Reg. No. :

Question Paper Code : 90866

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 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 are belt drives called 'flexible' drives?

2.   What are the advantages of chain drives?

3.   State two reasons for adopting involute curve for Gear tooth Profile.

4.   Draw a double helical gear.

5.   List the types of bevel gears.

6.   Write two drawbacks of worm gears.

7.   Enumerate the types of gearbox.

8.   How does a hydraulic fluid coupling work?

9.   Name four profiles used in cams.

10.   Differentiate the clutch and the brake.

PART B — (5 × 13 = 65 marks)

11. (a) A 6 × 19 wire rope with fiber core and ultimate tensile strength of 1570 N/mm² is used to raise the load of 20 kN as shown in figure 1. The nominal diameter of the wire rope is 12 mm and the sheave has 500 mm pitch diameter. Determine the expected life of the rope assuming 500 bends per week.
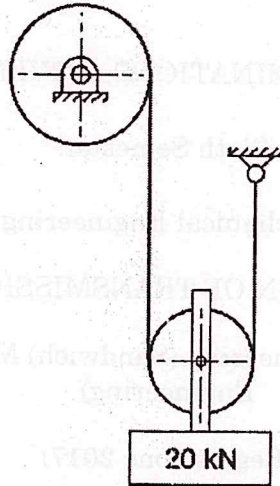

Figure 1

Or

(b) Design a chain drive to connect 5kW, 1400 rpm electric motor to a drilling machine. The speed reduction is 3:1. The centre distance should be approximately 500 mm. (i) Select a proper roller chain for the drive. (ii) Determine the number of chain links. (iii) Specify the correct centre distance between the axes of sprockets.

12. (a) A pair of spur gears with 20° full-depth involute teeth consists of a 20 teeth pinion meshing with a 41 teeth gear. The module is 3 mm while the face width is 40 mm. The material for pinion as well as gear is steel with an ultimate tensile strength of 600 N/mm². The gears are heat treated to a surface hardness of 400 BHN. The pinion rotates at 1450 rpm and the service factor for the application is 1.75. Assume that velocity factor accounts for the dynamic load and the factor of safety is 1.5. Determine the rated power that the gears can transmit.

Or

(b) A pair of parallel helical gears consists of a 20 teeth pinion meshing with a 100 teeth gear. The pinion rotates at 720 rpm. The normal pressure angle is 20°, while the helix angle is 25°. The face width is 40 mm and the normal module is 4 mm. The pinion as well as the gear is made of steel 4OC8(Sut = 600 N/mm²) and heat treated to a surface hardness of 300 BHN. The service factor and the factor of safety are 1.5 and 2 respectively. Assume that the velocity factor accounts for the dynamic load and calculate the power transmitting capacity of gears.

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13. (a) A pair of bevel gears transmitting 7.5 kW at 300 rpm is shown in figure 2. The pressure angle is 20°. Determine the components of the resultant gear tooth force and draw a free-body diagram of forces acting on the pinion and the gear.
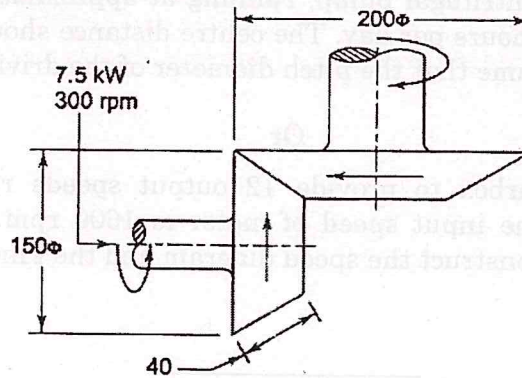

Figure 2

Or

(b) 1 kW power at 720 rpm is supplied to the worm shaft. The number of starts for threads of the worm is four with a 50 mm pitch – circle diameter. The worm wheel has 30 teeth with 5 mm module. The normal pressure angle is 20°. Calculate the efficiency of the worm gear drive and the power lost in friction.

14. (a) Design a sliding mesh nine speed gear box for a machine tool with speed ranging from 36 rpm to 550 rpm. Draw the speed diagram and kinematic arrangement showing number of teeth in all gears.

Or

(b) Explain about torque converters in automotive industries.

15. (a) A plate clutch consists of one pair of contacting surfaces. The inner and outer diameters of the friction disk are 100 and 200 mm respectively. The coefficient of friction is 0.2 and the permissible intensity of pressure is 1 N/mm². Assuming uniform-wear theory, calculate the power-transmitting capacity of the clutch at 750 rpm.

Or

(b) A four-wheeled automobile car has a total mass of 1000 kg. The moment of inertia of each wheel about a transverse axis through its centre of gravity is 0.5 kg-m². The rolling radius of the wheel is 0.35 m. The rotating and reciprocating parts of the engine and the transmission system are equivalent to a moment of inertia of 2.5 kg-m², which rotates at five times the road-wheel speed. The car is traveling at a speed of 100 km/h on a plane road. When the brakes are applied, the car decelerates at 0.5 g. There are brakes on all four wheels. Calculate the energy absorbed by each brake and the torque capacity of each brake.

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16.   (a)   Design V-belt drive to connect a 15kW, 2880 rpm normal torque AC. motor to a centrifugal pump, running at approximately 2400 rpm, for a service of 18 hours per day. The centre distance should be approximately 400 mm. Assume that the pitch diameter of the driving pulley is 125 mm.

Or

(b)   Design a gearbox to provide 12 output speeds ranging from 160 to 2000 rpm. The input speed of motor is 1600 rpm. Choose a standard speed ratio: construct the speed diagram and the kinematic arrangement.

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