

ME 384 DESIGN OF TRANSMISSION SYSTEMS

Time : 3 hr

Max Mark : 100

Usage of Approved Design Data book is permitted

Part A (10 X 2 = 20 mark)

1. What are the advantages and limitations of V- belt drives?
2. List the types of stresses induced in wire ropes.
3. What is meant by dynamic loading of gear tooth?
4. Define the term i. normal pitch ii. Helix angle in helical gears.
5. What is meant by composite gear tooth profile and what are its characteristics?
6. Bring out the advantages of worm gearing.
7. Why geometric progression series is most preferred series for speed steps of machine tool gear box?
8. What are the points to be considered while designing a sliding type multi-speed gear box?
9. What are the characteristics of friction materials used in clutches?
10. Where does the self- locking feature of the brake is desirable?

Part B (5 X 16 = 80 mark)

11. A cast iron flat pulley transmits 20 k W at a speed of 560 rpm through a belt drive. The pulley overhangs the nearest support bearing by 200 mm. Assuming the ratio of belt tension is 2, determine :

1. shaft diameter
2. pulley diameter
3. cross section of the eight rims.

12(a) A crane is used to lift a load of 30 k N through wire rope. The weight of the crane hook is 5 k N . The load to be lifted with an acceleration of 1 m / s^2 . Considering normal working conditions and neglecting the self weight of the rope , calculate required diameter of the wire rope . Use the following data for the design.

Ultimate stress for the rope material : 1800 M Pa

Factor of safety : 6

E for the rope material : 80 k N / mm²

Cross sectional area of the rope : $0.40 \text{ X } d^2$ (d is the diameter of the rope)

OR

(b) Design a roller chain drive for driving a compressor by 12 k W electric motor running at 1200 rpm. The compressor speed is around 350 rpm. The compressor operates 16 hours per day.

Contd..2

13 (a) A parallel helical gear set uses a 20 tooth pinion driving a 36 tooth gear. The pinion has left handed helix angle of 25° , normal pressure angle of 20° and normal module of 3 mm. The pinion rotates at 1500 rpm and transmits 5 kW. Find

- i. Normal, transverse circular pitches and axial pitches
- ii. Transverse module and transverse pressure angle.
- iii. radial and axial forces on the pinion bearing

OR

(b) A bronze spur pinion rotating at 560 rpm drives a cast steel gear. The transmission ratio is 4. The pinion has 18 teeth with 20° full depth involute profile, module being 5 mm. The face width of the gearing being 25 mm. Determine the power that can be transmitted using Lewis beam strength equation. Static strength of bronze is 80 MPa and for cast steel is 100 MPa

14(a) A three threaded worm rotating at 100 rpm drives a 31 teeth worm gear and transmits 11.25 kW. The worm has 20° teeth with 6 mm module, 50 mm pitch diameter and an inclined face angle of 60° . The coefficient of friction is 0.05. Determine :

1. helix angle of the worm
2. speed ratio
3. centre distance
4. efficiency of the gearing

OR

(b) A pair of straight bevel gears consist of pinion with 18 teeth and gear 54 teeth. The module is 8 mm, face width is 50 mm, the material is cast iron grade 30 and the service is continuous with light shock. Find the power that can be transmitted by this drive.

15(a) Design a nine speed gear box for a lathe, using the following data:

Minimum spindle speed	: 35 rpm
Maximum spindle speed	: 1400 rpm
Speed of the driving motor	: 1400 rpm

The input shaft of the gear box is to directly coupled to the motor shaft directly.

OR

(b) A differential band brake used for a winch, is wound round a drum of 0.75 m diameter. The two ends of the band are attached to the pins on the opposite sides of a fulcrum of the brake lever at a distance of 20 mm and 100 mm from the fulcrum. The angle of lap of the band on the drum is 240° . The coefficient of friction is 0.25. Determine the torque which can be applied brake, when a force of 500 N is applied to the lever in the upward direction at a distance of 1 m from the fulcrum.

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