(3 Hours)

N.B. 1) **Question No. 1 is compulsory**
2) Solve **Any Three** from remaining **Five** questions.
3) Use of ***PSG Design data book*** is permitted
4) Assume suitable data if necessary, giving justification

Q1 Answer any **Four** from the following

a) Explain how assumptions made in Lewis equation are taken into account during design. **5**

b) Discuss advantages and disadvantages of rolling contact bearings over sliding contact bearings. **5**

c) Explain the significance of pressure angle in cam and follower design. **5**

d) Discuss the desirable properties of friction materials and least out at least two friction materials. **5**

e) Discuss the advantages and disadvantages of belt drives as compare to the chain or gear drive. **5**

Q2 It is required to design a two stage spur gear reduction unit with 20^0 full depth involute teeth. The input shaft is connected to 10KW, 1440 rpm motor through a flexible coupling. The speed of output shaft shall be approximately 180 rpm. The starting torque of motor is 150% of rated torque. The gears are made of plain carbon steel with ultimate tensile strength of 700 N/mm^2 and heat treated to a surface hardness of 340 BHN. Design the gear and specify the dimensions. **20**

Q3 a) A worm and worm wheel drive is required to transmit power from an electric motor rated at 11KW and 1440 rpm with reduction ratio of 15. The power is supplied to a belt conveyor which operates for 12 hours per day. Selecting suitable material and stresses, design worm and worm wheel for strength and wear. Do not check for heat dissipation capacity. **10**

Q3 b) A ball bearing mounted on 90 mm shaft operates on the following work cycle. **10**

No.	Radial load (KN)	Speed (rpm)	Duration in sec.
1	3	720	3
2	7	1440	4
3	5	900	3

Select a suitable bearing for a life of 10,000 hours with 93% probability of survival.

Turn Over

Q4 a) The following data is given for 360^0 hydrodynamic bearing. **10**
Radial load = 10KN, Journal speed = 1450 rpm, L/D ratio = 1,
Bearing length = 50mm, Radial clearance = 20 microns, Eccentricity = 15 microns
Calculate

1) The minimum oil film thickness
2) The coefficient of friction
3) Power lost in friction
4) Viscosity of lubricant in Centipoise
5) The total flow rate of the lubricant in liters per minute.

Q4 b) Design a chain drive to meet following specifications **10**
Input Power = 5.5 KW
Input speed = 300 rpm
Output speed = 100 rpm

Q5 A cone clutch is required to transmit 11 KW at 960 rpm. Design following components by selecting suitable materials and design stresses. **20**

1) The Cone 2) The Cup 3) The Spring 4) The driven shaft

Draw neat sketches of above components and indicate dimensions. Assuming that the time for each engagement = 0.125 seconds and 30 engagements takes place per hour. Determine steady state temperature of the cup outer surface. Consider that the entire heat generated during engagement is transferred to the cup and heat dissipation takes place from the outer surface of cup.

Q6 a) A rotary disc cam with central translatory roller follower has following motion. **10**
Forward stroke of 25 mm in 120^0 of cam rotation with SHM motion, Dwell of 60^0 of cam rotation and return stroke of 25 mm in 100^0 of cam rotation with SHM. Remaining dwell to complete the cycle. Mass of the follower is 1 Kg and Cam shaft speed is 500 rpm. The maximum pressure angle during forward stroke and return stroke is limited to 25^0. The external force during forward stroke is 300 N and that of return stroke is 50 N.

1. Draw Displacement, Velocity and Acceleration time diagram
2. Find prime circle radius, Base circle radius
3. Calculate radius of curvature of pitch curve and Cam profile
4. Determine width of the cam

Q6 b) Determine size of a rubber canvas flat belt to transmit 5.5 KW from an electric motor rotating at 960 rpm to an intermediate shaft of machine tool. The reduction ratio is 2.8 approximately and Expected life is 1200 hours. **10**
