

1058

B.E. (Mechanical Engineering)

Sixth Semester

MEC-601: Design of Machines Elements – II

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Part. Use of design data book is allowed.

x-x-x

I. Write briefly:

(2x5)

- a. What is Chordal action in case of chain drive.
- b. What are the different modes of failure of a gear .
- c. Design of disc clutch is based on uniform wear theory. Why.
- d. What are the active coils of a spring.
- e. Why are connecting rods made of I sections.

PART A

- II. A 15 kW and 1200 r.p.m motor drives a compressor at 300 r.p.m through a pair of spur gears having 20° stub teeth. The centre to centre distance between the shafts is 400 mm. The motor pinion is made up of forged steel having an allowable static stress as 210 MPa, while the gear is made of cast steel having the allowable static stress as 140MPa. Assuming that the drive operates 8-10 hours per day under light shock conditions, find from the strength considerations, (i) Module (ii) Face width (iii) Number of teeth and pitch circle diameter of each gear. Also check the gears thus designed from the wear considerations. The surface endurance limit may be taken as 700 MPa. (10)
- III. a) A V belt drive is required for a 15kW, 1440 r.p.m electric motor, which drives a centrifugal pump running at 360 r.p.m for a service of 24 hours per day. From the space considerations, the centre distance should be approximately 1m. Determine the belt specifications ,number of belts, and the correct centre distance. (7)
b) In chain drive there are odd number of teeth in the sprocket and even number of links in chain . Why. (3)
- IV. a) A ball bearing operates on following work cycle of 1 minute duration. Dynamic load capacity of the bearing is 16600 N.
(i) Radial load of 3000 N at 720 rpm for 18 sec.
(ii) Radial load of 7000 N at 720 rpm for 30 sec.
(iii) Radial load of 5000 N at 720 rpm for 12 sec.
Calculate the rated life of the bearing in hours. (6)

- b) What is the importance of bearing modulus in the design of journal bearing. (4)

PART B

- V. (a) Design a helical spring for a spring loaded safety valve for the following data: Diameter of the valve seat=65mm, operating pressure=0.7MPa, Maximum pressure when the valve blows off=0.75MPa, Maximum lift when pressure rises from 0.7 to 0.75MPa=3.5mm, allowable shear stress=550 MPa and Modulus of rigidity= 84×10^3 N/mm² for spring material. Take spring index equal to 6. (7)
- (b) Why is nipping done in leaf springs. (3)
- VI. (a) A cone clutch is to be designed to transmit 7.5kW at 900 rpm. The cone has a face angle of 12°. The width of the face is half of the mean radius and maximum pressure between contact surfaces is not to exceed 0.09MPa. Determine the main dimensions of the clutch if the coefficient of friction is 0.2. Also find the axial thrust required to engage the clutch. (6)
- (b) Derive an expression for the braking torque for an internal expanding brake. (4)
- VII. Design a connecting rod for an I.C engine running at 1800 r.p.m and developing a maximum pressure of 3.15 N/mm². The diameter of piston is 100mm, mass of reciprocating parts per cylinder 2.25kg, length of connecting rod=380mm, stroke of piston=190mm and compression ratio is 6:1. Take factor of safety =6, length to diameter ratio for big end bearing is 1.3 and for the small end bearing as 2 and the corresponding bearing pressure are 10MPa and 15 MPa respectively. The density of the rod material may be taken as 8000kg/m³ and the allowable stress in bolts and cap as 60MPa and 80MPa respectively. (10)