CBCS SCHEME

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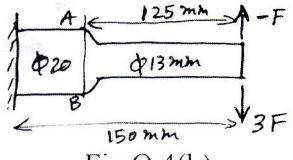
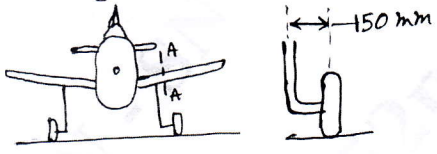
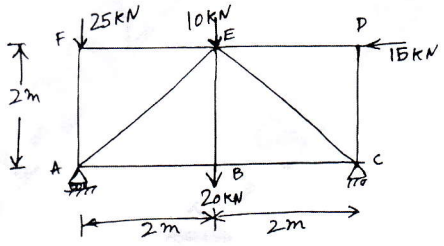
BAE502

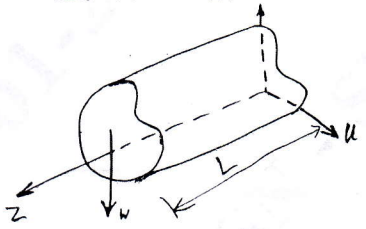
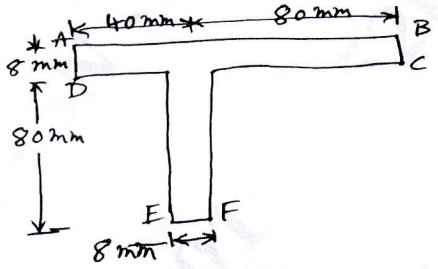
Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Aircraft Structures

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.

		Module – 1	M	L	C
Q.1	a.	Define: static strength, biaxial stress, stress tensor, principal stress and factor of safety.	10	L1	CO1
	b.	Explain : i) Design considerations ii) Codes and standards.	10	L1	CO1
		OR			
Q.2	a.	Explain any two theories of failure applicable for ductile materials.	8	L1	CO1
	b.	The load on a bolt consists of an axial pull of 10 kN together with a transverse shear force of 5 kN. Find the diameter of the bolt according to i) Max principal stress theory ii) Max shear stress iii) Max principal strain iv) Max strain energy v) Max distortion energy theory. Take permissible tensile stress at elastic limit = 100 MPa and $\mu = 0.3$.	12	L3	CO1
		Module – 2			
Q.3	a.	What is Impact stress? Derive an equation for impact factor of a bar subjected to an axial impact load.	10	L2	CO2
	b.	Define: Fatigue, stress concentration, miners rule, fluctuating stress and repeated stress.	10	L2	CO2
		OR			
Q.4	a.	Draw a SN diagram. Explain endurance strength and mention the factors on which it depends.	10	L2	CO2
	b.	Determine the maximum load which can be withstood by the beam as shown in Fig.Q.4(b) for an indefinite life based on Goodman and Soderberg criteria. Use a factor of safety as 2. Theoretical stress concentration factor is 1.42 and notch sensitivity is 0.9. Assume the following values. Ultimate stress = 550 MPa, yield stress = 470 MPa, Endurance limit = 275 Mpa, size factor = 0.85 surface finish factor = 0.89.  Fig.Q.4(b)	10	L3	CO2

		Module – 3			
Q.5	**a.**	Discuss the limitations of Eulers formula and hence derive the Rankines formula.	**10**	**L2**	**CO2**
	b.	A hollow circular cylinder of 2.8m long column is fixed at one end and hinged at the other end. External diameter is 150 mm, thickness is 15 mm, Rankine's constant is 1/1600, max compressive stress is 550 mm and Young's modulus is 80 GPa. Compare the buckling loads obtained by using Eulers and Rankines formula.	**10**	**L3**	**CO2**
		OR			
Q.6	**a.**	Draw a neat sketch of v-n diagram and explain the basic flight loading conditions.	**8**	**L1**	**CO2**
	b.	The aircraft shown in Fig.Q.6(b) weights 135 kN and has landed such that, at the instant of impact, the ground reaction on each main under carriage wheel is 200 kN and its vertical velocity is 3.5 m/s. If each under carriage wheel weights 2.25 kN and is attached to an oleo strut as shown in Fig.Q.6(b), calculate the axial load and bending moment in the strut, the strut may be assumed to be vertical. Determine also the shortening of the strut when the vertical velocity of the aircraft is zero. Finally calculate the shear force and bending moment in the wing at the section AA if the wing, outboard of this section weigts 6.6 kN and has its CG 3.05 m from AA.  Fig.Q.6(b)	**12**	**L4**	**CO2**
		Module – 4			
Q.7	**a.**	Explain statically determinate and indeterminate structure with suitable examples.	**8**	**L2**	**CO2**
	b.	A truss is loaded as shown in Fig.Q.7(b), determine the forces in all the members.  Fig.Q.7(b)	**12**	**L3**	**CO2**
		OR			
Q.8	**a.**	Explain Truss and Frame with suitable examples.	**8**	**L1**	**CO2**
	b.	A pin jointed truss is as shown in Fig.Q.7(b). Determine the vertical displacement of joint E by using unit load method. All the members have cross sectional area of 250 mm^2 and same modulus of elasticity 200 Gpa.	**12**	**L3**	**CO2**

		Module – 5			
Q.9	**a.**	Derive an equation for direct stress due to bending in an unsymmetrical section.	**8**	**L2**	**CO3**
	b.	The I section beam with flanges 200 mm × 20 mm and web 260 mm × 25 mm is subjected to a bending moment of 100 KNm applied in a plane parallel to the longitudinal axis of the beam but inclined at 30° to the left of the vertical. The sense of the bending moment is clockwise when viewed from the left hand edge of the beam section. Determine the distribution of stress.	**12**	**L3**	**CO3**
		OR			
Q.10	**a.**	Determine the horizontal and vertical components of the tip deflection of the cantilever shown in Fig.Q.10(a) The second moments of area of its unsymmetrical section are I_{XX}, I_{YY} and I_{XY}.  Fig.Q.10(a)	**8**	**L3**	**CO3**
	b.	A beam having cross section as shown in Fig.Q.10(b) is subjected to bending moment of 1500 Nm in a vertical plane. Calculate the maximum direct stress due to bending stating the point at which it acts.  Fig.Q.10(b)	**12**	**L3**	**CO3**

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