Reg. No. :

Question Paper Code : Q 2319

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Sixth Semester

(Regulation 2004)

Mechanical Engineering

ME 1352 — DESIGN OF TRANSMISSION SYSTEMS

(Common to B.E. (Part-Time) Fifth Semester, Regulation 2005)

Time : Three hours   Maximum : 100 marks

Usage of Approved Desing Data Book is permitted.

Assumptions and assumed data have to be stated clearly.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Sketch the cross section of a V-belt and label its important parts.

2. Why is the face of a pulley crowned?

3. What condition must be satisfied in order that a pair of spur gears may have a constant velocity ratio?

4. What is a herringbone gear? Where is it used?

5. What are the various forces acting on a bevel gear?

6. Usually worm is made of hard material and worm gear is made of softer material – Justify.

7. Which type of gear is used in constant mesh gear box? Justify.

8. Compare sliding mesh and synchromesh gear box.

9. Differentiate between self-energizing and self-locking brakes.

10. Why is it necessary to dissipate the heat generated during clutch operation?

PART B — (5 × 16 = 80 marks)

11. (a) Design a flat belt drive to transmit 110 kW for a system consisting of two pulleys of diameters 0.9 m and 1.2 m respectively, for a centre distance of 3.6 m, belt speed of 20 m/s and coefficient of friction = 0.3. There is a slip of 1.2 % at each pulley and 5% friction loss at each shaft with 20% over load.

Or

(b) A compressor is to be actuated from a 10 kW electric motor. The speed of the motor shaft is 1000 rpm and the compressor speed being 350 rpm. The minimum centre distance is 500 mm. The compressor operates 16 hours per day. Design a suitable chain drive.

12. (a) A motor shaft rotating at 1440 rpm has to transmit 15 kW to a low speed shaft rotating at 500 rpm. The teeth are 20° involute with 25 teeth on the pinion. Both the pinion and gear are made of cast iron with a maximum safe stress of 56 MPa. A safe stress of 35 MPa may be taken for the shaft on which the gear is mounted. Design and sketch the spur gear drive to suit the above conditions. The starting torque may be assumed as 1.25 times the running torque.

Or

(b) A helical gear speed reducer is to be designed. The rated power of the speed reducer is 75 kW at a pinion speed of 1200 rpm. The speed ratio is 3 to 1. For medium shock conditions and 24 hours operation; determine, the module, face width, number of teeth in each gear. The teeth are 20° full depth in the normal plane. Assume suitable material.

13. (a) A pair of cast iron bevel gears connect two shafts at right angles. The pitch diameters of the pinion and gear are 80 mm and 100 mm respectively. The tooth profiles of the gears are of $14 \frac{1}{2}°$ composite form. The allowable static stress for both the gears is 55 MPa. If the pinion transmits 2.75 kW at 1100 rpm, find the module and number of teeth on each gear and check the design. Take surface endurance limit as 630 MPa and modulus of elasticity for cast iron as 84 kN/mm².

Or

(b) Design worm and gear speed reducer to transmit 22 kW at a speed of 1440 rpm. The desired velocity ratio is 24 : 1. An efficiency of atleast 85% is desired. Assume that the worm is made of hardened steel and the gear of phosphor bronze. Take the centre distance as 100 mm.

14. (a) The maximum and minimum speeds of nine speed gear box are to be 600 rpm and 100 rpm respectively. The drive is from an electric motor giving 3 kW at 1440 rpm. Design the gear box. Construct the speed diagram and sketch the arrangement of gear box.

Or

(b) Design a 12 speed gear box for a headstock of a lathe. The maximum and minimum speeds are 600 rpm and 25 rpm respectively. The drive is from a electric motor giving 2.25 kW at 1440 rpm. Construct the speed diagram and sketch the arrangement of the gear box.

15. (a) A friction clutch is required to transmit 25 kW at 2000 rpm. It is to be of single plate disc type with both sides. The pressure is exerted by means of springs and limited to 70 kN/m². If the maximum possible outer diameter of the clutch plate is 300 mm, find the required inner diameter of the clutch plate and the total force exerted by the springs. Assume the wear to be uniform and coefficient of friction as 0.3.

Or

(b) An internal expanding shoe brake has the following dimensions : Diameter of the drum = 300 mm, distance between the fulcrum centers = 80 mm, distance of fulcrum centers and that of cam axis, both from the drum centre = 100 mm, distance of line of action of braking force from the cam axis = 90 mm, distance between the points where the cam acts on the two brake shoes = 30 mm. Each shoe subtends an angle of 90° at the drum centre. If the braking force is 750 N and the coefficient of friction is 0.3, find the braking torque on the drum. Assume the reactions between the brake shoes and the drum passes through the points bisects the contact angle. Also assume that forces exerted by the cam ends on the two shoes are equal.

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