U.S.N.										

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

Autonomous Institute Affiliated to VTU

May / June 2025 Semester End Main Examinations

Programme: B.E. **Semester: VIII**

Branch: Aerospace Engineering **Duration: 3 hrs.**

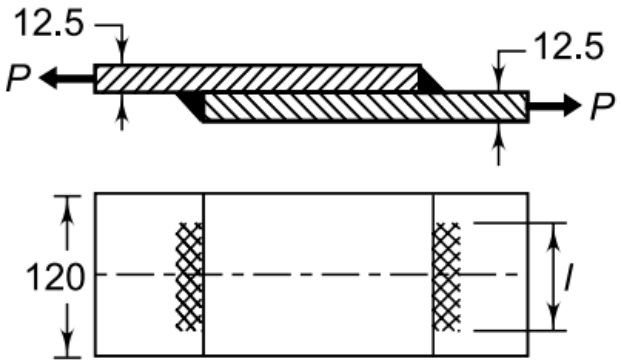
Course Code: 22AS8PEDME **Max Marks: 100**

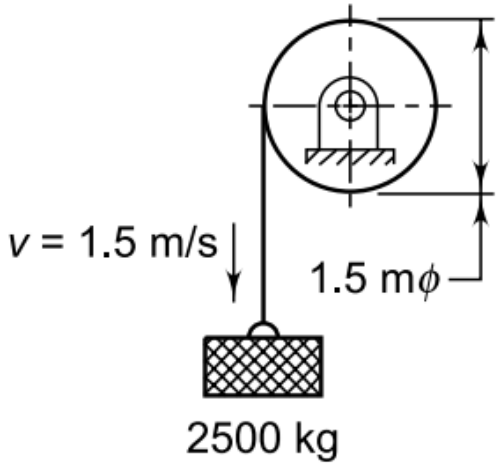
Course: Design of Machine Elements

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 a scientific calculator and a design data handbook is permitted.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	CO	PO	Marks
1	a)	List and explain briefly the various theories of failure.	CO1	PO1	**10**
	b)	Determine the maximum. load for a simply supported beam of 50 mm diameter and 400 mm span, centrally loaded, as the load cyclically varies from W to 3W. σ_{en} = 350 N/mm^2, σ_{yp} = 525 N/mm^2 and σ_u = 700N/mm^2. Design factor of safety is 1.3.	CO1	PO2	**10**
		OR			
2	a)	Explain the types of variable stresses with neat sketches.	CO1	PO1	**10**
	b)	A weight of 4.5 KN is being lowered on a 25 mm diameter wire rope from the sheave. Assuming that the brakes are applied instantaneously, find the maximum stress in the rope, if the cross section of wire rope is 250 mm^2, effective elastic modulus is 0.84 × 10^5 MN/mm^2, velocity with which is being lowered is 30 m/min and the fall of the rope is 10 m.	CO1	PO2	**10**
		UNIT - II			
3	a)	Explain the general design procedure for the design of the shaft.	CO2	PO1	**08**
	b)	The following details relate to an overhung shaft: Overhang of the shaft = 30 kW. Speed of pulley on the shaft = 200 RPM. Diameter of the pulley = 800 mm. Ratio of belt tensions = 2. Overhang of the shaft = 1000 mm. Permissible shear stress = 20 N/mm^2 . Permissible twist = 0.03 radians /m length. Neglecting the weight of the pulley, suggest a standard size shaft, which is torsionally and laterally rigid.	CO2	PO2	**12**

			OR			
	4	a)	Explain the shaft design on a strength basis.	*CO2*	*PO1*	**08**
		b)	A hoisting drum 500 mm in diameter is keyed to a shaft which is supported in two bearings. It is driven by an electric motor through a 12:1 reduction gear unit. Determine the power of the driving motor if a maximum load of 8000 N is hoisted at a speed of 50 m/min and the efficiency of the drive is 80%. Also determine the torque on the drum shaft and the rpm of the motor., Determine the diameter of the drum shaft which is made of machinery steel, the working stresses for which are 115 N/mm² in tension and 56 N/mm^2 in shear. The drive gear of diameter 450 mm is mounted at the end of the shaft such that it overhangs the nearest bearing by l50 mm. Combined shock and endurance factors are C_m = 2.0 and C_t = 1.5.	*CO2*	*PO2*	**12**
			UNIT - III			
	5	a)	Explain the types of welded joints and their advantages.	*CO3*	*PO1*	**10**
		b)	Two steel plates, 120 mm wide and 12.5 mm thick, are joined together by means of double transverse fillet welds as shown in Fig. 5b with dimensions in mm. The maximum tensile stress for the plates and the welding material should not exceed 110 N/mm^2. Find the required length of the weld if the strength of the weld is equal to the strength of the plates.  Fig.5b	*CO3*	*PO2*	**10**
			OR			
	6	a)	Explain the general procedure for designing of boiler riveted joints.	*CO3*	*PO1*	**10**
		b)	Find the working force carried by a 210 mm width of triple riveted butt joint. Make computations for different types of failure of the joint and compute the efficiency of the joint. If the joint is used on a 1.5 m diameter pressure vessel, find the permissible internal pressure. Main plate thickness = 20 mm. Diameter of rivet = 12 mm. Cover plate thickness = 30 mm. Working stresses are, $\sigma_t = 84\ N/mm^2$, $\sigma_c = 140\ N/mm^2$and $\tau = 56\ N/mm^2$.	*CO3*	*PO2*	**10**

			UNIT - IV			
	7	a)	Explain the clutches and their applications.	*CO4*	*PO1*	**10**
		b)	A single plate clutch consists of only one pair of contacting surfaces. It is used for an engine, which develops a maximum torque of 120 N-m. Assume a factor of safety of 1.5 to account for slippage at full-engine torque. The permissible intensity of pressure is 350 kPa and the coefficient of friction is 0.35. Assuming uniform wear theory, calculate the inner and outer diameters of the friction lining.	*CO4*	*PO2*	**10**
			OR			
	8	a)	Explain the types of brakes with applications.	*CO4*	*PO1*	**10**
		b)	A mass of 2500 kg is lowered at a velocity of 1.5 m/s from the drum as shown in Fig. 7b. The mass of the drum is 50 kg and its radius of gyration can be taken as 0.7 m. On applying the brake, the mass is brought to rest in a distance of 0.5 m. Calculate, (i) the energy absorbed by the brake; and (ii) the torque capacity of the brake.  Fig. 7b	*CO4*	*PO2*	**10**
			UNIT - V			
	9	a)	Write a general procedure for a gear design.	*CO5*	*PO1*	**08**
		b)	Design a pair of spur gears for a crusher. Power = 25 kW, Driver Speed = 1125 rpm (pinion), Speed reduction = 2.25:1, tooth profile 20-degree full depth, Pinion is forged untreated steel, service is 8 hrs./day. Design a compact drive with equally strong gear wheels and specify the drive completely.	*CO5*	*PO2*	**12**
			OR			
	10	a)	Write a general procedure for a antifriction bearing.	*CO5*	*PO1*	**08**
		b)	A wood turning machinery, two ball bearings of deep grove type are to be designed for the spindle of 50 mm diameter at a distance of 50 mm apart. One of the bearing is subjected to a radial load of 4000N and a thrust of 1500N whereas the other bearing is subjected to a radial load of 4500N only. The spindle rotates at 2000 rpm and operates for an 8 hrs./day, 5 days a week and two years. Light shock load is expected during the operation. Suggest a suitable size bearings.	*CO5*	*PO2*	**12**

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