B.Tech III Year I Semester (R13) Supplementary Examinations June 2017

DESIGN OF MACHINE MEMBERS – I

(Mechanical Engineering)

Use of Design data books is permitted in the examination hall

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Mention the factors considered for the selection of manufacturing methods for a machine element.
(b) State the principle stress theory of failure and mention why this theory is not applicable for ductile materials.
(c) What is the effect stress concentration on ductile and brittle materials under static and dynamic loadings?
(d) What is low cycle fatigue? Give practical example of low cycle fatigue failure.
(e) State the difference between hot and cold riveting.
(f) Give the manning and importance of uniform strength bolts. How is uniform strength bolts produced?
(g) What is knuckle joint? Mention two applications for knuckle joint.
(h) Mention materials used for making transmission shafts.
(i) Mention the purposes of couplings used in the machineries.
(j) What is flexible coupling? What are its types?

PART – B

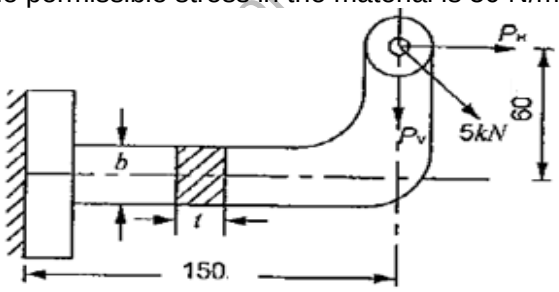
(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) State the design process of machine elements.
(b) Discuss how materials selection is done while designing of mechanical components.

OR

3 (a) A mild steel bracket shown in figure below is subjected to a pull of 5000 N acting 45 degrees to horizontal direction. The bracket is rectangular section whose depth is twice the thickness. Find the cross sectional dimensions of the bracket, if the permissible stress in the material is 50 N/mm^2.



(b) A bolt is subjected to a tensile load of 25 kN and shear load of 10 kN. Determine the diameter of the bolt according to: (i) Maximum principle stress theory. (ii) Maximum shear stress theory. Assume factor of safety as 2.5, yield point stress in simple tension = 300 N/mm^2, Poisson ratio = 0.25.

UNIT – II

4 (a) State the factors affecting endurance strength of the components.
(b) A machine component is subjected to a fluctuating stress that varies from 40 N to 100 N/mm^2. The corrected endurance limit of the machine component is 270 N/mm^2. The ultimate stress and yield point stress of the material are 600 and 400 N/mm^2 respectively. Find the factor of safety using: (i) Gerber formula. (ii) Solderberg line.

OR

5 A pulley is keyed to a shaft midway between two bearings. The shaft is made of cold drawn steel for which the ultimate strength is 550 MPa and the yield strength is 400 MPa. The bending moment at the pulley varies from – 150 N-m to +400 N-m as the torque on the shaft varies from –50 N-m to +150 N-m. Obtain the diameter of the shaft for an indefinite life. The stress concentration factors for the keyway at the pulley in bending and in torsion are 1.6 and 1.3 respectively. Take the following values: Factor of safety = 1.5. Load correction factors = 1.0 in bending and 0.6 in torsion. Size effect factor = 0.85. Surface effect factor = 0.88

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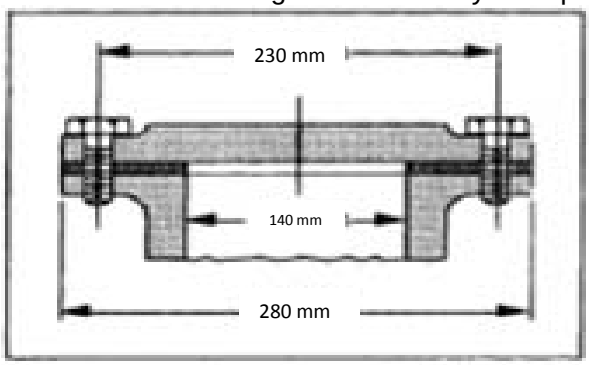
UNIT – III

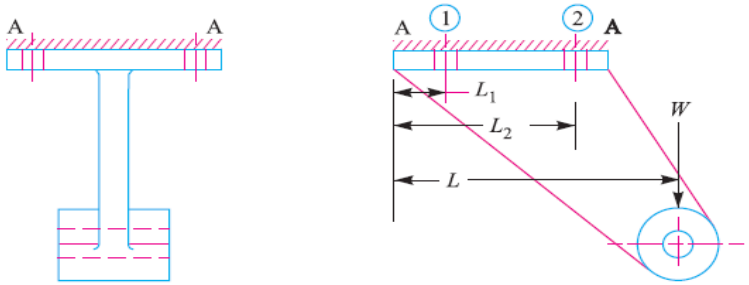
6 Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m in diameter subjected to a steam pressure of 0.95 N/mm^2. Assume joint efficiency as 75%, allowable tensile stress in the plate 90 MPa; compressive stress 140 MPa; and shear stress in the rivet 56 MPa.

OR

7 (a) The internal pressure of a vessel with gasketed end plate is sufficiently uniform that of the bolt loading can be considered as static. A gasket clamping pressure of at least 13 MPa is needed. Find: (i) For 12, 16 and 20 mm bolts with coarse threads and made of Steel determine the number of bolts needed. (ii) If the ratio of bolt circle circumference to number of bolts should not exceed 10 not to be less than 5, state which of the bolt sizes considered gives satisfactory bolt spacing.



(b) A bracket as shown in figure below supports a load of 30 kN. Determine the size of bolts, if the maximum allowable tensile stress in the bolt material is 60 MPa. The distances are: L_1 = 80 mm, L_2 = 250 mm and L = 500 mm.



UNIT – IV

8 Design a knuckle joint for a tie rod of a circular section to sustain a maximum pull of 70 kN. The ultimate strength of the material of the rod against tearing is 420 MPa. The ultimate tensile and shearing strength of the pin material are 510 MPa and 396 MPa respectively. Determine the tie rod section and pin section. Take factor of safety = 6.

OR

9 (a) A hollow shaft is required to transmit 600 kW at 110 rpm, the maximum torque being 20% greater than the mean. The shear stress is not to exceed 63 MPa and twist in a length of 3 meters not to exceed 1.4 degrees. Find the external diameter of the shaft, if the internal diameter to the external diameter is 3/8. Take modulus of rigidity as 84 GPa.

(b) A steel propeller shaft with 51 mm diameter transmits 1492 kW at 2000 rpm. Find: (i) Nominal stress at the surface. (ii) Determine the outside diameter required to give same outer surface stress if the hollow shaft inside diameter is 0.9 times the outside diameter used. (iii) Compare the weights of solid and hollow shafts

UNIT – V

10 Design a cast iron protective type flange coupling to transmit 15 kW at 900 rpm from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used: Shear stress for shaft, bolt and key material = 40 MPa; Crushing stress for bolt and key = 80 MPa; Shear stress for cast iron = 8 MPa.

OR

11 Design a flexible bush type coupling to transmit 5 kW at 750 rpm with a overload capcity of 120%. For shaft, bolt and keys permissible stress is 50 N/mm^2. For castiron shear stress is 15 N/mm^2 and bearing stress is 2 N/mm^2. For keys crushing stress is 10 N/mm^2.

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