

2014

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 Unit. Use of design data book is allowed.

x-x-x

Q.1 Give clear and brief answers to following questions:

- (a) What is polygonal action in roller chains? How will you reduce it?
- (b) Give two advantages and disadvantages of roller contact bearings over sliding contact bearings.
- (c) What are herringbone helical gears?
- (d) What are self energizing brakes?
- (e) Why are belt drives called as 'flexible drives'? (2 X 5=10)

PART – A

Q.2 Design a flat belt drive to connect two transmission shafts rotating at 800 rpm and 400 rpm respectively. The centre to centre distance between the shafts is approximately 3 m and belt drive is open-type. The power transmitted by the belt is 30 kW and load correction factor is 1.3. The belt should operate at a velocity between 17.8 m/s to 22.8 m/s. The power transmitting capacity of the belt per mm width per ply at 180° arc of contact and at a belt speed of 5.08 m/s is 0.0147 kW. Select preferred pulley diameters and specify the belt. (10)

Q.3 A pair of spur gears with 20° pressure angle consists of a 25 teeth pinion meshing with 60 teeth gear. The module should be taken as 5 while face width is 45 mm. The pinion rotates at 500 rpm. The gears are made of steel and heat treated to a surface hardness of 220 B.H.N. Assume the dynamic load is accounted by means of the velocity factor. The service factor is 1.75 & factor of safety is 2. Find (i) dynamic and static loads that the gear can transmit without pitting, (ii) wear strength of gears, and (iii) rated power that can be transmitted by gears. (10)

(2)

Q.4 (a) Explain briefly the term 'nipping of leaf springs'. (2)

(b) A semi-elliptical spring used for automobile suspension, consists of two extra full-length leaves and eight graduated-length leaves including master leaf. The centre-to-centre distance between two eyes is 1 m. The leaf material is steel and factor of safety is 2. The maximum spring load is not to exceed 30 kN. The leaves are prestressed so as to equalize stresses *in* all leaves under maximum load. Determine the dimensions of the cross-section of the leaves and deflection at the end of the spring. (8)

PART – B

Q.5 (a) What is difference between single & multiplate clutches? (2)

(b) A multiplate clutch consists of two steel disks with one bronze disk. The inside and outside diameters of contacting surfaces are 200 mm & 250 mm respectively. The coefficient of friction is 0.1 and maximum pressure between contacting surfaces is limited to 0.4 N/mm². Calculate force required to engage the clutch and power transmitting capacity at 720

rpm assuming (i) uniform wear theory, and (ii) uniform pressure theory. (8)

Q.6 (a) What do you understand by the term 'basic dynamic load rating' of a rolling contact bearing? (2)

(b) A single-row deep groove ball bearing is subjected to a radial load of 8 kN and a thrust force of 3 kN. The values of X and Y factors are 0.56 & 1.5 respectively. The shaft rotates at 1000 rpm. The diameter of shaft is 65 mm and bearing is subjected to a dynamic load of 112 kN. (i) Find the life of this bearing with 90% reliability, and (ii) Estimate reliability for 10000 hours life. (8)

Q.7 (a) Give Petroff's equation for journal bearings. (2)

(b) The following data has been given for a full hydrodynamic journal bearing:

Radial load = 25 kN, journal speed = 900 rpm, unit bearing pressure = 2.5 MPa, length-to-diameter ratio = 1.25, viscosity of lubricant = 20 cp, class of fit = H7e7

Calculate (i) dimensions of the bearing, (ii) minimum film thickness, and (iii) requirement of oil flow. (8)