CBCS SCHEME

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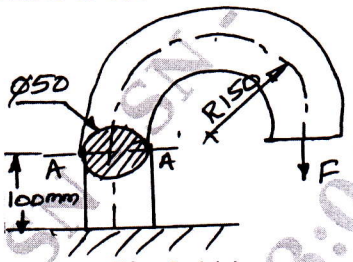
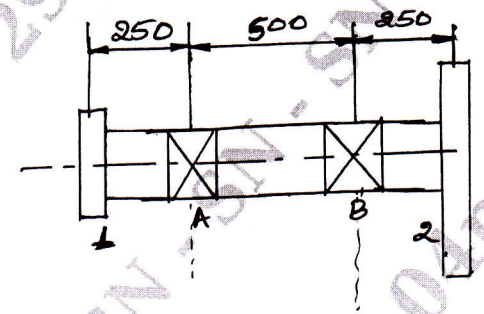
BAU503

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
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. Design data hand book is permitted.
4. Missing data may be assumed suitably.

		Module – 1	M	L	C
Q.1	a.	Explain the mechanical properties of engineering materials.	6	L2	CO1
	b.	Sketch and explain stress-strain diagram for a ductile material and brittle material. Show the salient points on them.	6	L2	CO1
	c.	Analyze and evaluate the load F to be applied for the component shown in Fig.Q.1(c). If allowable stress for the material is limited to 100N/mm^2. Radius of the curved member is 150 mm.  Fig.Q.1(c)	8	L3	CO1
		OR			
Q.2	a.	Explain the maximum normal stress theory and maximum shear stress theory of failures.	8	L2	CO1
	b.	What are S-N diagrams? Explain the importance of it in fatigue design.	6	L2	CO1
	c.	Explain the effect of load, size and surface factors in fatigue design.	6	L2	CO1
		Module – 2			
Q.3	a.	Sketch and explain the different types of keys with their applications.	6	L2	CO2
	b.	Analyze and design a knuckle joint to transmit 150 kN. The design stress may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in crushing.	7	L3	CO2
	c.	Analyze and design a unprotected type CI flanged coupling for a steel shaft transmitting 30 kW at 200 rpm. The allowable shear stress in the shaft and the key is 40 MPa. The maximum torque transmitted is 20% greater than the full torque. The allowable shear stress in the bolt is 60 MPa and in CI flange is 40 MPa.	7	L3	CO2

		OR			
Q.4	**a.**	Explain the following terms with their applications : i) Axle ii) Spindle iii) Countershaft iv) Jackshaft v) Line shaft	**5**	**L2**	**CO2**
	b.	Analyze and design a shaft carrying two pulleys 1 and 2 and supported on two bearings A and B as shown in Fig.Q.4(b). The shaft transmits 7.5 kW power at 360 rpm from the pulley 1 to the pulley 2. The diameters of the pulley 1 and 2 are 10 kg and 30 kg respectively. The belt tensions act vertically downwards and the ratio of belt tensions on the tight side to slack side for each pulley is 2.5:1. The shaft is made of plain carbon steel 40C8 with yield strength 380 N/mm^2 and the factor of safety is 3. Estimate the suitable diameter of shaft, if permissible angle of twist is 0.5° per metre length and torsional, rigidity modulus G = 79300 N/mm^2.  Fig.Q.4(b)	**15**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Develop an expression for the shear stress induced in a helical compression spring, with usual notations.	**6**	**L3**	**CO3**
	b.	Explain surge in helical springs and nipping in spring leaves.	**6**	**L2**	**CO3**
	c.	A railway wagon weighing 50 kN and moving with a speed of 8 km/hr has to be stopped by four buffer spring in which maximum compression allowed is 220 mm. Solve and determine the number of turns or coils in each spring of mean diameter 150 mm. The diameter of spring wire is 25 mm. Take G = 84 GPa. Also determine the shear stress induced in the spring.	**8**	**L3**	**CO3**
		OR			
Q.6	**a.**	Develop an expression for a torque capacity of the clutch based on the uniform pressure distribution.	**7**	**L3**	**CO3**
	b.	A multi plate clutch having effective outer diameter 250 mm and inner diameter 150 mm has to transmit 60 kW at 1200 rpm. The end thrust is 4.5 kN and coefficient of friction is 0.8 solve and determine the number of plates assuming. i) Uniform wear criteria ii) Uniform pressure criteria	**7**	**L3**	**CO3**

	c.	Explain the self energizing and self locking phenomenon in brakes.	6	L2	CO3
+		**Module – 4**			
Q.7	a.	Explain the functions of connecting rod of IC engine with a neat sketch.	6	L2	CO4
	b.	The following data refers to a connecting rod of circular section: Diameter of piston or cylinder bore 150 mm, explosion pressure 3.5 N/mm^2, length of connecting rod 350 mm, stroke of piston is 160 mm, mass of reciprocating parts 2.8 kg, speed of engine 1500 rpm, material for the connecting rod 48C8 steel with σ_{yt} = 328.6 N/mm^2, factor of safety for buckling is 4, length to diameter ratio of crank pin and gudgeon pin is 1.5, allowable bearing pressure at the crank pin is 16.5 N/mm^2, Allowable bearing pressure at the gudgeon pin 26 N/mm^2, material for the bolt and cap is 50C4 steel with σ_{yt} = 372.7 N/mm^2. Factor of safety for the bolt and cap 4. Assume any further data required. Solve and design connecting rod for gas load, inertia load, combined load on piston and component force along axis of connecting rod.	14	L3	CO4
		OR			
Q.8	a.	Design an overhung or side crank shaft with two main bearings and a flywheel in between them for an IC engine having single cylinder 250 mm × 300 mm. The fly wheel cum belt pulley weights 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 5kN. The torque is maximum when the crank is at 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 required and design .lt for overhung or side rank shaft top dead centre position case.	20	L3	CO4
		Module – 5			
Q.9		Explain the following with respect to EV: i) Battery pack development process ii) Stages of battery pack design iii) Types of cell and hierarchy of a EV battery pack iv) Busbar sizing v) Current equalization in parallel path	20	L2	CO5
		OR			
Q.10		Explain the following: i) Active thermal management in battery pack ii) Passive thermal management in battery pack iii) Heat generation in battery and its control. iv) Structural stability in battery pack. v) Vibrational effect on battery pack.	20	L2	CO5

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