

Roll No.

Total No. of Pages : 02

Total No. of Questions : 07

B.Tech. (ME) (2011 Onwards) (Sem.-5)

DESIGN OF MACHINE ELEMENTS-I

Code : BTME-501

Paper ID : [A2128]

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains SIX questions carrying TEN marks each and students have to attempt any FOUR questions.
3. Use of design databook is allowed. Assume appropriate value of missing data, if any.

SECTION-A

1. Write briefly :

- a) What do you mean by bearing stress?
- b) Why a hollow shaft is superior to a solid shaft?
- c) Define efficiency of a rivet joint.
- d) What is an eccentric loaded welded joint?
- e) Define endurance strength.
- f) Under what condition a flexible coupling is used?
- g) Why the saddle key is suitable only for light duty power transmission?
- h) Discuss the significance of initial tightening in a bolted joint.
- i) What is mechanical advantage in case of a lever?
- j) For pipes that are buried in the earth, which joint is used?

SECTION-B

2. With the help of block diagram, discuss the basic procedure of machine design. Give suitable examples in support. (10)
3. a) Find the efficiency of a single riveted lap joint of 6 mm plates with 20 mm diameter rivets having a pitch of 50 mm. Assume permissible stresses in tension, shear and crushing as 120 MPa, 90 MPa and 180 MPa respectively. (6)
b) Two shafts are connected by means of a flange coupling to transmit torque of 25 N-m. The flanges of the coupling are fastened by four bolts of the same material at a radius of 30 mm. Find the size of the bolts if the allowable shear stress for the bolt material is 30 MPa. (4)
4. Design a muff coupling which is used to connect two steel shafts transmitting 40 kW at 350 rpm. The material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15 MPa. (10)
5. a) A plate 50 mm wide and 12.5 mm thick is to be welded to another plate by means of parallel fillet welds. The plates are subjected to a load of 50 kN. Find the length of the weld. Assume allowable shear strength to be 56 MPa. (5)
b) A solid circular shaft is subjected to a bending moment of 3000 Nm and a torque of 10000 Nm. The shaft is made of 45C8 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 using maximum shear stress theory. (5)
6. Two mild steel rods are connected by a knuckle joint to transmit an axial force of 100 kN. Design the joint completely assuming the working stresses for both the pin and rod materials to be 100 MPa in tension, 65 MPa in shear and 150 MPa in crushing. (10)
7. Design a foot lever operated by 800 N load, which is acting at a distance of 1 m from the center of shaft. The arm is having rectangular x-section with width to thickness ration as 3:1 at a distance of 60 mm from the center of shaft. The allowable tensile stress may be taken as 73 MPa and allowable shear stress as 70 MPa. (10)