KUMARAGURU
college of technology
character is life

B.E DEGREE EXAMINATIONS: APRIL / MAY 2023

(Regulation 2018)

Sixth Semester

MECHANICAL ENGINEERING

U18MET6004: Design of Transmission system

(Design Data Book is Permitted)

COURSE OUTCOMES

CO1: Choose suitable flexible drive for specific application.
CO2: Design spur and helical gear by considering strength and life.
CO3: Estimate the dimensions of bevel and worm gears
CO4: Construct the gear box for suitable application.
CO5: Design braking system for various applications.
CO6: Apply the concepts of pressure and wear theories to design clutches.
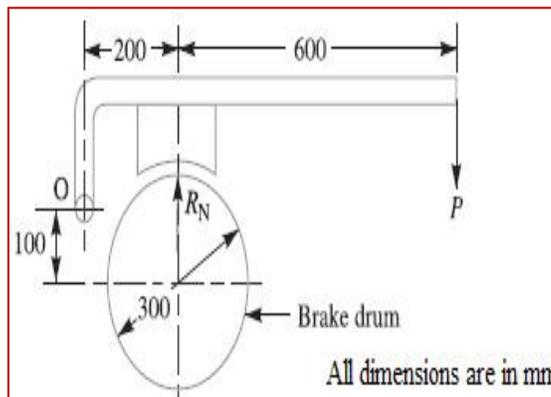
Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-
PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

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1.	Enumerate the merits and demerits of chain drive over the belt drive.	CO1	[K2]
2.	Illustrate and express the relationship of ratio of tensions in a V-belt drive.	CO1	[K2]
3.	State the significance of stub teeth.	CO2	[K2]
4.	Explain the terms helix angle and Axial pitch of a helical gear with a neat sketch.	CO2	[K2]
5.	Illustrate straight tooth bevel gear with a neat sketch.	CO3	[K2]
6.	Enlist the classifications of bevel gears.	CO3	[K1]
7.	State the conditions to be satisfied, while selecting number of teeth for each gear used in machine tool gear box.	CO4	[K2]
8.	How does the function of a brake differ from that of a clutch?	CO6	[K2]
9.	Classify the different types of clutches used in practice with examples.	CO6	[K1]
10.	Enumerate the properties that must be considered while selecting materials for brake lining.	CO5	[K1]

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11. Power of 60 kW at 750 r.p.m. is to be transmitted from an electric motor to compressor shaft at 300 r.p.m. by V-belts. The approximate larger pulley diameter is 1500 mm. The approximate centre distance is 1650 mm, and the overload factor is to be taken as 1.5. Give a complete design of the belt drive. A belt with a cross-sectional area of 350 mm² and density 1000 kg / m³ and having an allowable tensile strength 2 MPa is available for use. The coefficient of friction between the belt and the pulley may be taken as 0.28. The driven pulley is overhung to the extent of 300 mm from the nearest bearing and is mounted on a shaft having a permissible shear stress of 40 MPa with the help of a key. The shaft, the pulley and the key are also to be designed.   16 CO1 [K₃]

12. Design a pair of spur gears with the following data. Centre distance = 340 mm (app), Power to be transmitted = 77.28 kW, RPM of the pinion = 720, Speed reduction ratio = 5:1. Material to be used (a) C40 and (b) 40 Cr1.   16 CO2 [K₃]

13. Design a bevel gear drive to transmit 3.5 kW. Speed ratio = 4. Driving shaft speed = 200 rpm. The drive is non-reversible. Pinion is of steel and wheel of Cast Inn. Assume a life of 25000 hours.   16 CO3 [K₃]

14. A gear box is to be designed with the following specifications: 16 CO4 [K₃]
    Power = 14.72 kW. Number of speeds = 18, Minimum speed 16 rpm, step ratio = 1.25, motor speed = 1400 rpm. Sketch the layout of the gear box and speed diagram. Calculate the diameter of the shafts and the number of teeth on the gears.

15. a) The block brake, as shown in Figure, provides a braking torque of 360 N-m. The diameter of the brake drum is 300 mm. The coefficient of friction is 0.3. Find: 8 CO5 [K₃]

    1. The force (P) to be applied at the end of the lever for the clockwise and counter clockwise rotation of the brake drum; and

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    1. The force (P) to be applied at the end of the lever for the clockwise and counter clockwise rotation of the brake drum; and

2. The location of the pivot or fulcrum to make the brake self-locking for the clockwise rotation of the brake drum.

b) Fig. shows the arrangement of two brake shoes which act on the internal surface of a cylindrical brake drum. The braking force F_1 and F_2 are applied as shown and each shoe pivots on its fulcrum O_1 and O_2. The width of the brake lining is 35 mm. The intensity of pressure at any point A is $0.4 \sin \theta$ N/mm², where θ is measured as shown from either pivot. The coefficient of friction is 0.4. Determine the braking torque and the magnitude of the forces F_1 and F_2.   8   CO5   [K3]

All dimensions in mm.
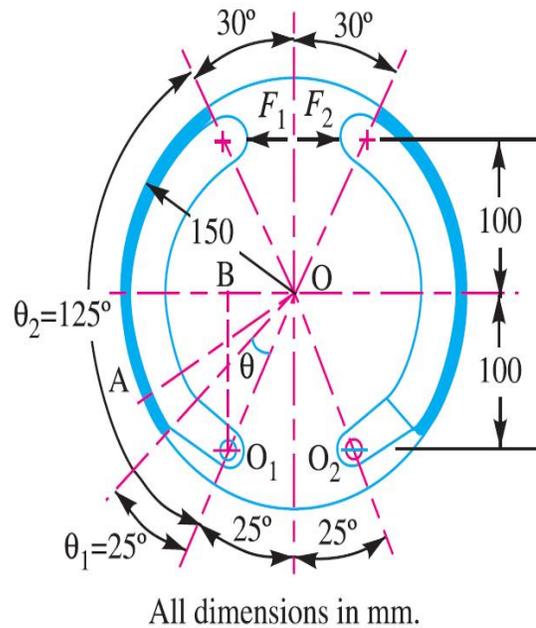
16.   A single dry plate clutch is to be designed to transmit 7.5 kW at 900 r.p.m.   16   CO6   [K3]
Find:
1. Diameter of the shaft,
2. Mean radius and face width of the friction lining assuming the ratio of the mean radius to the face width as 4,
3. Outer and inner radious of the clutch plate, and
4. Dimensions of the spring, assuming that the number of springs are 6 and spring index = 6.
The allowable shear stress for the spring wire may be taken as 420 MPa.

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