimensions of the joint so as to have the strength of the joint same as the strength of the rods in tension. For all the parts of the joint take the allowable stresses as follows:
Tensile Strength = 120 N/mm² Shear Strength = 70 N/mm² and
Compression strength = 240 N/mm².

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- 7 A machine shaft turning at 600 rev/min, is supported on bearings 1000 mm apart as shown in figure-7.4. 15 KW is supplied to the shaft through a 450 mm pulley located 250 mm to the left of the right bearing. The power is transmitted from the shaft through a 200 mm spur gear located 250 mm to the right of the left hand bearing. The belt drive is at angle of 60° above the horizontal. The pulley weighs 800 N to provide some flywheel effect. The ratio of the belt tensions is 3:1. The gear has a 20° tooth form and mates with another gear located directly above the shaft. If the shaft material selected has an ultimate strength of 500 MN/m^2 and a yield point of 310 MN/m^2 determine the necessary diameter using the shock and fatigue factors as $K_b = 1.5$ and $K_t = 1.0$ in bending and torsion respectively.

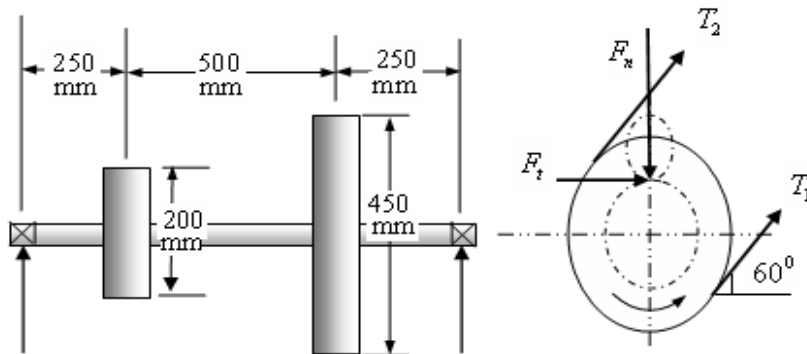


Figure-7.4

- 8 Design and sketch the dimensioned view of the rigid coupling for heavy duty with the following data:
- (i) Power (KW) to Speed (rpm) ratio = 1.5;
 - (ii) Maximum shear strength is 80 N/mm^2 , and
 - (iii) Assume suitable any missing data.
