

(3 Hours)

[Total Marks: 80]

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

Q1 Answer any **Four** from the following

- a) Discuss the type of materials and properties of clutch plate lining. **5**  
 b) Explain the Chordal action of a chain drive. **5**  
 c) Write note on Design consideration of forging. **5**  
 d) Discuss about oil feeding and oil circulating methods in Journal bearings. **5**  
 e) Express the relation between shear stress and crushing stress for a square key equally strong in shear and crushing. **5**

Q2a) Screw jack has to lift a load of 90 KN through a height of 350 mm.

- 1) Select suitable material for screw and nut. **04**  
 2) Design screw and nut. **07**  
 3) Check screw for buckling failure. **04**

Q2b) Explain overhauling of screw and self-locking of screw. **05**

Q3a) A shaft is housed in the bearing 2.2 m apart. It carries a pulley of diameter 350 mm at 200 mm to the right of the left-hand bearing. It also carries another pulley of 550 mm diameter to a distance of 1000 mm to the left of right-hand bearing. 350 mm diameter pulley receives 25 KW power from a motor kept below it with the help of flat belt drive. 550 mm diameter pulley delivers power with the help of horizontal flat belt drive. The coefficient of friction and angle of contact for both the pulleys are 0.28 and  $160^\circ$ . Design the solid shaft. Assume the weight of both the pulleys are 1.2 KN each and the shaft is made of C45. The assembly rotates with 440 rpm in clockwise direction when viewed from left to right. **15**

Q3b) Draw and explain different fatigue stress cycles. **05**

Q4a) A ball bearing mounted on a 90 mm shaft operates on the following work cycle. **10**

No.	Radial Load (KN)	Speed (rpm)	Duration in second
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

- Q4b) The load on a  $75 \times 75$  mm  $360^0$  hydrodynamic bearing is 12.5 KN. Journal speed 2000 rpm **10**  
and viscosity of oil 10 CP. Clearance ratio  $\frac{1}{1000}$ . Calculate.  
1) The minimum oil film thickness.  
2) The coefficient of friction.  
3) Power lost in friction.  
4) The total oil flow rate.  
5) Rise in temperature of bearing.
- Q5a) Determine size of rubber canvas flat belt to transmit 5.5 KW power from an electric motor **10**  
rotating at 960 rpm to an intermediate shaft of machine tool. The reduction ratio is 2.8  
approximately and expected life is 1200 hours.
- Q5b) Calculate the factor of safety on breaking load for a chain 10A-2 DR50 which is used to **10**  
transmit 15 KW design power. The input speed is 960 rpm and reduction ratio is 2.90.
- Q6a) A helical spring is subjected to the load varying from 500 N to 1100 N, having spring index **15**  
of 6, free length of spring is to lie between 100 mm to 150 mm. The maximum compression  
under variation of load is 3 cm. Assuming stresses for spring material and  $G = 0.8 \times 10^5$   
 $\text{N/mm}^2$ . Design the spring and find the energy stored in the spring.
- Q6b) State different theories of failure and explain any two in details. **05**
-