2006 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY

III B.TECH I SEMESTER SUPPLEMENTARY EXAMINATIONS
DESIGN OF MACHINE ELEMENTS
(COMMON TO MECHANICAL ENGINEERING AND PRODUCTION ENGINEERING)
NOVEMBER 2006

TIME -3 HOUR
MARK – 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) What are the properties to be considered in selecting the materials in the design of Machine Parts? Discuss.

(b) In a hydro dynamic journal bearing, the bearing bush is fitted with a recommended class of fit 50H8-s6 in its housing. The limiting dimensions are as follows:
for bearing 50 +0.046 +0.000 and for Journal 50-0.053 -0.072 Find the type of Fit used and justify the answer   [10+6]

2. A hollow cylindrical chimney is 25m height, 2.5m external diameter and 2m internal diameter. The density of the chimney material is 700 Kg/m3. A horizontal wind pressure of 125 Pa of projected area is acting on the chimney throughout its height. Find

(a) the maximum and minimum normal stresses induced in the base of the chimney, and

(b) the limiting value of the wind pressure so that no point in the base is under tensile stress.   [10+6]

3. (a) Explain the effect of the following factors on the type of fatigue failure

i. Range of imposed stress

ii. Surface treatement

(b) A stepped shaft transmits a torque varying from 800 N m to 1200 N m. The ratio of diameter is 1.5 and the stress concentration factor is 1.2. Determine the diameter of the shaft for an infinite life for a design factor of safety 1.8. The ultimate tensile strength of the material of the shaft is 600 MPa. Yield stress of the material is 450 MPa. Consider the size effect and surface finish effect.   [6+10]

4. (a) Explain the following terms in connection with riveted joints

i. Pitch

ii. Back pitch

iii. Diagonal pitch

iv. Margin

(b) A double riveted butt joint, in which the pitch of the rivets in the outer rows is twice that in the inner rows, connects two 16 mm thick plates with two cover plates each 12 mm thick. The diameter of the rivets is 22 mm. Determine the pitches of the rivets in the two rows if the working stresses are not to exceed the following limits: Tensile stress in plates = 100 MPa, Shear stress in rivets = 75 MPa and bearing stresses in rivets and plates = 150 MPa. Make a fully dimensioned sketch of the joint showing atleast two views   [2+2+2+2+8]

5. A bracket carrying a load of 15 KN is to be welded . Find the size of weld required if the allowable shear stress is not to exceed 80 MPa.

                                        [16]

6. (a) Describe the purpose of gib in cotter joint? What are the applications of cotter joints?

(b) Design a knuckle joint to transmit 140 kN, with permissible stresses in tension; shear and compression are 75 Mpa ; 60 Mpa and 150 Mpa respectively.   [8+8]

7. A hollow shaft of 0.5m outside diameter and 0.3m inside diameter is used to drive a propeller of a marine vessel. The shaft is mounted on bearings 6 meter apart and it transmits 5600 KW at 150 rpm. The maximum axial propeller thrust is 500 kN and the shaft weighs 70 kN determine the maximum shear stress developed in the shaft and the angular twist between the bearings.   [16]

8. Design a C.I flange coupling to transmit 150Hp at 250 rpm. The following permissible stresses may be used Permissible shear stresses for shaft, bolt and key material = 50N/mm2. Permissible crushing stress for bolt and key = 150N/mm2. Permissible shear stress for cart Iron = 8N/mm2. [16]