Reg. No.												

Question Paper Code	12621

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2024

Sixth Semester

Mechanical Engineering

20MEPC601 - DESIGN OF TRANSMISSION SYSTEMS

Regulations - 2020

(Use of PSG Design Data Book is permitted)

Duration: 3 Hours | Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	What is initial tension in belts?	2	K2	CO1
2.	List the advantages of chain drives.	2	K1	CO1
3.	What are the main types of gear tooth failure?	2	K1	CO2
4.	Define a virtual number of teeth in a helical gear.	2	K1	CO2
5.	Classify the bevel gears.	2	K2	CO3
6.	When do we use worm gear?	2	K1	CO3
7.	Distinguish between the structural diagram and the speed diagram.	2	K2	CO4
8.	Name the types of speed reducers.	2	K1	CO4
9.	Compare clutches and brakes.	2	K2	CO6
10.	What are the factors required to design a brake?	2	K1	CO6

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

			Marks	K – Level	CO
11.	a)	Design a V-belt drive to operate a centrifugal pump at 340 rpm, driven by a 100 kW motor operating at 1440 r.p.m. The drive is intended to operate for at least 20 hours per day, with a center distance between the motor shaft and the pump shaft of 1200 mm.	13	K3	CO1
		OR			
	b)	The transporter of a heat treatment furnace is driven by a 4.5 kW, 1440 r.p.m. induction motor through a chain drive with a speed reduction ratio of 2.4. The transmission is horizontal with a bath type of lubrication. Rating is continuous with 3 shifts per day. Design the complete chain drive. Assume the center distance is 500 mm and the service factor is 1.5.	13	K3	CO1
12.	a)	Design a spur gear drive for a rock crusher. The pinion is transmitting 18 kW at 1200 r.p.m. The gear ratio is 3.5. Gear is expected to work 8 hours per day for 3 years. Assume suitable materials for pinion and wheel.	13	K3	CO2

OR

b) Design a helical gear drive to transmit a power of 15 kW at 1400 r.p.m. to the following specifications speed reduction is 3, pressure angle is 20°, Helix angle is 15°, The material for both gears is C45 steel, Allowable static stress is 180 N/mm^2 Young's modulus of the material = 2×10^5 N/mm^2. *13 K3 CO2*

13. a) Design a straight bevel gear drive between two shafts at right angles to each other. The speed of the pinion shaft is 360 r.p.m and the speed of the gear wheel shaft is 120 r.p.m. The pinion is of steel and the wheel is of cast iron. Each gear is expected to work 2 hours/day for 10 years. The drive transmits 9.37 kW. *13 K3 CO3*

OR

b) A hardened steel worm rotates at 1440 rpm and transmits 12 kW to a phosphor bronze gear. The speed of the worm wheel should be within 60 ± 3% r.p.m. Design the worm gear drive to achieve an efficiency of at least 82%. Additionally, calculate the heat generated and determine the required cooling area to dissipate this heat. The temperature rise should be restricted to 40°C, and the heat transfer coefficient is given as 10 W/m²°C. *13 K3 CO3*

14. a) Design the layout of a 12-speed gearbox for a lathe. The minimum and maximum speeds are around 30 r.p.m. and 1400 r.p.m. respectively. Construct the speed diagram using a standard speed ratio and sketch the arrangement of the gearbox. *13 K3 CO4*

OR

b) Design a nine-speed gearbox, used as a turret lathe's headstock gearbox that provides a speed range of 180 r.p.m. to 1800 r.p.m. Construct the speed diagram and the kinematic layout using the standard step ratio. Also, determine and fix the number of teeth on all gears. *13 K3 CO4*

15. a) Design a differential band brake as shown in Figure-1. for a which lifting a load of 20kN through a steel wire rope wound around a barrel of 600mm diameter. The brake drum, keyed to barrel shaft, is 800mm diameter and the angle of lap of the band over the drum is about 240°. Operating arms of the brake are 50mm and 250mm. The length of operating lever is 1.6m**.** *13 K3 CO6*

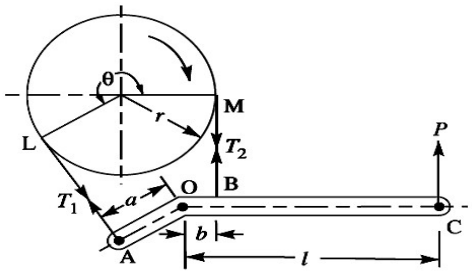

Figure-1

OR

b) A single-block brake is shown in Figure - 2 have a drum diameter of 250 mm. The angle of contact is 90°, and the coefficient of friction between the drum and the lining is 0.35. If the torque transmitted by the brake is 80 N-m, determine the force required to operate the brake. *13 K3 CO6*

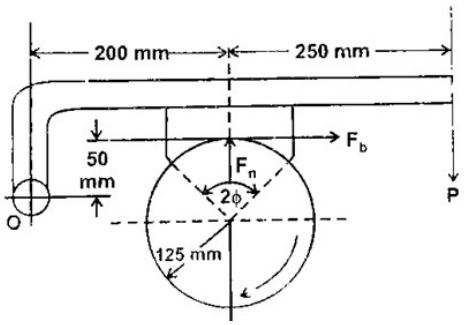

Figure - 2

PART - C (1× 15 = 15 Marks)

16. a) A single plate clutch, effective on both sides, is required to transmit 25 kW at 1500 r.p.m. Determine the inner and outer diameter of the friction surface if the coefficient of friction is 0.25, the ratio of diameters 1.5, and the maximum pressure is not to exceed using 0.2 N /mm^2. Also, estimate the axial thrust to be provided by springs. Assume the uniform wear theory. *15 K3 CO5*

OR

b) Design a leather-faced Conical friction clutch. The clutch has a cone angle of 30°, and the intensity of pressure between the contact surface does not exceed $6x10^4$ N/mm². The breadth of the conical surface is not to be greater than 1/3 of the mean radius. Determine the dimensions of the contact surface of the clutch. Given that $\mu = 0.20$ and the clutch transmits 37 kW at 2000 r.p.m. *15 K3 CO5*