

December 2022
B.Tech. (HE) - V SEMESTER
Design of Machine Elements-I (PCC-ME-503/21)

Time : 3 Hours]

[Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*
4. *Use of Design data Handbook is allowed.*

PART-A

1. (a) Explain different material properties. (1.5)
- (b) What do you mean by stress concentration? (1.5)
- (c) What are different type of screw threads? (1.5)
- (d) What are applications of cotter joints? (1.5)
- (e) What is a clutch? (1.5)
- (f) Classify couplings. (1.5)

- (g) What is the function of key? Explain. (1.5)
- (h) What is nipping in leaf spring? Discuss its role. (1.5)
- (i) Distinguish between closely coiled & open coiled helical springs. (1.5)
- (j) Differentiate between shaft, spindle and axle. (1.5)

PART-B

- 2. (a) What is fatigue life? What are different concepts of fatigue failure and what are the factors that affect endurance limit of a machine part? (10)
- (b) What are factors affecting Factor of safety? (5)
- 3. (a) Explain the design procedure for an eccentrically loaded riveted Joint having six rivets symmetrically. (5)
- (b) A knuckle joint is required to withstand a tensile load of 25 kN. Design the joint if permissible stresses are : Tensile = 56 MPa, Shear : 40 MPa and Crushing = 70 MPa. (10)
- 4. Design a muff coupling to connect two shafts for 25 kW at 360 rpm. The shaft and key are made of plain carbon steel ($S_y = 400 \text{ N/mm}^2$). The sleeve is made of grey cast iron ($S_{ut} = 200 \text{ N/mm}^2$). The F.O.S. for shaft and key is 4 while for sleeve is 6. (15)

5. (a) What are different types of keys? (5)
- (b) A propeller shaft is required to transmit 50 kW power at 600 rpm. It is a hollow shaft having an inside diameter 0.8 times of outside diameter. It is made of steel ($S_y = 380 \text{ N/mm}^2$) and FOS is 4. Calculate inside & outside diameter of the shaft. (10)
6. (a) Design a leaf spring for the following specifications :
Total Load = 140 kN. Number of springs = 4,
Number of leaves = 10, Span = 1000 mm. Permissible deflection = 80 mm, $E = 200 \text{ kN/mm}^2$. Allowable stress in spring material as 600 MPa. (10)
- (b) Explain the design procedure of a single plate friction clutch for both uniform pressure and uniform wear concepts. (5)
7. An engine developing 45 kW at 1000 rpm is fitted with a cone clutch. The cone has a face angle of 12.5° and a maximum mean diameter of 500 mm. The c.o.f is 0.2. The normal pressure on clutch face is not to exceed 0.1 N/mm^2 . Determine : 1 the face width required, and 2 the axial spring force necessary to enlarge the clutch. (15)
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