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Question Paper Code : 70905

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

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. How is a V-belt designated?
2. List the features of a chain drive.
3. Dedendum value is more than the addendum value. Why?
4. What is herringbone gear? Where it is used?
5. Under what situation bevel gears are used?
6. A pair of worm gears is designated as 2/54/10/5. Find the gear ratio.
7. Compare sliding mesh and synchromesh gear box.
8. Define torque converter. List its applications.
9. Differentiate between uniform pressure and uniform wear theories adopted in design of clutches.
10. What do you mean by self-energizing brake?

PART B — (5 × 13 = 65 marks)

11. (a) Design an open type flat belt drive for a fan running at 360 rpm which is driven by a 10 kW at 1440 rpm motor. The distance between the centre of pulleys is 1800 mm. The diameter of a driven pulley is 900 mm.

Or

- (b) Design a V-belt drive to transmit 12 kW power at 400 rpm. The speed ratio is 2.5. Centre distance between the pulleys is 650 mm.

12. (a) Design a spur gear drive to transmit 40 kW at pinion speed of 1000 rpm. The velocity ratio is 3.5:1. The teeth are 20° full depths involute with 20 teeth on the pinion. The safe static stress is 180 N/mm². Assume medium shock condition.

Or

- (b) Design a helical gear for the following specification:

Power - 10kW

Pinion speed - 1200 rpm

Gear Ratio - 3:1

Pressure angle - 20°

Helix angle - 15°

Gear is expected to work 8 hours per day for 10 years.

13. (a) Design a pair of bevel gears to transmit 12.5 kW at 1440 rpm of the pinion. The velocity ratio should be about 4. Material for gear is 15 Ni 2 Cr 1Mo 15 Steel. The tooth profiles of the gears are of 20° composite form.

Or

- (b) A worm rotates at 1440 rpm and transmits 15 kW to a worm wheel. The speed of the worm wheel should be $60 \pm 3\%$ rpm. By assuming suitable material for worm and worm wheel, design the drive for an efficiency of at least 82 %.

14. (a) Design a 9 speed gear box for a minimum speed of 180 rpm and a maximum speed of 1250 rpm. The input speed of motor is 1400 rpm. Draw the speed diagram, kinematic diagram and calculate the number of teeth on each gear.

Or

- (b) A 12 speed gear box is required to furnish output speeds in the range of 160 to 560 rpm. For standard step ratio, draw the speed diagram and the kinematic arrangement of the gear box.

15. (a) A multi plate disc clutch transmits 55 kW of power at 1800 rpm. Coefficient of friction for the friction surfaces is 0.1. Axial intensity of pressure is not to exceed 160 kN/m². The internal radius is 80mm and is 0.7 times the external radius. Find the number of plates needed to transmit the required torque.

Or

- (b) A single block brake having a drum of 250 mm diameter, contact angle of 90°, and the operating force of 700 N is applied at the end of lever which is at 250 mm from the center of the brake block. Determine the torque that may be transmitted. The fulcrum is 200 mm from the center of brake block with an offset of 50 mm from the surface of contact. The coefficient of friction is 0.35.

PART C — (1 × 15 = 15 marks)

16. (a) A roller chain drive is used between a driver shaft running at 1440 rpm and a driven shaft running approximately at 720 rpm. The power transmitted is 15kW. The drive is to be used for 2 shifts per day with 8 hours per shift. The center distance is approximately 1000 mm and the chain tension can be adjusted by moving the motor in the rails. Design the drive.

Or

- (b) A spur gear train with 20° full depth involute tooth is shown in Fig-1. Gear 1 is the driving gear and transmits 50 kW power at 300 rpm to the gear train. The number of teeth on gears 1, 2, 3, and 4 are 25, 50, 30 and 60 respectively, while the module is 8 mm for all gears. Gear 1 is rotating in clockwise direction when seen from the left side of the page. Calculate
- Tangential and Radial Components of the tooth forces between gears 1 & 2 and 3 & 4
 - Resultant reactions at bearing B_1 & B_2

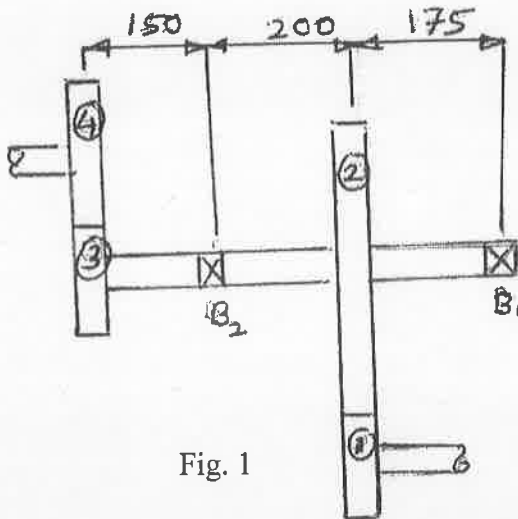


Fig. 1

All dimensions are in mm