July-22-00298

B. Tech. EXAMINATION, 2022

Semester V (CBCS)

MACHINE DESIGN–1

(ME, AE)

ME-504

Time : 3 Hours   *Maximum Marks : 60*

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt *Five* questions in all, selecting *one* question from each Section A, B, C and D. Q. No. 9 is compulsory. Design Data Book is required.

Section A

1. (a) What is the basic procedure of Machine design ?   4

Fig. 2

6. (a) What is the cause of residual stresses in welded joint ? How are they relieved ?   4

(b) A welded joint, as shown in Fig. 3, is subjected to an eccentric load of 2500 N. Find the size of the weld, if the maximum shear stress in the weld is not to exceed 50 N/mm^2.   6
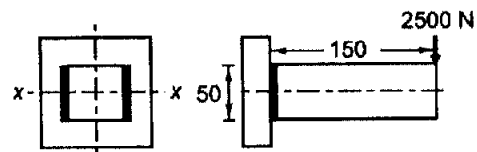

Fig. 3

Section D

7. Two rods are connected by means of a cotter joint. The inside diameter of the socket and outside diameter

(b) What are the types of failure ? Explain each in detail. **6**

2. (a) What is BIS system of fits and tolerance in design ? **4**

(b) What are the principles of Design for Manufacture and Assemblies (DFMA) ? **6**

Section B

3. The armature shaft of a 40 kW, 720 rpm electric motor, mounted on two bearings A and B, is shown in Fig. 1. The total magnetic pull on the armature is 7 kN and it can be assumed to be uniformly distributed over a length of 700 mm midway between the bearings. The shaft is made of steel with an ultimate tensile strength of 770 N/mm² and yield strength of 580 N/mm². Determine the shaft diameter using the ASME code if, kb = 1.5 and kt = 1.0. Assume that the pulley is keyed to the shaft. **10**
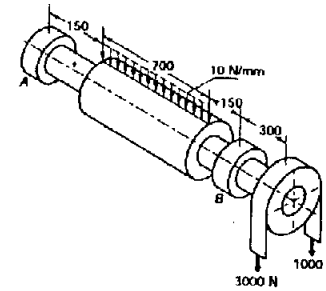

Fig. 1

4. (a) What are the advantages and disadvantages of Woodruff key over flat key ? **4**

(b) A solid circular shaft of diameter d is subjected to a bending moment of Mb and torsional moment of Mt. Prove that according to maximum shear stress theory : **6**

$$\frac{0.5\, S_{yt}}{(fs)} = \frac{16}{\pi d^3} \sqrt{(M_b)^2 + (M_t)^2} .$$

Section C

5. Two plates, each 5 mm thick, are connected by means of four rivets as shown in Fig. 2. The permissible stresses for rivets and plates in tension, shear and compression are 80, 60 and 120 N/mm² respectively. Calculate : (i) diameter of the rivets; (ii) width of the plate; and (iii) efficiency of the joint. **10**

(g) What is the critical speed of shaft ? 2

(h) What is parallel fillet weld ? 2

(i) What is double-strap butt joint ? 2

(j) How is rivet specified ? 2

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/mm^2) and the factor of safety is 4. The width of the cotter is five times of thickness. 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. 10

8. (a) Explain the stress developed in pipes. 4

(b) Explain the design consideration of hydraulic pipe joints for high pressure. 6

(Compulsory Question)

9. (a) What is the final outcome of a machine design process ? 2

(b) What is X20Cr18Ni2 designation of steel ? 2

(c) What is a casting process ? Give examples of components made by casting. 2

(d) What is yield point ? 2

(e) What is fracture toughness in fracture mechanics ? 2

(f) What is Kennedy key ? Give its applications. 2