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Question Paper Code : 11045

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

Sixth Semester

Mechanical Engineering

080120034 — DESIGN OF TRANSMISSION SYSTEMS

(Regulation 2008)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1.   Name four important elements in a chain.

2.   Write down the disadvantages of flat belt drives.

3.   What is meant by diametral pitch?

4.   How the axial thrust by helical gears is balanced?

5.   List the advantage and limitations of bevel gears.

6.   What are the types of wheel rim constructions?

7.   What is backlash?

8.   List the components of a gear box.

9.   Write down the types of brakes.

10. What factor determines to the outer diameter of the base of a screw jack?

PART B — (5 × 16 = 80 marks)

11. (a) (i)   A machine is to transmit a power of 150 HP at 1440 rpm to an
                another machine running at 400 rpm by a V-belt. Diameter of the
                driving wheel is 300 mm and centre distance between two pulleys is
                3 m. Design a V-belt and pulley. (Assume suitable values)   (6 + 6)

         (ii) What are the classification of chains? Write short notes on silent
                chains.   (4)

Or

(b) (i) Design a roller chain to transmit 200 HP from an engine running at 100 rpm to a generator running at 550 pm. Determine the size of the sprocket the pitch and number of strands required. (4 + 4 + 4)

(ii) In a belt drive of open type, whether the lower side of the upper side should be tight? Explain. (4)

12. (a) (i) A 20 HP at 1200 rpm engine drives a shaft at 300 rpm through a pair of spur gears having 20° stub teeth. The centre distance between the shaft is 40cm. The allowable static stress of pinion is 2100 kg/cm² and on gear is 1400 kg/cm². Assume that the drive operates 10 hrs a day. Determine – module of gear; face width of gear and number of teeth pitch circle diameter of each gear.

(4 + 4 + 4)

(ii) Write notes on gear materials. (4)

Or

(b) (i) A pair of helical gear with 300 helix angle is used to transmit 20 kW at 10,000 rpm from an IC engine from the pinion shaft with a velocity ratio of 5:1. The static strength of gear is 75 N/mm² and the pinion is 120 N/mm². Find the module pitch diameter and face width for 20° full depth involute teeth. (12)

(ii) Explain fatigue strength and factor of safety. (4)

13. (a) (i) A pair of bevel gear is required to transmit 50 HP at 500 rpm. The output shaft is running at 200 rpm and is at 900 to the input shaft. The gears are supported in the housing close to them. The gear is of cast iron with static strength of 700 kg/cm² and pinion is of cast steel with static strength of 1500 kg/cm². The gears of 20° involute stub tooth. Determine the proportions of the gears on the basis of strength. (10)

(ii) Power to be transmitted at right angle using straight bevel gears. The velocity ratio is 3:1. The allowable static stress on pinion is 800 kg/cm² and on the gear is 700 kg/cm². The pinion transmits 40 HP at 1000 rpm. If the pinion has determine the face width and the pitch diameters of the gear wheels. (3 + 3)

Or

(b) (i) A worm drive speed reducer is to transmit 20 HP at 500 rpm. The desired velocity ratio is 30:1 and efficiency is 80%. Assume the worm is made of hardened steel. Determine pitch diameter of the worm, length of thread portion if the wheel pitch circle diameter is 40 mm. (10)

(ii) A worm rotating at 1200 rpm is to transmit 20 HP with a speed reduction of 10:1. The distance between the shaft is 25 mm. Axial pitch is 2.5 cm. Assume the heat dissipation capacity as $k = 0.30$ kcal/hr, $\mu = 0.025$. Determine the thermal heat dissipation and efficiency of worm and gear. Assume suitable values. (6)

14. (a) Design a four speed gear box to have following speed ratio. First gear is 5:1 second gear is 3:1, third gear is 1.5:1 and the top gear is 1:1. The centre distance between the input and the output shafts is 150 mm. All gears are 4 mm module. Determine the number of gears of all wheels, pitch circle diameter of all wheels and sketch the diagrammatic arrangement of the gear box. (Assume number of teeth not less than 20 and pressure angle 20°) (7 + 6 + 3)

Or

(b) (i) A three speed gear box has ratios 4:1, 2:1 and 1:1. The centre distance between the shafts is 100 mm. The pressure angle on all gears is 20°. The number of teeth on gear is not less than 20. If the power input is 50 HP at 2000 rpm, determine the maximum horizontal force on the lay shaft by the gears and the greatest torque reaction on the casing. (6 + 6)

(ii) Write down the guidelines for designing a gear box. (4)

15. (a) (i) The lead screw of a lathe has square threads of 25 mm outside diameter 5 mm pitch. To drive the tool garage the screw exerts an axial force of 2000 N. Find the efficiency of the screw and the HP required to drive the screw if it rotates at 30 rpm. Neglect bearing friction and assume coefficient of friction of the screw thread as 0.12. (8)

(ii) A multi-disc clutch employs 3 steel and 2 bronze discs having outer diameter 30 cm and inner diameter 20 cm. If the coefficient of friction is assumed as 0.22, find the axial pressure and the HP transmitted if the unit normal pressure is 1.5 kg/cm^2 and the speed is 700 rpm. (8)

Or

(b) (i) A 8 ton screw jack having a maximum lift of 200 mm, has double square threads. Determine the size of the screw, size of cap collar and the length of the nut, if the maximum allowable compressive stress is not to exceed 300 kgf/cm^2. Also determine the torque to rise the load and over all efficiency of the jack. (6)

(ii) A 30 kg wheel 500 mm diameter turning at 200 rpm in stationary bearings is brought to rest by pressing a brake shoe radially against a rim with a force of 100 N. If the radius of gyration of the wheel is 0.3m, how many revolution will the wheel makes before coming to rest. Assume that the coefficient of friction between shoe and the rim has the steady value of 0.5. (10)