Sem VI / MECH

Paper / Subject Code: 89421 / Machine Design

(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) Why factor of safety is necessary in design of mechanical elements? Discuss the important factors influencing the selection of factor of safety. **5**

b) Explain overhauling of screw and self-locking of screw. **5**

c) What do you understand by stress concentration? How to minimize the stress concentration **5**

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

e) Write a note on Nipping in a leaf spring **5**

Q2 a) Design a Socket and Spigot type of cotter join to transmit an axial load of 60 KN. Select suitable material, factor of safety and draw informative sketch. **15**

b) Explain the terms applied to rolling element bearing - 1) Rated life 2) Dynamic capacity 3) static capacity. **05**

Q3 a) A shaft is supported in bearings A and B, 1000 m apart. An involute spur gear having PCD 400 mm is located at 300 mm to the right of LH bearing and a 600 mm diameter pulley is mounted 350 mm to the left of RH bearing. The gear is driven by a pinion located vertically above, while the pulley transmits power via belt drive to a pulley located vertically below. The ratio of belt tension is 2.0. The pulley weighs 2500N. Design the shaft, if power transmitted is 30 KW at 400 rpm. The shaft rotates clockwise when viewed from A. **15**

b) Write note on – Criteria for material selection. **05**

Q4 a) A DGBB is to be selected for an intermediate shaft of helical gear box which is subjected to an axial load of 5 KN and radial load of 12 KN when operating at 600 rpm. Select suitable size of bearing if it is required to have a life of 20000 hours with a probability of survival of 92%. **10**

b) Following data is given for a 360^0 hydrodynamic bearing. **10**
Radial load = 10 KN, Journal speed = 1450 rpm, l/d ratio =1, bearing length = 50 mm, radial clearance = 20 microns, eccentricity = 15 microns. Calculate 1) the minimum oil film thickness 2) Coefficient of friction 3) Power lost in friction 4) Viscosity of lubricant in CP 5) total flow rate of lubricant in liters/minutes.

Q5 a) A single cylinder four stroke cycle internal combustion engine produces 15 KW power at 700 rpm. Design a suitable flywheel, assuming coefficient of fluctuation of speed as 0.04. The torque developed during the power stroke may be considered as sine curve and work done during the power stroke is 30% more than the work done per cycle. **10**

b) Calculate the factor of safety on breaking load for a chain $10A_2$ DR50 which is used to transmit 15 KW design power. The input speed is 960rpm and reduction ratio is 2.90. **10**

Q6 a) A close coil helical compression spring is subjected to an axial load varying from 5 KN to 6.5 KN at frequency of 20 cycle per second. The spring rate is 70 N/mm. Design the spring for a factor of safety 1.8. the properties of spring material are **15**

$S_u = \frac{2000}{d^{0.17}} MPa$ $S_{ys} = \frac{1200}{d^{0.17}} MPa$ $Sno = \frac{600}{d^{0.15}} MPa$ $G = 80000\ N/mm^2$

Where d is diameter of wire.

b) State different theories of failure and explain any two in details. **05**
