[03 Hours] **[Total marks – 80]**

N.B.:
1. Question No **1** is **compulsory**
2. Solve **Any Three** questions from the remaining **Five** questions.
3. Assume any **suitable data** if necessary with justification.
4. Use of **Standard Data Book** is permitted
5. Figures to the right indicate full marks.

Q1. Attempt any **Four** of the following. **20**

(a) Explain self-locking and Overhauling Screws? **05**

(b) List out the design considerations in casting & Forging **05**

(c) Explain Nipping of leaf spring **05**

(d) Differentiate between hydrostatic bearing and hydrodynamic bearing? **05**

(e) Define stress concentration and with neat sketches explain various methods to reduce the effect of stress concentration. **05**

Q2. **(a)** Design a Socket and Spigot Cotter Joint for an axial load of 20 kN by selecting suitable material. Check Cotter for bending and draw the neat sketch of joint. **15**

(b) Explain surge in spring with the methods to eliminate it. **05**

Q3. **(a)** Determine the suitable diameter for the solid shaft, if it is supported by two bearings placed 800 mm apart. A 300 mm diameter pulley is mounted at a distance of 250 mm to the right of left hand bearing and this drives a pulley directly below it with the belt. Another pulley 400 mm diameter is placed 350 mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulley is 180˚ & $\mu = 0.3$. The shaft transmits 12 KW at 1440 rpm and weight of pulley A is 300 N and that of B is 450 N. Assume that the torque of one pulley is equal to that of the other pulley. **15**

(b) A piston rod of hydraulic cylinder exerts an operating force of 10kN. The friction due to piston packing and stuffing box is equivalent to 10 % of operating force. The pressure in the cylinder is 10 MPa. The cylinder is made of Cast Iron, FG 200 and Factor of safety is 5. Determine the diameter and thickness of cylinder. **05**

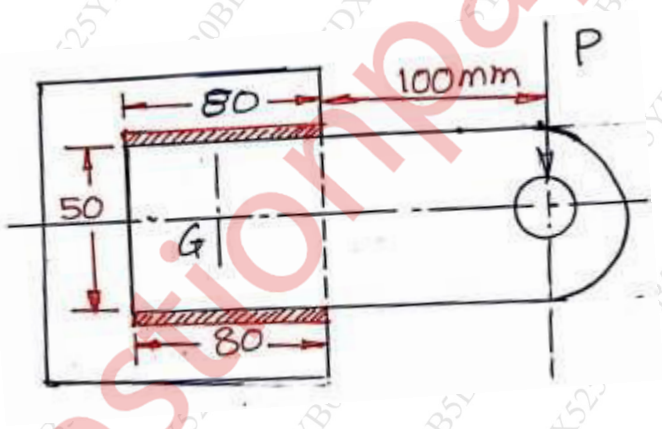
Q4. **(a)** DGBB is subjected to a radial load of 5 KN and axial load of 2.5 KN when operating on 600 rpm. Consider the expected life of 20000 hours with survival probability of 93%. Select suitable standard bearing from the manufacturer's catalogue. **10**

(b) A radial load on 360^0 hydro dynamically lubricated self-contained bearing supports 10kN. The journal rotates at 1450 rpm. Assuming journal length to it diameter as 1 with the bearing length as 50 mm. Take radial clearance as 20 microns, eccentricity as 20 microns, specific gravity of lubricants as 0.86, specific heat of lubricants 2.09 kJ/kg ^{0}C. Find, **10**

i. Oil film thickness.
ii. Coefficient of friction.
iii. Viscosity

Q5. **(a)** A protected type flange coupling is required to transmit 20 kW at 900 r.p.m. Design the coupling by selecting suitable materials for various component. **10**

(b) A plate welded to a channel as shown in fig. no.1, is subjected to an eccentric load P= 8 KN. Determine the size of weld if the permissible shear stress for the weld is not to exceed 80 MPa. **10**



(Fig. No.1)

Q6. **(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. **12**

(b) Determine the size of rubber canvas belt to transmit 5 kW from an electric motor rotating at 960 rpm to an intermediate shaft of a machine tool. The approximate reduction ratio is 2.8 and expected life is 1200 hours. Also check for induced stress in the belt. **08**

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