Code No: R2031032 **R20** SET - 1

III B. Tech I Semester Supplementary Examinations, July -2023
DESIGN OF MACHINE MEMBERS - I
(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
*****

UNIT-I

1. a) List and explain briefly the manufacturing considerations in design. [7M]
   b) A shaft subjected to twisting and bending moments of 1200N-m and 800 N-m respectively. If the permissible stresses are 60 MPa in tension and 40 MPa in shear. Determine the diameter of the shaft. [7M]

(OR)

2. a) Describe any four factors that govern selection of material while designing a machine component. [6M]
   b) A bolt is subjected to an axial pull of 10 KN and a transverse shear force of 5 kN. The yield strength of the bolt material is 300 MPa. Considering a factor of safety of 2.5 determine the diameter of the bolt, using (i) maximum normal stress theory (ii) maximum shear stress theory. Take poisson's ratio as 0.25 [8M]

UNIT-II

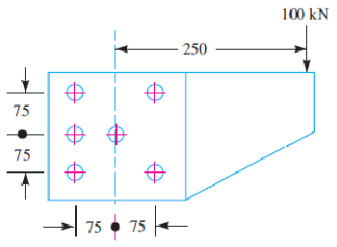
3. A machine component is subjected to a flexural stress which Fluctuatesbetween+400 MN/m^2 and $-200MN/m^2$.Determine the value of minimum ultimate strength according to (i) Gerber relation, (ii) Modified Good man relation; and(iii) Soderberg relation. [14M]
   Take yield strength = 0.55 Ultimate strength ;
   Endurance strength = 0.5 Ultimate strength;
   Factor of safety = 2.

(OR)

4. a) Discuss the various methods of reducing stress concentration. [6M]
   b) A 40 mm diameter shaft, made from carbon steel is hardened to 180 Brinnel. is subjected to a torque, which fluctuates from +2000 N-m to -1000 N-m. Calculate the factor of safety using soderberg criteria. Use the following information: [8M]
   Ultimate tensile strength (U.T.S) = 33 X B.H.N kgf/cm^2
   Torsional endurance limit = 0.25 X U.T.S
   Yield strength = 0.6 X U.T.S
   Yield strength in shear = 0.5 X U.T.S

UNIT-III

5. a) A bracket is riveted to a column by 6 rivets of equal size as shown in Fig below it carries a load of 100 kN at a distance of 250 mm from the column. If the maximum shear stress in the rivet is limited to 63 MPa, find the diameter of the rivet. [8M]

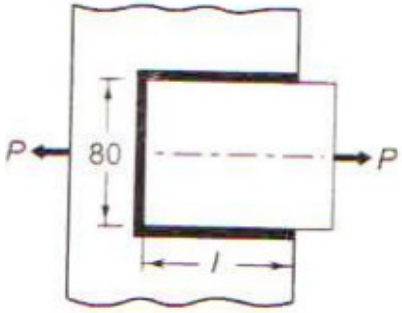


All dimensions in mm.

b) Explain the method of determining the size of the bolt when the bracket carries an eccentric load perpendicular to the axis of the bolt. [6M]

(OR)

6. a) 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. below. 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. [10M]



b) Classify the keys and state their applications. [4M]

UNIT-IV

7. a) Describe any two types of shaft couplings, with sketches. [7M]

b) A solid shaft is to transmit 1000 kW at 120 rpm. Find the shaft diameter if the permissible shear stress is 80 N/mm^2. If the shaft is made hollow, find the inside and outside diameters when the ratio of inside to outside diameters is 0.5. [7M]

(OR)

8. A mild steel shaft has to transmit 70 kW at 240 rpm. The allowable shear stress in the shaft material is limited to 45 MPa, and the angle of twist is not to exceed 1^0 in a length of 20 times the shaft diameter. Determine the shaft diameter, and design a cast iron flange coupling of protected type for the shaft. The shear stress in the coupling bolts is to be limited to 30 MPa. [14M]

UNIT-V

9. a) A load of 1kN is dropped axially on a closed helical compression spring from a height of 250 mm. The spring has 20 active coils. Take wire diameter as 20mm. Spring index is 8. Determine the deflection and stress induced in the spring. Take G=0.84X 10^5MPa. [10M]

b) Enumerate the Materials suitable for leaf springs in detail. [4M]

(OR)

10. a) Design a compression helical spring to carry a load of 600 N with a deflection of 28 mm. The spring index may be taken as 9. Assume the following values of the spring material: Permissible shear stress=350 MPa Modulus of rigidity =84 kN/mm$^{2.}$ Wahl's factor = (4C-1) / (4C-4) +0.615/C, where C is spring index. [7M]

b) Derive the expressions for stress and deflection of a helical spring of circular wire [7M]