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Question Paper Code : 40837

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

Sixth Semester

Mechanical Engineering

ME 8651 — DESIGN OF TRANSMISSION SYSTEMS

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

(Regulations 2017)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. How is a V belt specified?

2. In chain drives, the sprocket has odd number of teeth and the chain has even number of links. Why?

3. Determine the circular pitch and diametral pitch for a pair of spur gears having 3 mm module.

4. Compare the features of spur and helical gears.

5. How do you specify a pair of worm sears?

6. Explain with neat diagram about the various forces acting on a bevel gear.

7. Specify the significance of a multispeed gearbox in a machine tool.

8. Mention the conditions at which the fluid couplings are used.

9. State the effects of temperature rise in clutches.

10. Define the term 'self-energizing brake'.

PART B — (5 × 13 = 65 marks)

11. (a) A 10 kW, 1440 rpm motor with 200 mm diameter pulley is to drive a blower at a speed of 480 rpm. The approximate centre distance is 2 times the larger pulley diameter. Design a suitable V-belt drive. (13)

Or

(b) Design a chain drive to actuate a vibrator running at 800 rpm from a 2.5 kW electric motor at 1400 rpm. Minimum centre distance should be 550 mm. Vibrator operates on an average of 10 hours per day with heavy shocks. (13)

12. (a) Design a spur gear pair to transmit 18 kW from a shaft rotating at 1440 rpm to a parallel shaft which is to rotate at 250 rpm, maintaining a distance of 160 mm between the shaft centres. The working life as 10,000 hours. (13)

Or

(b) Design a pair of helical gears to transmit 20 kW power from a shaft running at 1500 rpm to a parallel shaft to be run at 450 rpm. The helix angle is 15°. Select 15 Ni2Cr1Mo15 for pinion and C45 for gear. (13)

13. (a) Design a pair of bevel gears to transmit 12kW at 1440 rpm. The reduction ratio desired is 5:1. The pinion has 20 teeth and material for pinion and gear is C45 steel. Take service factor as 1.25. (13)

Or

(b) Design a worm gear drive to transmit 40 kW at 500 rpm of worm. The speed ratio is 25. The worm gear is made of phosphor bronze and that of worm is made of case hardened carbon steel 10C4. Also determine the efficiency of the drive. (13)

14. (a) Design a 12 speed gear box having an output speeds ranging from 112 rpm to 1400 rpm. Power is applied to the gear box from a 6kW induction motor at 1440 rpm. Find the number of teeth on each gear using ray diagram and kinematic arrangement. (13)

Or

(b) A nine speed gear box for a machine is connected to a 5kW electric motor running at 1720 rpm. gear box provides speed range of 100 rpm to 1500 rpm. Using standard step ratio

   (i) Draw ray diagram and gear box layout

   (ii) Draw percentage deviation diagram and check if the design is within permissible limits. (13)

15. (a) A single plate clutch is to be designed to transmit 4.5 kW at 750 rpm. Find:

   (i) Diameter of the shaft

   (ii) Mean radius and face width of the friction lining assuming the ratio of the mean radius to the face width as 4

   (iii) Outer and inner diameter of the clutch plate and

   (iv) Dimensions of the spring.

   Assume that the number of springs are 6 and spring index is 6. The allowable shear stress for the spring wire may be taken as 420 MPa. (13)

Or

(b) Explain the principle of operation of an internal expanding brake with neat sketch and derive the expression for the braking torque. (13)

PART C — (1 × 15 = 15 marks)

16. (a) A pair of cast iron bevel gears connect two shafts at right angles. The pitch diameters of the pinion and gear are 80mm and 100mm respectively. If the pinion transmits 2.75 kW at 1100 rpm., find the module and number of teeth on each gear from the standpoint of strength and check the design from the standpoint of wear. Take allowable static stress for both the gears is 55 MPa; surface endurance limit as 630 MPa; and modulus of elasticity for cast iron as 84 kN/mm². (15)

Or

(b) A rotary disc cam with central translatery roller follower has following motion. Forward stroke of 25mm in 120° of cam rotation with SHM motion dwell of 60° and return stroke of 25 mm in 100° of cam rotation with SHM. Remaining dwell to complete the cycle. Mass of the follower is 1kg and cam shaft speed is 600 rpm. The maximum pressure angle during forward and return stroke is limited to 25°. The external force during forward stroke is 300kN and that of return stroke is 50kN.

   (i) Draw displacement, velocity and acceleration time diagram

   (ii) Find prime circle and base circle radius,

   (iii) Calculate radius of curvature of pitch curve and cam profile

   (iv) Determine the width of the cam. (15)

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