

Fifth Semester B.E./B.Tech. Degree Examination, June/July 2026
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 Stress tensor, Principal stress, Static strength, codes and standards.	10	L1	CO1	
	b.	Elucidate the general considerations involved in design.	10	L2	CO1	
OR						
Q.2	a.	Explain the two theories of failure which are considered most accurate for ductile materials.	8	L2	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 required according to : i) Max principal stress Theory ii) Max shear stress Theory iii) Max principal strain Theory iv) Max strain energy Theory v) Max distortion energy Theory Take permissible stress at elastic limit = 100 MPa, $\mu = 0.3$.	12	L3	CO1	
Module – 2						
Q.3	a.	Derive the equations for maximum stress in a bar subjected to axial impact load and bending impact load.	10	L3	CO1	
	b.	Draw a sn diagram and discuss the factors affecting it.	10	L1	CO1	
OR						
Q.4	a.	Define Fatigue, stress concentration, stress ratio, mean stress and stress amplitude.	10	L1	CO1	
	b.	Determine the max load by Goodman and Soderberg criteria for the cyclically loaded beam as shown in Fig. Q4(b). Ultimate stress = 770 MPa yield stress = 520 MPa, endurance limit = 320 MPa use a factor of safety of 1.25 load, size factor and surface finish factors are 1, 0.75 and 0.9 respectively.	10	L3	CO1	

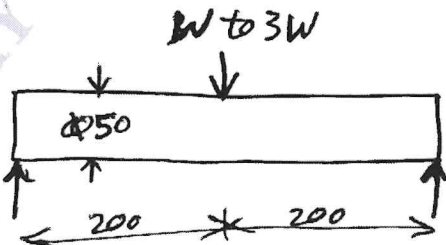


Fig. Q4(b)

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Module – 3

Q.5	a.	Discuss the limitations of Euler's formula and derive the Rankine's formula.	10	L3	CO2
	b.	A hollow circular section 2.8 m long column is fixed at one end and hinged at the other end. External diameter is 150 mm and thickness is 15 mm. Take Rankine's constant as $1/1600$, $E = 80$ GPa max compressive stress 550 MPa. Compare the buckling loads obtained by using Euler and Rankine.	10	L3	CO2

OR

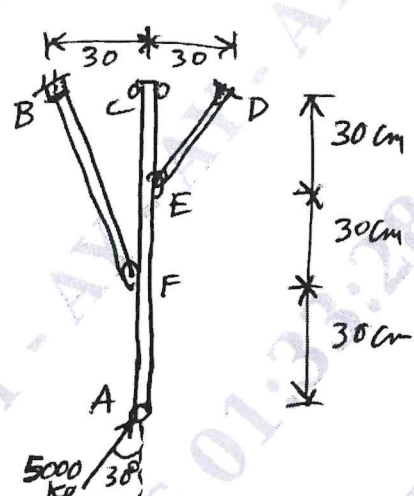
Q.6	a.	Define limit load, load factor and draw a vn diagram and explain.	10	L1	CO2
	b.	Fig.Q6(b) shows a simplified airplane loading gear unit. The brace struts are pinned at each end and the support at 'C' is of roller type. A known load of 5000 kg is applied to axle unit at A. Find the load in the brace struts and reaction at C. 	10	L3	CO2

Fig.Q6(b)

Module – 4

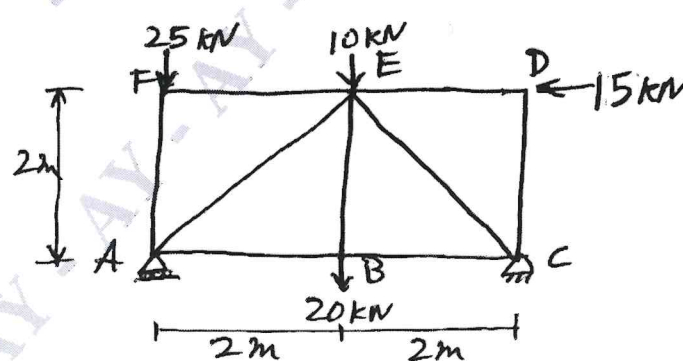
Q.7	a.	Explain with neat examples, determinate and indeterminate structures.	8	L1	CO2
	b.	Determine the internal forces in the members of the truss as shown in Fig.Q7(b). 	12	L3	CO2

Fig.Q7(b)

OR

Q.8	a.	Derive Clapeyron's three moment equation.	8	L3	CO2
	b.	Use unit load method to find the deflection at the center of the beam shown in Fig.Q8(b). Take $E = 200 \text{ GPa}$ and $I = 400 \times 10^6 \text{ mm}^4$.	12	L3	CO2

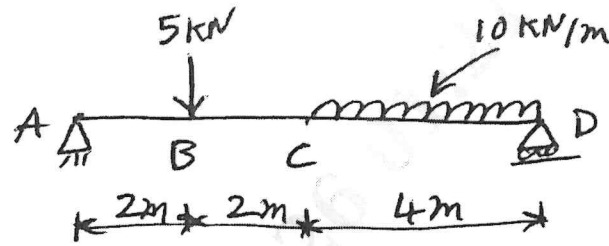


Fig.Q8(b)

Module – 5

Q.9	a.	Derive an equation for direct stress due to bending in an unsymmetrical section.	10	L3	CO3
	b.	An I section beam with flanges $200 \text{ mm} \times 20 \text{ mm}$ and web of $260 \text{ mm} \times 25 \text{ mm}$ is subjected to a bending moment of 150 kN m applied in a plane parallel to the longitudinal axis of the beam but inclined at 40° to the left of the vertical. The sense of the bending moment is clockwise when viewed from the left edge of the beam section. Determine the orientation of neutral axis and distribution of direct stress.	10	L3	CO3

OR

Q.10	a.	Determine the horizontal and vertical components of the tip deflection of the cantilever shown in Fig.Q10(a). The second moments of the area are I_{xx} , I_{yy} and I_{xy} .	8	L3	CO3
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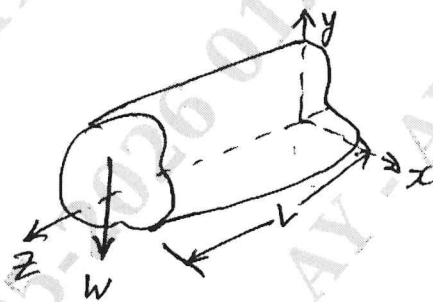


Fig.Q10(a)

	b.	A beam having the cross section as shown in Fig.Q10(b) is subjected to a bending moment of 1800 Nm in a vertical plane, calculate the maximum direct stress due to bending.	12	L4	CO3
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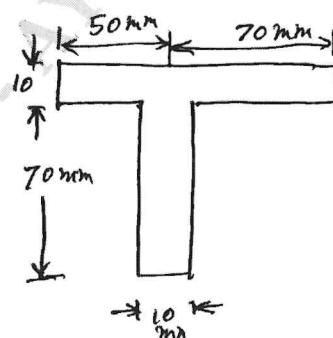


Fig.Q10(b)
