CBCS SCHEME

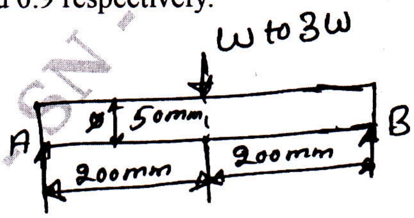
USN | | | | | | | | | | |

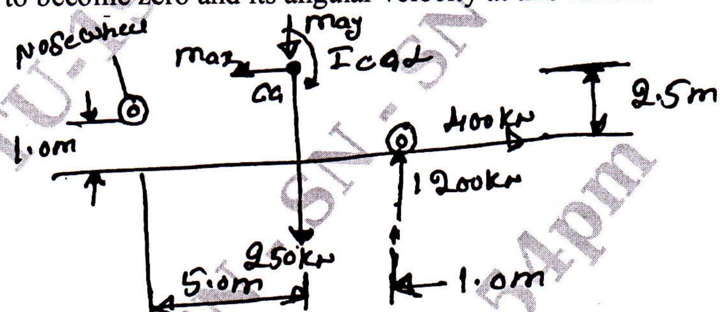
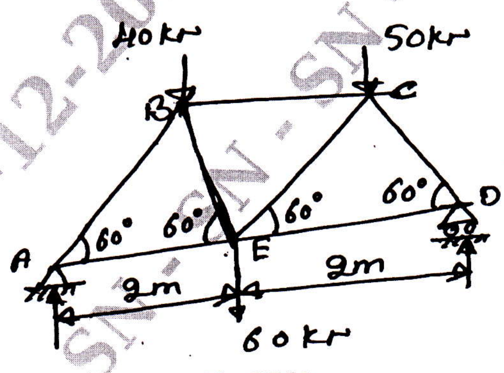
BAE502

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.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.	Explain the following terms : i) Principle stress ii) Principle planes iii) Factors of safety iv) Biaxial stresses	10	L1	CO1
	b.	A point in a body is subjected to turbine stresses 10 MPa and 70 MPa along two mutually perpendicular directives. The point is also subjected to shear stress of magnitude 50 MPa. Calculate : i) Normal stress and shear stress acting on a plane which is at an angle of 120° with reference to the 100 MPa stress plane. ii) Magnitude of principal stresses and maximum shear stress	10	L3	CO1
		OR			
Q.2	a.	Discuss maximum normal stress theory and maximum strain energy theory.	10	L2	CO1
	b.	Determine the diameter of a bolt which is subjected to an axial pull of 10 kN together with transverse shear force of 5 kN using maximum permissible stress of 100 MPa i) Maximum principal stress theory ii) Maximum principal strain theory and Poisson ratio 0.3	10	L3	CO1
		Module – 2			
Q.3	a.	Define Impact Strength and derive an instantaneous stress due to axial impact.	10	L2	CO2
	b.	A unknown weight fall through 20 mm on to a call or rigidity attached to the lower end of a vertical bar 2m long and 500 mm^2 section. If the maximum instantaneous extension is 2 mm. What is the corresponding stress and value of the unknown weight? Take E = 200 GPa.	10	L3	CO2
		OR			
Q.4	a.	Derive Soderberg relationship for fatigue loading.	10	L2	CO2
	b.	Determine the maximum load for the simply supported beam, cyclically loaded as shown in Fig Q4(b). The ultimate strength is 700 MPa, the field point in torsion is 520 MPa and the endurance limit is reversed bending is 320 MPa, use factor of safety of 1.25. The load size and surface correction factor are 1, 0.75 and 0.9 respectively.  Fig Q4(b)	10	L3	CO2

