CBCS SCHEME

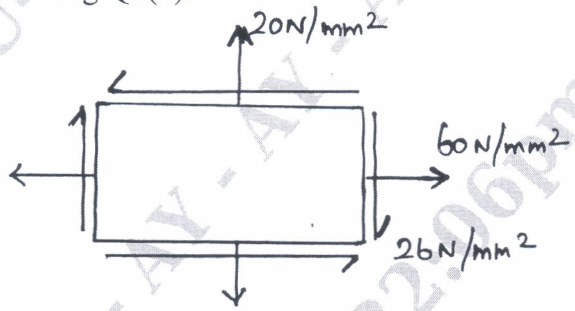
USN | | | | | | | | | | |

BAE502

Fifth Semester B.E./B.Tech. Degree Examination, June/July 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 the following : i) Stress tensor ii) Principal stress iii) Factor of safety iv) Normal stress v) Principal planes	10	L1	CO1
	b.	Evaluate the principal stresses and principal planes for the state of stress shown in the below Fig.Q1(b).  Fig.Q1(b)	10	L3	CO1
		OR			
Q.2	a.	A solid circular shaft is subjected to a bending moment of 60 KNm and a torque of 6 KNm. Design the diameter of the shaft according to : i) Maximum principal stress theory ii) Maximum shear stress theory iii) Maximum strain energy theory	10	L3	CO1
	b.	Explain the following : i) Maximum principal strain theory ii) Maximum distortions energy theory.	10	L2	CO1
		Module – 2			
Q.3	a.	Define impact strength. Writ the equations for impact stresses due to axial, bending loads and explain.	10	L2	CO2
	b.	Define the following : i) Fluctuating stress ii) Endurance limit iii) Stress concentration factor iv) Factor of safety for fatigue loading v) Alternating stress.	10	L1	CO2
		OR			
Q.4	a.	With suitable sketches, explain the Goodman and soderberg relationship.	10	L2	CO2
	b.	Discuss the following : i) Stresses due to combined loading ii) Cumulative fatigue damage.	10	L2	CO2

Module – 3

Q.5	a.	List the assumptions made in Euler's column theory and derive the equation for critical load for columns with one end fixed and the other end free.	10	L2	CO2
	b.	A T-section 150 mm × 120 mm x 20 mm is used as a strut of 4 m long with hinged at its both ends. Calculate the crippling load, if Young's modulus for the material be 200 GPa.	10	L3	CO2

OR

Q.6	a.	Define load factor. Illustrate the flight envelope and discuss the key factors.	10	L2	CO2
	b.	The aircraft shown in Fig.Q6(b)(i), weights 135 N 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 weighs 2.25 kN and is attached to an oleo strut, as shown in Fig.Q6(b)(ii), 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, out board of this section, weighs 6.6 kN and has its CG 3.05 m from AA.	10	L4	CO2

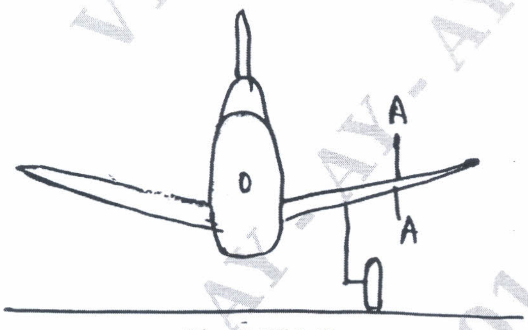


Fig.Q6(b)(i)

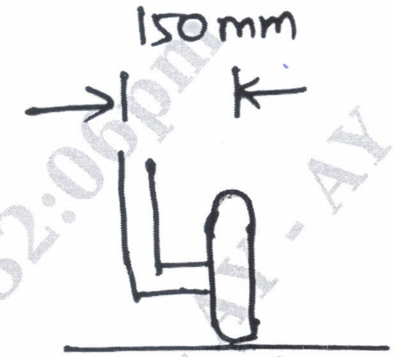


Fig.Q6(b)(ii)

