CBCS SCHEME

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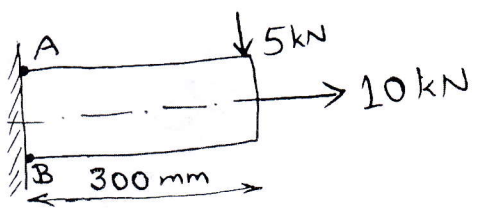
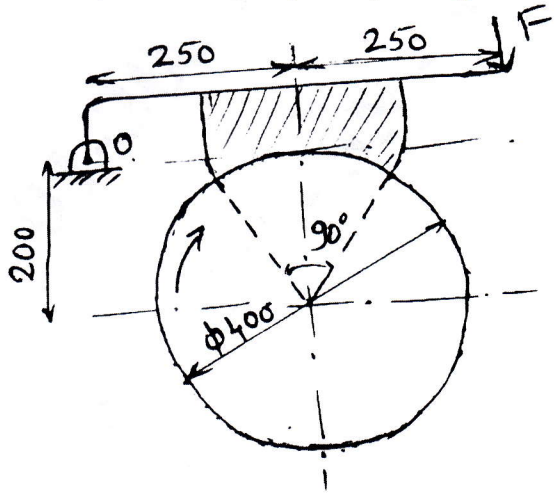
BAU503

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Design of Automobile components

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.
3. Use of Design data hand book is allowed.

		Module – 1	M	L	C
Q.1	a.	Define these material properties with example : i) Plasticity ii) Ductility iii) Toughness iv) Stiffness.	8	L1	CO1
	b.	A point in machine member is subjected to pure shear stress of magnitude 50 N/mm^2. Determine, i) Stresses acting on a plane inclined at an angle of 30° with respect to vertical plane ii) Principle stresses and their locations.	6	L2	CO1
	c.	A piston rod is subjected to a maximum reversed axial load of 110 kN. It is made of steel having an ultimate stress of 900 N/mm^2 and the surface is machined. The average endurance limit is 50% of the ultimate strength. Take size correction coefficient as 0.85 and factor of safety = 1.75. Determine the diameter of the rod.	6	L3	CO1
		OR			
Q.2	a.	Draw the stress – strain diagram for mild steel and explain the salient points.	8	L1	CO1
	b.	A material has maximum yield strength in tension and compression of σ_y = 100 MPa. Compute the FOS for i) Maximum normal stress theory ii) Maximum shear stress theory using following stresses σ_1 = 70 MPa, σ_2 = 70 MPa, σ_3 = 0 σ_1 = 70 MPa, σ_2 = 30 MPa, σ_3 = 0 σ_1 = 70 MPa, σ_2 = -30 MPa, σ_3 = -70 MPa	6	L2	CO1
	c.	A circular rod of 60 mm diameter is subjected to loads as shown in Fig Q2(c). Determine the nature and magnitude of stresses at critical point A.  Fig Q2(c)	6	L3	CO1
		Module – 2			
Q.3	a.	Derive the bending moment and shear force formulation for a cantilever beam subjected to UDL for the entire span.	10	L2	CO1

	b.	Design a knuckle joint to connect two mild steel rods subjected to an axial pull of 100 kN. The allowable stresses for rods and pin are 100 MPa, 130 MPa in tension, crushing and shear respectively. The bending of the pin is prevented by selection of proper fit.	10	L3	CO1
		OR			
Q.4		A shaft is supported by two bearings placed 1 m apart. A 500 mm diameter pulley is mounted at a distance of 200 mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 3 kN. The pulley weighs 1000 N. Another pulley 300 mm diameter is placed 300 mm to the left of right hand bearing is driven with the help of electric motor and the belt which is placed horizontally to the right when viewed from the left bearing. This pulley weighs 500 N. The angle of contact for both the pulleys is 180° and $\mu = 0.24$. Determine suitable diameter for a solid shaft, assuming torque on one pulley is equal to torque on other pulley. Choose C15 steel ($\sigma_y = 235.4$ MPa, $\sigma_u = 425$ MPa) as the shaft material and use ASME code for design of shaft. Assume minor shock condition.	20	L3	CO1
		Module – 3			
Q.5	a.	List the types of springs.	6	L1	CO1
	b.	A 25 kW at 3000 rpm is to be transmitted by a multiplate friction clutch. The plates have friction surfaces of steel and phosphor bronze alternatively and run in oil. Design the clutch for 25% over load.	14	L3	CO1
		OR			
Q.6	a.	Design a helical compression spring to support an axial load of 3000 N. The deflection under load is limited to 60 mm. The spring index is 6. The spring is made of chrome Vanadium steel and FOS = 2.	10	L4	CO1
	b.	A single block brake is shown in Fig Q6(b). The brake drum diameter is 400 mm and rotates at 150 rpm. The friction material permits a maximum pressure of 0.5 MPa and $\mu = 0.25$. Face width of the block is 50 mm. If the brake is applied for 10 Sec at full capacity to bring the shaft to stop determine: i) Effort ii) Maximum torque iii) Heat generated.  Fig Q6(b)	10	L3	CO1

		Module – 4			
Q.7	**a.**	Design a connecting rod for a petrol engine from following data : Cylinder bore = 100 mm, Length of connecting rod = 350 mm, Maximum gas pressure = 3 N/mm^2, Length of stroke = 150 mm, Engine speed = 1500 rpm, Weight of reciprocating parts = 25 N. Compression ratio = 4 : 1. Assume any further data for the design.	**20**	**L3**	**CO3**
		OR			
Q.8		Design an overhung crank shaft with two main bearing and a flywheel in between them for an IC engine having single cylinder 250 mm × 300 mm. The flywheel cum belt pulley weighs 10 kN. The maximum pressure is 2 MPa. The ratio of length of connecting rod to crank length is 4.5. Total belt pull is 5 kN. The toreque is maxium when the crank 35 ° from inner dead centre. The gas pressure at this instant is 1.05 MPa. Width of hub for flywheel cum belt pulley is 200 mm. Assume any further data for design.	**20**	**L4**	**CO3**
		Module – 5			
Q.9	**a.**	Explain different components of a battery pack.	**7**	**L2**	**CO4**
	b.	A car battery has a rating of 220 ampere hours (Ah). This rating is one indication of the total charge that the battery can provide to a circuit before failing : i) What is the total charge this battery can provide (in coulombs)? ii) Determine the maximum current that the battery can provide for 38 minutes.	**4**	**L3**	**CO4**
	c.	Describe the considerations for battery pack temperature.	**9**	**L2**	**CO4**
		OR			
Q.10	**a.**	Determine the heat load of an electric converter whose mass flow rate is 6.75 and the specific heat of the system is 1000 and the enthalpy ranges from 21.5 to 26.55.	**4**	**L3**	**CO4**
	b.	Describe the forces acting on the battery pack.	**6**	**L2**	**CO4**
	c.	Describe how vibrations affect a battery pack.	**10**	**L2**	**CO4**

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