		Module – 3			
Q.5	**a.**	Derive an expression for columns with one end pined other end hinged.	**10**	**L2**	**CO2**
	b.	A hollow cast Iron column whose outside diameter is 200 mm has a thickness of 20 mm. It is 4.5 m long and is fixed at both ends. Calculate the safe load by Rankine's formula using FOS of 4. Estimate the Slenderness ratio. The ratio of Euler's to Rankine's critical loads. Take $f_c = 550\ N/mm^2$. $a = 1/1600$ in Rankine's formula and $E = 9.4 \times 10^4\ N/mm^2$.	**10**	**L3**	**CO2**
		OR			
Q.6	**a.**	Explain structural nomenclature and functions of structural components.	**10**	**L1**	**CO2**
	b.	An aircraft having a weight of 250 kN and a tri cycle under carriage lands at a vertical velocity of 3.7 m/sec, such that the vertical are horizontal reactions on the main wheels are 1200 kN and 400 kN respectively at this instant the nose wheels is 1.0 m from the ground as shown in Fig Q6(b). If the moment of inertia of the air craft about its CG is $5.65 \times 10^8\ NS^2mm$. Determine the inertia forces on the aircraft, the time takes for its vertical velocity to become zero and its angular velocity at this instant.  Fig Q6(b)	**10**	**L3**	**CO2**
		Module – 4			
Q.7	**a.**	Discuss statically determinate and indeterminate structures.	**10**	**L1**	**CO2**
	b.	Determine the forces in all the members of the truss shown in Fig Q7(b) and indicate the magnitude and nature of forces on the diagram of the truss. All inclined members are at 60° to horizontal and length of each member is 2 m.  Fig Q7(b)	**10**	**L3**	**CO2**

<table>
<tr><td colspan="6" align="center">OR</td></tr>
<tr><td>Q.8</td><td>a.</td><td>Derive the Clapeyron's equation of three moment's distribution.</td><td>10</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>b.</td><td>Determine the forces in all the member of the truss shown in Fig Q8(b)

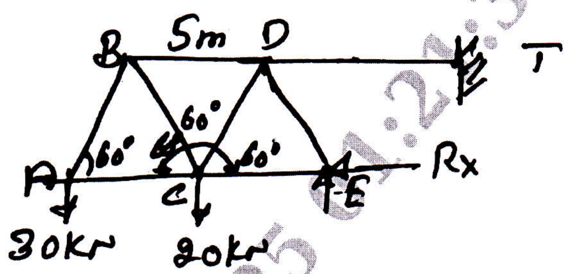



Fig Q8(b)</td><td>10</td><td>L3</td><td>CO2</td></tr>
<tr><td colspan="6" align="center">Module – 5</td></tr>
<tr><td>Q.9</td><td>a.</td><td>Discuss symmetrical bending and mention the various assumptions made during bending.</td><td>10</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>b.</td><td>The cross-section of a beam has the dimensions shown in Fig Q9(b). If the beam is subjected to a negative bending moment of 100 kNm. Applied in a vertical plane. Determine the distribution of direct stress through the depth of the section.

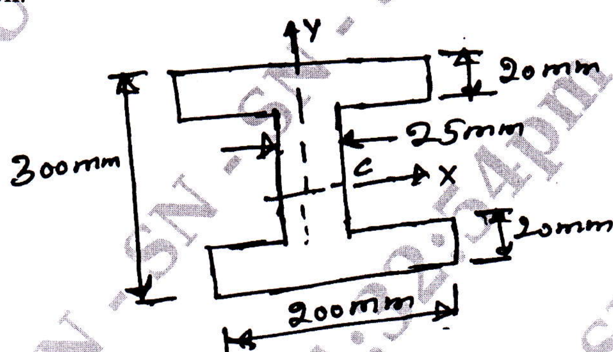



Fig Q9(b)</td><td>10</td><td>L4</td><td>CO3</td></tr>
<tr><td colspan="6" align="center">OR</td></tr>
<tr><td>Q.10</td><td>a.</td><td>Derive an expression for direct stress distribution due to unsymmetrical bending.</td><td>10</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>b.</td><td>A beam having a cross section is as shown in Fig Q10(b). Subjected to a bending moment of 1500 N-m in a vertical plane. Calculate the maximum direct stress due to bending stating the point at which it act.

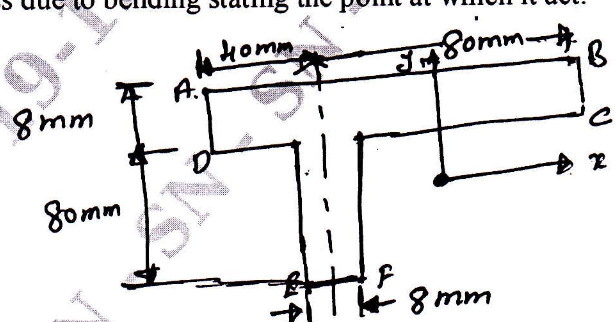



Fig Q10(b)</td><td>10</td><td>L3</td><td>CO3</td></tr>
</table>

* * * * *