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Question Paper Code : 70833

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Sixth/Seventh Semester

Mechanical Engineering

ME 6601 – DESIGN OF TRANSMISSION SYSTEM

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

(Regulations 2013)

Time : Three hours Maximum : 100 marks

(Use of approved design data book is permitted.)

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Name the four types of belts used for transmission of power.
2. When do you use stepped pulley drive?
3. What are the effects of increasing or decreasing the pressure angle in gear design?
4. Differentiate double helical and herringbone gears.
5. How bevel gears are manufactured?
6. What is helical angle of worm?
7. Differentiate ray diagram and structural diagram.
8. List any two methods used for changing speeds in gear boxes.
9. Write the difference between dry and wet clutch.
10. What is meant by self-energizing brakes?

PART B — ($5 \times 13 = 65$ 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 center distance of 3.6m, 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% overload.

Or

(b) A 7.5 kW electric motor running at 1400 rpm is used to drive the input shaft of the gear box of a special purpose machine. Design a suitable roller chain to connect the motor shaft to the gear box shaft to give an exact speed ratio of 10 to 1. Assume the minimum centre distance between driver and driven shaft as 600 rpm.

12. (a) Select a High speed duck flat belt drive for a fan running at 360 rpm which is driven by 10 kW, 1440 rpm motor. The belt drive is open type and space available for a center distance of 2 m approximately. The diameter of the driven pulley is 1000 mm.

Or

(b) A Centrifugal pump running at 340 rpm is to be driven by a 100 kW motor running at 1440 rpm. The light duty drive is to work for atleast 20 hours every day. The center distance between the motor shaft and the pump shaft is 1200 mm. Suggest a suitable multiple V belt drive for this application.

13. (a) Design a worm gear drive to transmit 22.5 kW at a worm speed of 1440 rpm. Velocity ratio is 24: 1. An efficiency of atleast 85% is desired. The temperature rise should be restricted to 40°C. Determine the required cooling area.

Or

(b) Design a bevel gear drive to transmit 7.36 kW at 1440 rpm for the following data. Gear ratio 3, material for pinion and gear C45 surface hardened.

14. (a) Design the layout of a 12 speed gear box for a milling machine having an output of speeds ranging from 25 to 600 rpm. Power is applied to the gear box from a 2.25 kW induction motor at 1440 rpm. Construct the speed diagram using standard speed ratio. Calculate the number of teeth on each gear and sketch the arrangement of the gear box.

Or

(b) Sketch the arrangement of a six speed gear box for a minimum speed of 460 rpm and a maximum speed of 1400 rpm. Draw the speed diagram and kinetic arrangement showing number of teeth in all gears. Check whether all the speeds obtained through the selected gears are within ± 2% of standard speeds. The drive is form an electric motor giving 2.25 kW at 1440 rpm.

15. (a) A multi disc clutch, steel on bronze is to transmit 20 kW at 1440 rpm. The clutch is to be operated in oil with the co-efficient of friction 0.08 and the average pressure 0.3 MPa. Space limitation permits only 230 mm as outside diameter of the clutch. Assuming uniform pressure determine (i) size of the clutch, if the ratio of mean radius to face width is 3 (ii) actual axial force required, (iii) actual maximum pressure (iv) actual average pressure. The ratio of R_i/R_0 can be chosen between 0.5 to 0.75, suitably and logically.

Or

(b) A 400 mm radius brake drum contacts a single shoe as shown in fig. 15(b) and sustains 200 N-m torque at 500 rpm. For a coefficient of friction 0.25, determine (i) Normal force on the shoe (ii) Required force F to apply the brake for clockwise rotation (iii) Required force F to apply the brake for counter clockwise rotation (iv) The dimension C required to make the brake self-locking, assuming other dimensions remain same (v) Heat generated.

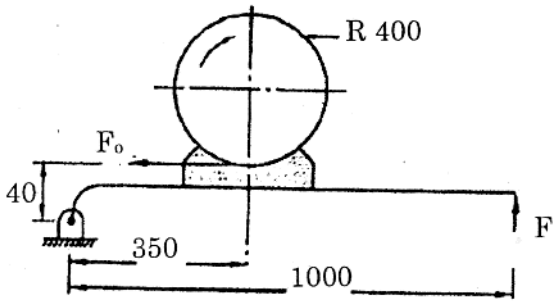

Fig.15(b)

PART C — (1 × 15 = 15 marks)

16. (a) The transporter of a heat treatment furnace is driven by a 4.5 kW, 1440 rpm induction motor through a chain drive with a speed reduction ratio of 2.4. The transmission is horizontal with bath type of lubrication. Rating is Continuous with 3 shifts per day. Design the complete chain drive. Assume center distance as 500 mm and service factor as 1.5.

Or

(b) A workshop crane is lifting a load of 25 kN through a wire rope and hook. The weight of the hook etc., is 15 kN. The rope drum diameter may be taken as 30 times the diameter of the rope. The load is to be lifted with an acceleration of lm/s^2. Calculate the diameter of the wire rope. Take a factor of safety of 6 and E for the wire is 80 kN/mm^2. The ultimate stress may be taken as 1800 MPa. The cross sectional area of the wire rope may be taken as 0.38 times the square of the wire rope diameter.

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