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R 3465

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2007.

Sixth Semester

Mechanical Engineering

ME 1352 — DESIGN OF TRANSMISSION SYSTEMS

(Regulation 2004)

Time : Three hours

Maximum : 100 marks

Usage of Approved Design Data Book is permitted.

Assumptions and assumed data have to be stated clearly.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What will be the effect on the limiting ratio of tensions of a belt if the co-efficient of friction between the belt and rim of pulley is doubled while angle of lap remains the same?
2. What is a silent chain? In what situations, silent chains are preferred?
3. Why is a gear tooth subjected to dynamic loading?
4. Differentiate the following terms with respect to helical gears :
 - (a) Transverse circular pitch
 - (b) Normal circular pitch and
 - (c) Axial pitch.
5. Why is the crossed helical gear drive not used for power transmission?
6. Why is the efficiency of a worm gear drive comparatively low?
7. Differentiate ray diagram and structural diagram.
8. List out the basic rules to be followed for optimum gear box design.
9. What are the effects of temperature rise in clutches?
10. What is the significance of pressure angle in cam design?

PART B — (5 × 16 = 80 marks)

11. (a) A crane is lifting a load of 18 kN through a wire rope and a hook. The weight of the hook etc., is 10 kN. The load is to be lifted with an acceleration of 1 m/sec². Calculate the diameter of the wire rope. The rope diameter may be taken as 30 times the diameter of the rope. Take a factor of safety of 6 and Young's modulus for the wire rope 0.8×10^5 N/mm². The ultimate stress may be taken as 1800 N/mm². The cross-sectional area of the wire rope may be taken as 0.38 times the square of the wire rope diameter.

Or

- (b) A 15 kW squirrel cage motor, 1250 r.p.m. is driving a centrifugal pump at 550 r.p.m. The centrifugal pump is located at 700 mm from the motor. Design a chain drive.
12. (a) The pitch circles of a train of spur gears are shown in Fig. 1. Gear A receives 3.5 kW power at 700 r.p.m. through its shaft and rotates in the clockwise direction. Gear B is the idler gear while gear C is the driven gear. The number of teeth on gears A, B and C are 30, 60 and 40 respectively, while the module is 5 mm.

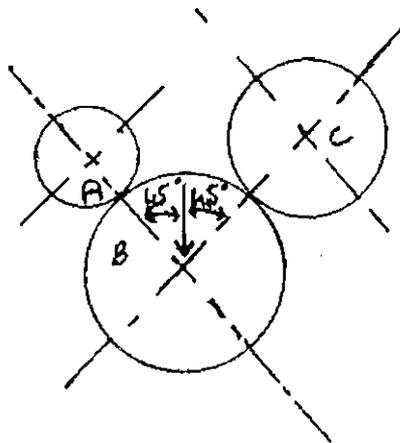


Fig. 1

Calculate :

- (i) the torque on each gear shaft and (4)
- (ii) the components of gear tooth forces (4)
- (iii) draw a free-body diagram of forces and determine the reaction on the idler gear shaft. (8)

Assume the 20° involute system for the gears.

Or

- (b) A pair of helical gears subjected to moderate shock loading is to transmit 30 kW at 1500 r.p.m. of the pinion. The speed reduction ratio is 4 and the helix angle is 20° . The service is continuous and the teeth are 20° FD in the normal plane. For the gear life of 10,000 hours, design the gear drive.
13. (a) Design a bevel gear drive to transmit 3.5 kW with the following specifications : speed ratio = 4; driving shaft speed = 200 r.p.m.; drive is non-reversible; material for pinion is steel; material for wheel is cast iron; and life 25000 hours.

Or

- (b) Design a worm gear drive to transmit a power of 22.5 kW. The worm speed is 1440 r.p.m. and the speed of the wheel is 60 r.p.m. The drive should have a minimum efficiency of 80% and above. Select suitable materials for the worm and wheel and decide upon the dimensions of the drive.
14. (a) A machine tool gear box is to have 9 speeds. The gear box is driven by an electric motor whose shaft rotational speed is 1400 r.p.m. The gear box is connected to the motor by a belt drive. The maximum and minimum speeds required at the gear box output are 1000 r.p.m. and 200 r.p.m. respectively. Suitable speed reduction can also be provided in the belt drive. What is the step ratio and what are the values of 9 speeds? Sketch the arrangement. Obtain the number of teeth on each gear and also the actual output speeds.

Or

- (b) A six speed gear box is required to provide output speeds in the range of 125 to 400 r.p.m. with a step ratio of 1.25 and transmit a power of 5 kW at 710 r.p.m. Draw the speed diagram and kinematic diagram. Determine the number of teeth module and face width of all gears, assuming suitable materials for the gears. Determine the length of the gear box along the axis of the gear shaft.

15. (a) A cycloidal cam with a central roller follower has a rise of 25 mm in cam angle of 70° . Base circle radius is 90 mm and the follower roller radius is 20 mm. Speed of rotation of the cam is 5000 rpm. Mass of the follower is 0.5 kg. Find the maximum value of the acceleration of the follower, corresponding pressure angle, stiffness of the spring used with the follower and maximum cam force. The friction between the follower and the guide may be ignored.

Or

- (b) The layout of a double block brake is shown in Fig. 2. The brake is rated at 250 N-m at 650 r.p.m. The drum diameter is 250 mm. Assuming coefficient of friction to be 0.3 and for conditions of service a pV value of 1000 (kPa) m/s may be assumed.

Determine :

- (i) spring force 'S' required to set the brake, and
- (ii) width of shoes.

Which shoe will have greater rate of wear and what will be the ratio of rates of wear of the two shoes?

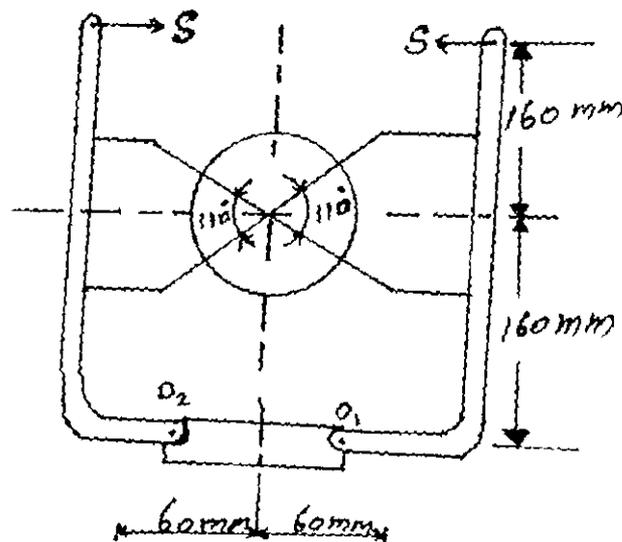


Fig. 2