

(3 Hours)

- 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 and Kale Khandare is permitted
 4) Assume suitable data if necessary, giving justification

Q1 Answer any **Four** from the following

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| a) | Explain various types of gear tooth failures. | 5 |
| b) | Explain the significance of pressure angle in Cam and follower design | 5 |
| c) | Discuss advantages and disadvantages of rolling contact bearings over sliding contact bearings | 5 |
| d) | Enumerate the qualities of the friction material used in clutches. | 5 |
| e) | What are the advantages and disadvantages of V-belt drive over the flat belt drive | 5 |

Q2 A pair of straight bevel gear is used to transmit power from output shaft of gear box to agitator shaft. The two axes are inclined at 85° . The agitator shaft rotates at 15 rpm and reduction ratio is 4:1. The power is supplied from an electric motor of 25KW at 1500 rpm. 20

- 1) Selecting suitable material for bevel pinion and gear, find module, face width, pitch circle diameter and outside diameter of two gears to satisfy strength and wear criteria.
- 2) Give constructional detail of both gears.
- 3) Draw sketch of the two gears in assembled condition with leading dimensions

Q3a) 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°C , select a suitable standard bearing. 10

Q3b) The following data is given for 360⁰ hydrodynamic bearing. 10
 Radial load = 10KN, 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) 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.

[PTO]

- Q4a) 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
- Q4b) Calculate factor of safety on breaking load for a chain (10A₂ DR50) which is used to transmit 15 KW design power. The input speed is 960 rpm and reduction ratio is 2.90 10
- 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) 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
- Q6 Rotary disc cam and central translatory roller follower has following follower motions. Forward stroke of 22 mm in 100° of cam rotation with cycloidal motion. Dwell of 50° of cam rotation. Return stroke of 22 mm in 90° of cam rotation with SHM. Remaining dwell to complete the cycle. Mass of follower is 1.5 Kg, cam shaft speed 500 rpm. Maximum pressure angle is 25° during the forward stroke, external force during the forward stroke is 600 N and during return stroke is 100 N. 20
- 1) Design the cam, roller follower along with pin and springs.
 - 2) Calculate the maximum cam shaft torque.
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