Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 80920

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Sixth Semester

Mechanical Engineering

ME 8651 — DESIGN OF TRANSMISSION SYSTEMS

(Common to Mechanical Engineering (Sandwich)/Mechanical and Automation Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the effect of center distance and pulley size on the life of a belt?

2. Write about the materials used in the components of chain.

3. State the two significant reasons for adopting involute curve for gear tooth profile.

4. Define the following terminologies used in helical gears :
   (a) Helix angle and
   (b) Normal circular pitch.

5. Why dedendum value is higher than the addendum value in a gear?

6. Mention the advantages of Herringbone gears in relation with the helical gears.

7. List out the design principles to be followed to obtain an optimum design of a gear box.

8. In a constant mesh gear box, how does transmission of motion take place?

9. The clutches are designed based on the basis of uniform wear. Justify.

10. Brief the phenomenon 'Jumping speed of a cam'.

PART B — (5 × 13 = 65 marks)

11. (a) Select a suitable V-belt and design the drive for a wet grinder. Power is available from a 0.5 kW motor running at 750 rpm. Drum speed is to be about 100 rpm. Drive is to be compact.

Or

(b) Design a chain drive to actuate a compressor from a 10 kW electric motor at 960 rpm. The compressor speed is to be 350 rpm. Minimum center distance should be 0.5 metres. Motor is mounted on an auxiliary bed. Compressor is to work for 8 hours per day.

12. (a) A motor shaft running at 1440 rpm has to transmit 15 kW to a low-speed shaft rotating at 500 rpm through a gear drive. 20° Pressure angle, involute profile tooth, pinion and gear are used. The minimum number of teeth for pinion is 20. Design the spur gear drive.

Or

(b) Design a pair of helical gears to transmit 12 kW at 1200 rpm of pinion. The velocity ratio is 3:1. The teeth are 14.5° involute form profile with helix angle 25°. Select suitable gear material for pinion and wheel. The service life of the gears is 10,000 hours.

13. (a) A steel worm running at 240 rpm receives 1.5 kW from its shaft. The speed reduction is 10:1. Design the drive so as to have an efficiency of 80 percentage. Also determine the cooling area required, if the temperature rise is restricted to 45°. Take overall heat transfer coefficient as 10 W/m^2 °C.

Or

(b) Design a worm gear drive with a standard centre distance to transmit 7.5 kW from a worm rotating at 1440 rpm to a worm wheel at 20 rpm.

14. (a) A gear box is to be designed for the following specifications :

Power = 5 kW; Number of speeds = 12. The minimum and maximum speeds are 100 rpm and 1200 rpm. The 12 speeds are obtained as 2 × 3 × 2.

(i) Sketch the layout of the gear box (4)

(ii) Draw the speed diagram (4)

(iii) Estimate the number of teeth in the gears. (5)

Or

(b) Design a multi speed gear box for the following specifications:

Power = 6 kW at 1440 rpm; Number of speeds = 6; Minimum speed = 460 rpm and Maximum speed = 1440 rpm.

15. (a) An automotive single plate clutch consists of two pairs of contacting surfaces. The inner and outer radii of friction plate are 120 mm and 250 mm respectively. The coefficient of friction is 0.25 and the total axial force is 15 kN. Calculate the power transmitting capacity of the clutch plate at 500 rpm using

(i) Uniform Wear theory and (8)

(ii) Uniform Pressure theory. (5)

Or

(b) Draw the free body diagram of an internal expanding shoe brake and derive the relation for the actuating force.

PART C — (1 × 15 = 15 marks)

16. (a) In an open flat belt drive, the pulley diameters are 300 mm and 450 mm, and the corresponding angles of lap are 160° and 200°. The smaller pulley runs at 240 rpm. The coefficient of friction between the pulleys and the belt is 0.3. It is found that the belt is on the point of slipping when 5 kW power is transmitted. To increase the power transmitted, two alternatives are suggested as described below :

(i) Increasing the initial tension by 15% and (8)

(ii) Increasing the coefficient of friction by 15%.

Which one of the above methods would be more effective? Justify the results. (7)

Or

(b) An automobile engine has an output of 80 kW at 3000 rpm. The mean diameter of the clutch is 200 mm with a permissible pressure of 0.2 MPa. Friction lining is of asbestos with μ=0.22. Determine the inner diameter of the disc? Take both the sides of the plates with friction lining as effective. There are 8 number of springs and the axial deflection in a spring is limited to 10mm. Take G = 80 kN/mm^2 and Spring Index = 6.