JULY-2025

B.Tech. - 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

Q1 (a) What is stress concentration? (1.5)

(b) Explain S-N curve. (1.5)

(c) What is endurance limit? (1.5)

(d) Classify rivetted joints. (1.5)

(e) What is application of knuckle joint? (1.5)

(f) What is usefulness of spline key? (1.5)

(g) Why axial loading is to be considered in shaft design? (1.5)

(h) Explain surge in springs. (1.5)

(i) Draw a cone clutch. (1.5)

(j) What are thermal considerations in brakes design. (1.5)

PART -B

Q2 (a) Classify engineering materials. What are various mechanical properties? (10) Explain.

(b) What are factors affecting Factor of safety? (5)

Q3 (a) Draw and explain different types of keys. (5)

(b) A rigid flange coupling is used to transmit 20 kW power at 720 rpm. There are (10) four bolts and the pitch circle diameter of the bolts is 125 mm. The bolts are made of steel 45C8 (Syt = 380 N/mm2) and the factor of safety is 3. Determine the diameter of the bolts.

Q4 (a) Two rods are connected by means of a socket and spigot cotter joint. The (10) inside diameter of the socket and outside diameter of the socket collar are 50 and 100 mm respectively. The rods are subjected to a tensile force of 50 kN. The cotter is made of steel 30C8 (Syt = 400 N/mm2) and the factor of safety is 4. The width of the cotter is five times of thickness.
Design and Calculate:
(i) width and thickness of the cotter on the basis of shear failure; and
(ii) width and thickness of the cotter on the basis of bending failure.

(b) What are different types of welding joints? Explain with diagrams. (5)

Q5 (a) What are different types of stresses which may occur in a shaft? (5)

(b) A solid circular shaft is subjected to a bending moment of 3000 N-m and a (10) torque of 10 000 N-m. The shaft is made of 45 C 8 steel having ultimate tensile stress of 700 MPa and an ultimate shear stress of 500 MPa. Assuming a factor of safety as 6, determine the diameter of the shaft.

Q6 (a) Derive an expression for stresses in Helical Spring of Circular Wire. (10)

(b) What is nipping in a leaf spring? Discuss its role. List the materials commonly used for the manufacture of the leaf springs. (5)

Q7 (a) What is function of clutch? Explain various types of clutches with diagram. (8)

(b) Draw and explain constructional detail of an Internal Expanding Brake. (7)

****