

PART C — (1 × 15 = 15 marks)

16. (a) It is necessary to design an elevator to a height of 15 m and the total weight to be lifted is 10 kN with an acceleration of 1 m/s<sup>2</sup>. The 6 × 19 wire ropes having 10 mm diameter with fibre core is used. The tensile elongation of the wire is 1570 and the factor of safety should be 10. Determine the number of wire ropes needed ignoring the bending stresses.

Or

- (b) (i) Discuss about important limitations associated with disc cam design in terms of pressure angle and under cutting. (7)
- (ii) A set of gears is used to reduce the speed from an electric motor to a shaft driving a conveyor as shown in Fig. 2. The gear on the motor shaft is a 10-pitch pinion, has 15 teeth and drives at 1800 rpm clockwise. Determine the speed of the mating gear which has 45 teeth. Also calculate the pitch line velocity. (8)

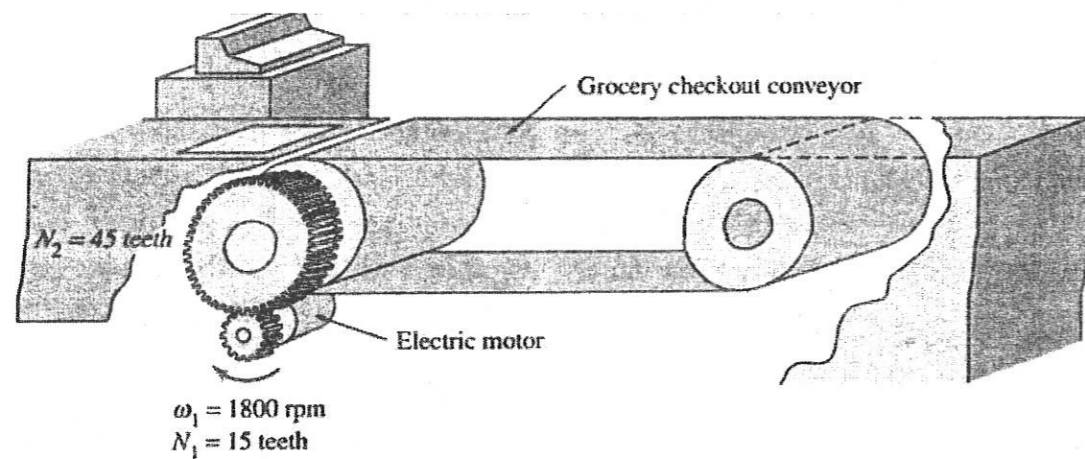


Fig. 2

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**Question Paper Code : 20863**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

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. Why belt drives are called as friction drives?
2. Distinguish between Gear and Sprocket.
3. In which gear, axial thrust is zero? Why?
4. Define pressure angle in gear.
5. Define virtual number of teeth.
6. Under which circumstances self locking of worm gears occur?
7. Explain the need for a gear box in an automobile.
8. Distinguish between constant mesh gear box and variable speed gear box.
9. When undercutting of a cam will occur?
10. List any two advantages of double shoe brakes.

11. (a) A fan shown in Fig. 1 is rigidly connected to a 300 mm diameter pulley which is rotating at 1800 rpm by a belt driven by another pulley attached to the shaft of an electric motor. While operating, tight side of the belt is loaded in tension to 2000 N and the slack side to 200 N in tension. Assume that the centre distance between the pulleys equal to 1 m. Design a suitable flat belt drive.

