

Design of Mechanical Drives

P. Pages : 2

Time : Three Hours

**NKT/KS/17/7476/7522**

Max. Marks : 80

- Notes :
1. All questions carry marks as indicated.
 2. Solve Question 1 OR Questions No. 2.
 3. Solve Question 3 OR Questions No. 4.
 4. Solve Question 5 OR Questions No. 6.
 5. Solve Question 7 OR Questions No. 8.
 6. Due credit will be given to neatness and adequate dimensions.
 7. Assume suitable data whenever necessary.
 8. Illustrate your answers whenever necessary with the help of neat sketches.
 9. Use of non programmable calculator is permitted.
 10. Use of design data book is permitted.

1. a) Design a bush pin flexible coupling to connect output shaft of motor to the shaft of centrifugal pump. The motor delivers 20 KW power at 720 rpm. Starting torque of motor can be assumed to be 150% of rated torque. Design the coupling and specify its dimensions. **10**
- b) Design a full hydrodynamic bearing for machine tool application with the following specifications. **10**
 - a) Journal diameter = 75 mm
 - b) Journal speed = 1440 rpm
 - c) Radial load = 10 KN
 - d) Min^m oil film thickness = 22.5 micron
 - e) Inlet temperatures = 40°C
 - f) Bearing material - Babbitt

Determine length of bearing and select suitable oil for this application.
2. a) The turning moment diagram for an engine is drawn to a base of a crank angle. The areas above and below the mean torsional moment line are. **10**

+ 34.8, -9.03, +10.3, and -36.07 cm² the scales being : 1 cm = 11 N.m and 1 cm = 12° of crank angle. Determine the weight of flywheel to keep the speed between 297 to 303 rev/min. if radius of gyration is 0.54 m. Also determine the suitable dimensions of the CI flywheel rim whose breadth is twice its radial thickness. The density of cast iron is 7250 kg/m³ and assume that 95% of the flywheel effect is provided by the rim.
- b) A 75 mm diameter machine shaft is to be supported at the ends. It operates continuously for 8 hrs/day, 300 days/yr for 12 yrs. The load and speed cycle for bearing is as follows. **10**

Sr. No.	Fraction of cycle	Radial load (kN)	Thrust load (kN)	Speed (rpm)	Type of load.
1.	0.25	3	1.5	1000	Light stock
2.	0.25	2	1	1500	Moderates Shock
3.	0.5	2.5	1.2	800	Steady

Select suitable bearing.

3. a) A 45 kw engine used, roller chain to drive a rear axle. The driving sprocket runs at 800 rpm and driven at 200 rpm. The center distance is approx 900 mm. The efficiency of transmission between engine and driving sprocket is 85%. Suggest suitable chain designation. Also, determine other details of sprocket and chain. **10**
- b) The following data refers to flat belt drive. **10**
 Power transmitted = 10 kw @ 600 rpm. Angle of contact = 210° .
 Select suitable belt cross section.
4. a) Select suitable V-belt designation and number of belts required to transmit 50 kw power from an electric motor to gang – saw. The pulley dia of gang saw is 900 mm. The Angular speed of motor is 75 rad/sec. and that of driven pulley is 30 rad/sec. **10**
- b) Determine size of 6x19 standard plow steel rope to be used with dram hoist to lift 25 kN from depth 90 meter. Assume rope speed of 300 m/min. and acceleration of 2 m/sec^2 , when starting with no. Slack. **10**
 Also determine no. of cycles till failure.
5. In a reciprocating compressor, power is to be supplied by 960 rpm motor to the compressor shaft rotating at 300 rpm through helical gears. Torque to which compressor shaft is subjected is 450 N-m. Assume material for pinion & gear as steel having basic strength 195 mpa, and helix angle 23° . Design the gear pair also design gear blank. **20**
6. a) A pair of bevel gear is mounted on shafts, which are intersecting at right angle. No. of teeth on pinion and gear are 21 and 28 respectively pressure angle is 20° . The pinion shaft is connected to an electric motor developing 5 kw power at 1440 rpm. The service factor can be taken as 1.5 pinion and gear are made of steel having basic strength 210 mpa. and heat treated to surface hardness of 350 BHN. Determine **16**
 a) Module b) Face width
 c) Dynamic load d) Wear strength
- b) Discuss advantages of helical gear over spur gear. **4**
7. Design a worm-and worm gear speed reducer to transmit 22 kw at 960 rpm from an electric motor to conveyer shaft. The required velocity ratio is 24:1. Determine complete proportions for worm and worm gear. **20**
8. Design a CI piston for a single acting for stroke engine for the following specification **20**
 Cylinder bore = 120 mm
 Stroke = 140 mm
 Max gas pressure = 5 N/mm^2
 Brake mean effective pressure = 0.65 N/mm^2
 Fuel consumption = 0.227 kg/kw/hr
 speed = 2200 rev /mm
 Assume suitable data.
