PVP 14

Code: ME5T5

III B.Tech - I Semester – Regular/Supplementary Examinations
October 2019

DESIGN OF MACHINE MEMBERS-I
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: Use of approved designed data books is permitted

PART – A

Answer ***all*** the questions. All questions carry equal marks

11x 2 = 22 M

1.

a) Explain standardisation.
b) Distinguish unilateral and bilateral stresses**.**
c) Enumerate three basic modes of failure of mechanical components**.**
d) Differentiate high cycle fatigue and low cycle fatigue with the S-N curve.
e) Discuss the factors affecting endurance limit of a machine part.
f) Compare riveted and welded joints.
g) Illustrate the objective of caulking and fullering.
h) What is a stud?
i) Infer the reason for providing taper on only one side of cotter**.**
j) Choose a method to incorporate curvature effect in design of springs.
k) Outline the concept of springs in series and parallel connections.

PART – B

Answer any ***THREE*** questions. All questions carry equal marks.
3 x 16 = 48 M

2. a) A steel saw blade 1 mm thick is bent into an arc of a circle of 50 cm radius. Determine the flexural stresses induced and the bending moment required to bend the blade which is 15 mm wide. Take E = $2.1X10^5$ N/mm^2 8 M

b) A machine element is loaded so that σ_1 = 120 Mpa, σ_2 = 70Mpa, σ_3 = −90Mpa the material has a maximum yield strength in tension and compression of 360Mpa. Find the factor of safety for each of the following theories. i) Maximum Normal stress theory ii) Distortion energy theory. 8 M

3. a) A shaft made of steel having ultimate tensile strength of 700 MPa and yield point 420 MPa is subjected to a torque of 2000 N-m clockwise to 600 N-m anti-clockwise. Calculate the diameter of the shaft if the factor of safety is 2 and it is based on the yield point and the endurance strength in shear. 8 M

b) A simply supported beam has a concentrated load at the centre, which fluctuates from a value of P to 4 P. The span of the beam is 0.5 m and its cross-section is circular with a diameter of 0.06 m. Taking for the beam material an ultimate stress of 700 MPa, a yield stress of 500 MPa,

endurance limit of 330 MPa for reversed bending, and a factor of safety of 1.3, Calculate the maximum value of P. Take a size factor of 0.85 and a surface finish factor of 0.9. 8 M

4. a) A double riveted lap joint is made between 15-mm thick plates. The rivet diameter and pitch are 25 mm and 75 mm respectively. If the ultimate stresses are 400 MPa in tension, 320 MPa in shear and 640 MPa in crushing, find the minimum force per pitch which will rupture the joint. If the above joint is subjected to a load such that the factor of safety is two, Find out the efficiency of the joint. 8 M

b) A steel plate, 80 mm wide and 10 mm thick, is joined to another steel plate by means of a single transverse and double parallel fillet weld, as shown below Fig. 1. The strength of the welded joint should be equal to the strength of the plate to be joined. The permissible tensile and shear stresses for the weld material and the plates are 100 MPa and 70 MPa respectively. Find the length of each parallel fillet weld. Assume that the tensile force passes through the centre of gravity of three welds. 8 M

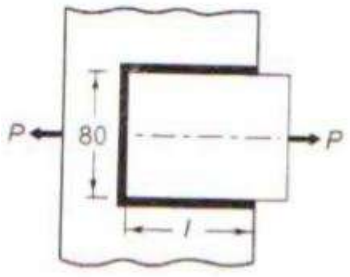

Fig. 1

5. a) Describe the purpose of gib in cotter joint. What are the applications of cotter joints? 8 M

b) Design a socket and spigot type of cotter joint to sustain an axial load of 100kN. The material selected for the joint has the following design stresses. σ_t = 120 MPa, σ_c = 160 MPa and τ= 60 MPa. 8 M

6. a) A railway car weighing 20 kN and moving with a velocity of 15 kmph is to be stopped by a buffer consisting of 4 helical compression springs in which the maximum compression allowed is 0.3 m. Find the no. of active turns required if the spring is made of 20 mm diameter wire and 160 mm mean coil diameter. Also find the maximum shear stress induced in the coils. 8 M

b) A truck spring has 10 leaves and is supported at a span length of 1m, with a central band of 80mm wide. A load of 6kN is applied at the centre of spring whose permissible stress is 300MPa. The spring has a ratio of total depth to width of about 2.5. Determine the width, thickness, deflection and length of all leaves. 8 M