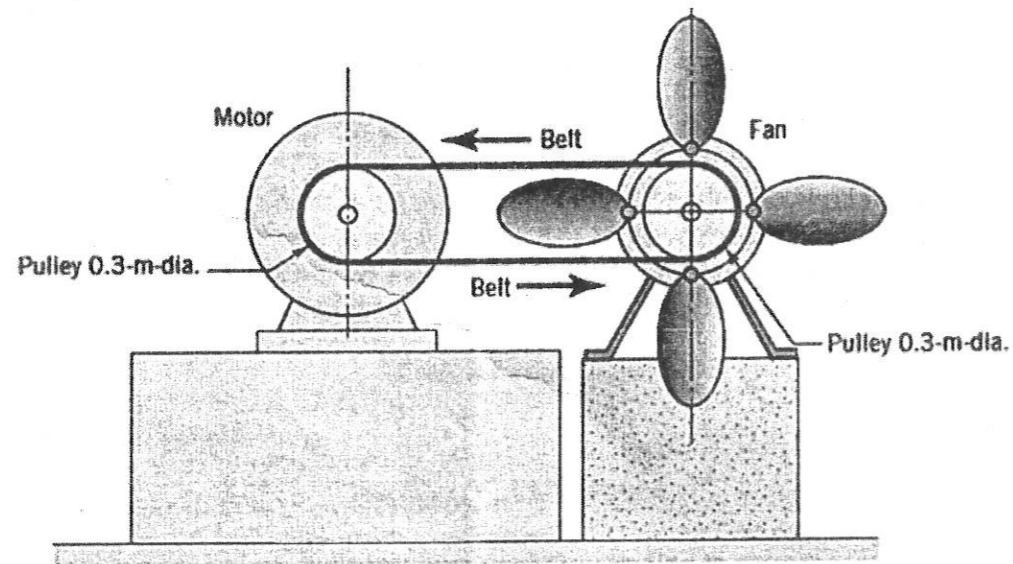


Fig. 1

Or

- (b) It is required to drive a compressor which is rotating at a speed of 300 rpm and works for 10 hours/day, using a 5 kW electric motor which runs at 500 rpm. The minimum centre distance should be 400 mm and the motor is mounted on an auxiliary bed. Design a chain drive to connect the compressor and electric motor.
12. (a) Design a pair of spur gears to transmit 30 kW at a pinion speed of 1500 rpm. The transmission ratio is 3 and the pinion is made of 15Ni2Cr1Mo15 and gear is made of C45 Steel.

Or

- (b) Design a helical gear drive pair to transmit 40 kW at a pinion speed of 1200 rpm. The velocity ratio is 3, the pinion is made of C15 steel and gear is made of Cast Iron grade 30.

13. (a) Design a bevel gear drive to transmit 10 kW at 1440 rpm for gear ratio of three and 10,000 hours life. Assume that both the gear and pinion are made of C45 surface hardened steel.

Or

- (b) Design a worm gear drive to transmit 10kW from a worm at 1440 rpm to the worm wheel. Assume the bronze is sand chill cast. The speed of the wheel should be  $40 \pm 4$  rpm, initial sliding velocity is 4 m/s and efficiency is 85%.
14. (a) Design the layout of a 12 speed gear box for a machine tool. The minimum and maximum speeds are 200 and 2400 rpm. Power is 10 kW from 1440 rpm motor. Use a standard speed ratio and construct the speed diagram. Find the number of teeth in each gear wheel and sketch the arrangement of the gear box.

Or

- (b) Design a 9 speed gear box for a shaping machine with minimum and maximum speeds of 60 to 100 rpm respectively and the output speed is 720 rpm. Find the number of teeth and speeds of each gear and show the values on a neat sketch. Also calculate module, centre distance and diameter of the spindle. Assume that the gears and shafts are made of C45 steel.
15. (a) A single disk clutch having one pair of contacting surface is required to transmit 20 kW at 1000 rpm under normal working conditions. Due to space restriction the outer diameter should be limited to 300 mm. The coefficient of friction is 0.25 and the permissible intensity of pressure is 1 N/mm<sup>2</sup>. Use (i) uniform wear theory and (ii) uniform pressure theory and calculate the clutch dimensions.

Or

- (b) Determine the important dimensions of a double block brake for the following data: The brake sheave is mounted on the cast iron drum shaft. The hoist with its load weighs 60 kN and moves downward with a velocity of 1 m/s. The pitch diameter of the hoist drum is 1 m. The hoist must be stopped within a distance of 3 m. Ignore the kinetic energy of the drum. Assume sintered metal block shoe, equal friction force on each shoe, continuous service and poor heat condition.