(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)	Discuss on various types of threads used for power screw.	**5**
c)	What do you mean by endurance limit? How the endurance limit of a component is decided?	**5**
d)	Discuss advantages and disadvantages of rolling contact bearings over sliding contact bearings	**5**
e)	What is surge in spring? How it can be eliminated.	**5**

Q2a) Design a Knuckle joint subjected to an axial pull of 10 KN. Selecting suitable material for all the parts decide the allowable stresses. Design should include figures for the Joint and failure areas. **15**

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

Q3a) A solid shaft transmitting 40 KW at 960 rpm, is supported on two bearings 1m apart and has two spur gears keyed on it. The pinion is having 200 mm PCD and is located 150 mm to the left of RH bearing and tangential force acts horizontally on it. The gear is having 500 mm PCD and is located 250 mm to the right of LH bearing, and tangential force acts vertically downward on it. Select suitable material and determine the diameter of shaft using maximum shear stress theory. **15**

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

Q4a) A DGBB is subjected to a radial load of 4.5KN and an axial load of 2.5KN. The bearing rotates at 600 rpm. Considering the expected life of 18000 hours with survival probability of 93% and operating temperature of 135 ^{0}C, select a suitable standard bearing. **10**

Q4b) Following data is given for a 360^0 hydrodynamic bearing. **10**
Radial load = 6.5KN, Journal speed = 1200 rpm, journal diameter = 60 mm, bearing length = 60 mm, minimum oil film thickness = 0.009 mm. The class of fit is H_7e_7 normal running fit. Specify the viscosity of lubricating oil that you will recommend for this application. Choose the lubricant (SAE No.) if mean operating temperature of the bearing is given as 100^0

Q5a) 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**

Q5b) Design a chain drive to meet the following specification **10**
Input power = 5.5 KW, Input speed = 300 rpm, Output speed = 100 rpm.

Q6a) A helical compression spring is subjected to a maximum force of 5000N with a corresponding deflection of 70 mm. The spring is to operate over a 50 mm diameter rod. Determine the wire diameter and number of active turns. Also decide other details such as free length, pitch, helix angle. Check for solid stress and buckling. State whether the spring is a closed coiled helical spring. For the material of the spring assume following properties. **15**

$S_u = \frac{2000}{d^{0.17}}$ *Mpa* $S_{ys} = \frac{1200}{d^{0.17}}$ *Mpa* $G = 80$ *Gpa*

Q6b) State different theories of failure and explain any two in details. **05**
