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Question Paper Code : 51650

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

Sixth Semester

Mechanical Engineering

ME 2352/ME 61/ME 1352/10122 ME 603 — DESIGN OF TRANSMISSION
SYSTEMS

(Common to Mechanical and Automation Engineering)

(Regulation 2008/2010)

(Common to PTME 2352 — Design of Transmission Systems for B.E. (Part-Time)
Fifth Semester Mechanical Engineering Regulation 2009)

Time : Three hours

Maximum : 100 marks

Approved Design Data Book is permitted to use in the examination.

Any missing data can be suitably assumed.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the factors upon which the coefficient of friction between the belt and pulley depends?
2. Brief the term "Crowning of Pulley".
3. What is pressure angle? What is the effect of increase in pressure angle?
4. What condition must be satisfied in order that a pair of spur gears may have a constant velocity ratio?
5. Define the following terms: (a) Cone distance, (b) Face angle.
6. What is virtual number of teeth in bevel gears?

7. What is step ratio? Name the series in which speeds of multi-speed gear box are arranged.
8. Sketch the kinematics layout of gears for 3 speeds between two shafts.
9. Classify clutches based on the coupling methods.
10. What is meant by a self-energizing brake?

PART B — (5 × 16 = 80 marks)

11. (a) A V-belt drive is to transmit 45 kW in a heavy duty saw mill which works in two shifts of 8 hours each. The speed of motor shaft is 1400 rpm with the approximate speed reduction of 3 in the machine shaft. Design the drive and calculate the average stress induced in the belt. (16)

Or

- (b) Design a chain drive to actuate a compressor from 15 kW electric motor running at 1,000 r.p.m., the compressor speed being 350 rpm. The minimum centre distance is 500 mm. The compressor operates 15 hours per day. The chain tension may be adjusted by shifting the motor. (16)
12. (a) (i) Explain the phenomenon of interference in involute gears. (4)
 - (ii) Design and draw spur gear drive transmitting 30 kW at 400 r.p.m. to another shaft running approximately at 1000 r.p.m. The load is steady and continuous. The material for the pinion is cast steel and for gear is cast iron. Take module as 10 mm. Also check the design for dynamic load and wear. (12)

Or

- (b) A single stage helical gear reducer is to receive power from a 1440 r.p.m., 25 kW induction motor. The gear tooth profile is involute full depth with 20° normal pressure angle. The helix angle is 23°, number of teeth on pinion is 20 and the gear ratio is 3. Both the gears are made of steel with allowable beam stress of 90 MPa and hardness 250 B.H.N.
 - (i) Design the gears for 20% overload carrying capacity from the standpoint of bending strength and wear. (10)
 - (ii) If the incremental dynamic load of 8 kN is estimated in tangential plane, what will be the safe power transmitted by the pair at the same speed? (6)

13. (a) A 2 kW power is applied to a worm shaft at 720 mm. The worm is of quadruple start with 50 mm as pitch circle diameter. The worm gear has 40 teeth with 5 mm module. The pressure angle in the diametral plane is 20° . Determine (i) the lead angle of the worm, (ii) velocity ratio, and (iii) centre distance. Also, calculate efficiency of the worm gear drive, and power lost in friction. (16)

Or

- (b) Design a bevel gear drive to transmit 10 kW power at 1440 rpm. Gear ratio is 3, and life of gears 10,000 hrs. Pinion and gear are made of C45 steel and minimum no. of teeth is 20.

14. (a) Sketch the arrangements of a six speed gear box. The minimum and maximum speeds required are around 460 and 1400 rpm. Drive speed is 1440 rpm. Construct speed diagram of the gear box and obtain various reduction ratios. Use standard output speeds and standard step ratio. Calculate number of teeth in each gear and verify whether the actual output speeds are within $\pm 2\%$ of standard speeds. (16)

Or

- (b) Draw the ray diagram and kinematic lay out of a gear box for an all geared headstock of a lathe. The maximum and minimum speeds are to be 600 and 23 rpm respectively. Number of steps is 12 and drive is from a 3000 W electric motor running at 1440 rpm. (16)

15. (a) A plate clutch with maximum diameter 6 cm has maximum lining pressure of 350 kPa. The power to be transmitted at 400 rpm is 135 kW and $\mu = 0.3$. Find inside diameter and spring force required to engage the clutch. Springs with spring index 6 and material of the spring is steel with safe shear stress 600 MPa are used. Find the diameters if 6 springs are used. (16)

Or

- (b) A hydraulically operated clutch is to be designed for an automatic lathe. Determine the number of plates and operating force required for the clutch to transmit 35 Nm. The clutch is to be designed to slip under 300% of rated torsional moment to protect the gears and other part of the drive. The limits for the diameter of friction surfaces due to space limitation are 100 mm and 62.5 mm. This clutch is to operate in an oily atmosphere. (16)