Module – 4

Q.7	a.	A king post truss of 8 m span is loaded as shown is Fig.Q7(a). Find the forces in each member.	14	L3	CO2

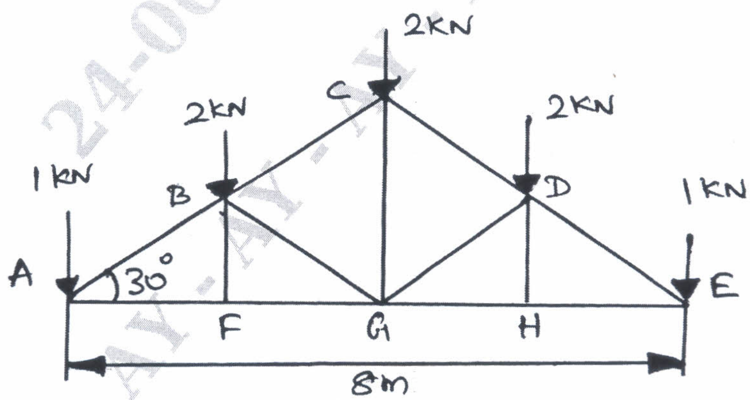
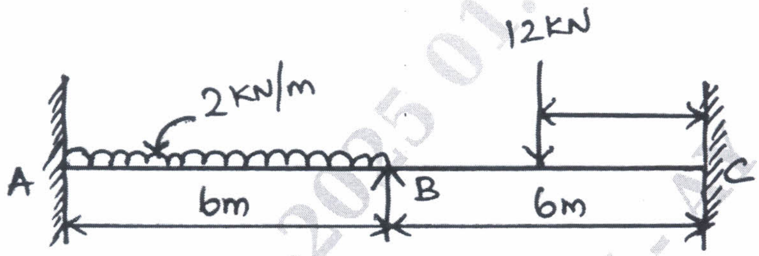
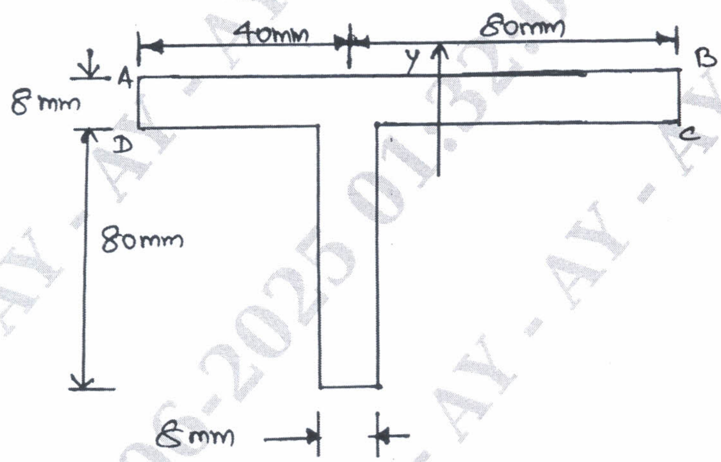


Fig.Q7(a)

	b.	Differentiate statically determinate and indeterminate structures.	06	L1	CO2

		OR			
Q.8	**a.**	State and derive Clapeyron's Three moment equation.	**10**	**L2**	**CO2**
	b.	Evaluate the bending moment and shear force diagrams of the beam shown in Fig.Q8(b). What are the reactions at the supports?  Fig.Q8(b)	**10**	**L3**	**CO2**
		Module – 5			
Q.9	**a.**	Derive the equation bending stress equation for unsymmetrical sections and determine the position of its neural axis.	**10**	**L2**	**CO3**
	b.	With relevant sketches, explain the sign conventions and notions for unsymmetrical section's bending stress.	**10**	**L1**	**CO3**
		OR			
Q.10	**a.**	A beam having the cross-section shown in Fig.Q10(a) is subjected to a bending moment of 1500 Nm in a vertical plane. Calculate the maximum bending stress stating the point at which its acts.  Fig.Q10(a)	**15**	**L4**	**CO3**
	b.	Write the bending stress equations for symmetrical sections and explain its notations.	**05**	**L1**	**CO3**

* * * * *