B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2024 Supplementary Examinations

Programme: B.E.   **Semester: V**

Branch: Mechanical Engineering   **Duration: 3 hrs.**
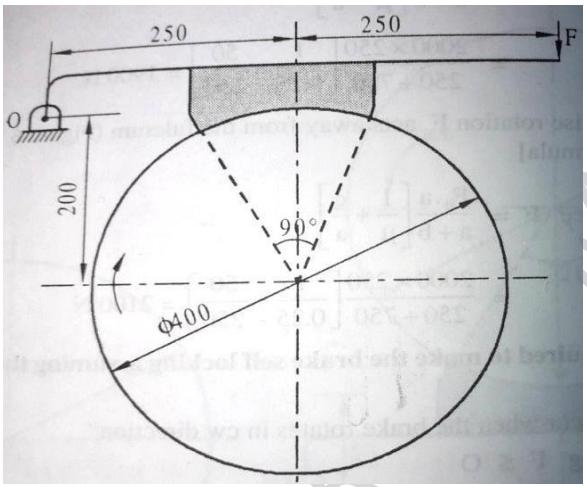
Course Code: 20ME5DCDM2   **Max Marks: 100**

Course: Design of Machine Elements - 2

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
                2. Missing data, if any, may be suitably assumed.
                3. Use of Machine Design Data handbook permitted.

			UNIT - I	**CO**	**PO**	**Marks**
1	a)		Derive an expression for stress distribution due to bending moment in a curved beam.	*CO1,2*	*PO1*	**10**
	b)		A crane hook of trapezoidal section is having inner width 30 mm, outer width 20 mm and depth 30 mm. The inner radius of the crane hook is 90 mm. The hook is used to lift a load of 8 kN with the line of loading coinciding with centre of curvature of the hook. If the material of the hook is steel with a yield strength of 450 MPa, determine the factor safety adopted.	*CO1,2*	*PO3*	**10**
			OR			
2	a)		Derive an expression for total stress in helical compression with usual notations and hence state the importance of Wahl's shear stress factor.	*CO1,2*	*PO1*	**08**
	b)		A car weighing 9000N empty has a seating capacity of 5 passengers each weighing 600 N. It has a wheel base of 2000 mm has it's CG at 1100 mm behind the front axle. The car is to be supported on 4 similar long semi-elliptical carrying springs of each 840 mm between shackle pins. Design a suitable spring using a factor of safety of 1.5 on the proof stress of 0.84 GPa. The static loads are to be multiplied by a load factor of 2.5 to allow the impact load. The maximum deflection of the leaves equal to 50mm. Number of full-length leaves are 2 and graduated leaves 8. Take E= 210 GPa.	*CO1,2*	*PO3*	**12**
			UNIT - II			
3	a)		In a multiple disc clutch, the radial width of the frictional material is to be 0.2 times of the maximum radius. The coefficient of friction is 0.25, i) How many discs are required to transmit 60 kW at 3000	*CO1,2*	*PO3*	**10**

				CO1	PO3	

rpm? The maximum diameter of clutch is limited to 250 mm. Axial force is not to exceed 600 N. (Assume uniform wear condition)

    ii)   What is the mean unit pressure on each contact surface.

| | b) | Fig 3b shows a single block brake. The brake drum diameter is 400 mm and rotates at a speed of 150 rpm. The friction materiel permits a maximum pressure of 0.5 MPa and coefficient of friction as 0.25. Face width of the block is 50 mm. If the brake is applied for 10 secs at full capacity to bring the shaft to stop determine

i) Effort ii) Maximum torque iii) Heat generated. | CO1 | PO3 | 10 |

Fig 3b

UNIT - III

4		A pair of spur gears with 20^0 full depth involute profile is used to transmit 12 kW at 1200 rpm of pinion. The gear has to rotate at 300 rpm. The material used for both pinion and gear is medium carbon steel whose allowable bending stress may be taken as 230 MPa. Determine the module and face width of the spur pinion and gear. Suggest suitable hardness. Take 24 teeth on pinion. Modulus of elasticity may be taken as 210 GPa.	CO4,5	PO3	20

OR

5		Design a pair of bevel gears to transmit a power a 25 kW from a shaft rotating at 1200 rpm to a perpendicular shaft to be rotated at 400 rpm. Assume
		
		  i. Power angle $= 20^o$ full depth
		  ii. Moderate medium shock and 8 to 10 hrs of duty per day.
		  iii. Pinion material as Alloy steel, case hardened (SAE 2320)
		       Straight tooth bevel gears
			CO4,5	PO3	20

UNIT - IV

6	a)	Derive Petroff's equation for the coefficient of friction in a lightly loaded journal bearing,	CO1,2	PO1	08

		b)	Design a journal bearing for a centrifugal pump running at 1200 rpm. Diameter of journal is 100 mm and load on bearing is 15 kN. Take L/d = 1.5, bearing temperature as 50° C and ambient temperature 30° C. Also find whether artificial cooling is required.	*CO4,5*	*PO3*	**12**
			UNIT - V			
	7	a)	Select a V- belt drive to transmit 10 kW of power from a pulley of 20 mm pitch diameter mounted on an electric motor running at 720 rpm to another pulley mounted on a compressor running at 200 rpm. The service is heavy duty varying from 10 hrs to 14 hrs per day at enter distance between pullies is 600 mm.	*CO5,6*	*PO3*	**10**
		b)	Select a wire rope to life a load of 10 kN, through a height of 600 m from a mine. The weight of bucket is 2.5 kN. The load should attain a maximum speed of 50 m / min	*CO5,6*	*PO3*	**10**

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