Model Question Paper-1 with effect from 2020-21 (CBCS Scheme)

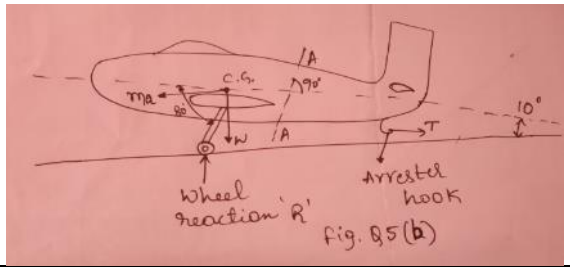
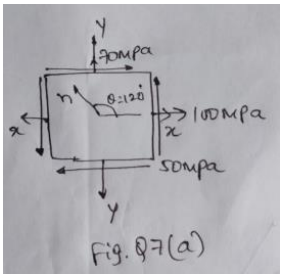
USN | | | | | | | | | | |

Fifth Semester B.E. Degree Examination
Aircraft Structure-I

TIME: 03 Hours **Max. Marks: 100**

Note: Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.

		Module – 1	Marks
Q.1	**(a)**	Determine the diameter of a bolt which is subjected to an axial pull of 9KN together with a transverse shear force of 4.5KN using i) Maximum principal stress theory ii) Maximum principal strain theory.	12
	(b)	Explain failure of brittle and ductile materials.	08
		OR	
Q.2	**(a)**	At a section of a mild steel shaft, the maximum torque is 8437.5 Nm and the maximum bending moment is 5062.5 Nm. The diameter of the shaft is 90 mm and the stress at the elastic limit in simple tension for the material of the shaft is 220 N/mm^2. Determine whether failure of the material occur or not. If not find the factor of safety based on i) Maximum shear stress theory ii) Maximum strain energy theory.	12
	(b)	Explain the following: i) Stress tensor ii) Factor of safety iii) Principal stresses	08
		Module – 2	
Q.3	**(a)**	What are the important modifying factors that effects the endurance limit.	10
	(b)	Define fatigue. With neat sketch explain S-N diagram.	10
		OR	
Q.4	**(a)**	Define impact strength. Write the equations for impact stresses due to axial, bending and torsional loads.	10
	(b)	What is endurance limit? Explain the Goodmann and Soderberg relationship.	10
		Module – 3	
Q.5	**(a)**	Explain symmetric manoeuvre loads.	08

	(b)	An aircraft having a total weight of 45 KN lands on the deck of an aircraft carrier and is brought to rest by means of a cable engaged by an arrester hook, as shown in Fig.Q5 (b). If the deceleration induced by the cable is 3 g determine the tension, T, in the cable, the load on an undercarriage strut and the shear and axial loads in the fuselage at the section AA; the weight of the aircraft aft of AA is 4.5 KN. Calculate also the length of deck covered by the aircraft before it is brought to rest if the touch-down speed is 25 m/s.  Fig. Q5(b)	12
OR			
Q.6	**(a)**	With a neat sketch explain V-N diagram.	08
	(b)	Write a short note on following: i) Aluminium alloys ii) Stainless steel iii) Titanium alloys iv) Composites	12
Module – 4			
Q.7	**(a)**	A point in a body is subjected to tensile stresses 100 Mpa and 70 Mpa along two mutually perpendicular directions. The point is also subjected to shear stress of magnitude 50Mpa. Determine i) Normal stress and shear stress acting on a plane which is at an angle of 120^o with reference to the 100 Mpa stress plane ii) Magnitudes of principal stresses and maximum and minimum shear stresses. iii) Orientations of principal planes and maximum and minimum shear stress planes. iv) Normal stress on the planes of maximum and minimum shear stresses.  Fig. Q7(a)	12
	(b)	Derive the equilibrium equation for the state of stress in three dimensions.	08
OR			

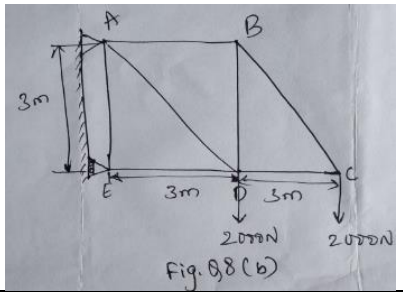
Q.8	**(a)**	Derive the strain displacement relationship.	12
	(b)	Determine the forces in all the members of the truss shown in fig.Q8(b)  Fig. Q8 (b)	08
		Module – 5	
Q.9	**(a)**	A column has an I section with equal flanges of 200 mm x 10 mm and web 300 mm x 10 mm. When the column is used as a simply supported beam with udl of 24 KN/m, maximum deflection at the centre is 6mm. Determine the safe load the column can carry for the following conditions i) one end is free and other end is fixed. ii) One end is fixed and other end is hinged. Take FOS as 2.5 and young's modulus as 210 Gpa.	10
	(b)	State and explain Castigliano's theorem and Maxwell's reciprocity theorem.	10
		OR	
Q.10	**(a)**	Derive the expression for strain energy stored in a body when the load is applied: i) Suddenly ii) Gradually iii) With impact	10
	(b)	A hollow CI column whose outside diameter is 200 mm has a thickness of 20mm. It is 4.5m long and is fixed at both ends. Calculate the safe load by rankine's formula using a FOS of 4. Calculate the slenderness ratio and the ratio of euler's and rankine's critical loads. Take f_c = 550 N/mm2, a = 1/1600 in rankine's formula and E = 9.4 x 10^4 N/mm^2.	10

Table showing the Bloom's Taxonomy Level, Course Outcome and Programme Outcome				
Question		**Bloom's Taxonomy Level attached**	**Course Outcome**	**Programme Outcome**
Q.1	(a)	L4	CO2	PO4
	(b)	L2	CO1	PO1
Q.2	(a)	L5	CO2	PO5
	(b)	L2	CO1	PO2
Q.3	(a)	L3	CO3	PO11
	(b)	L2	CO2	PO10
Q.4	(a)	L6	CO3	PO6
	(b)	L3	CO2	PO9
Q.5	(a)	L2	CO1	PO6
	(b)	L6	CO3	PO5
Q.6	(a)	L2	CO1	PO1
	(b)	L3	CO3	PO7
Q.7	(a)	L5	CO2	PO4
	(b)	L4	CO1	PO2
Q.8	(a)	L4	CO2	PO3
	(b)	L6	CO1	PO4
Q.9	(a)	L5	CO2	PO3
	(b)	L2	CO3	PO6
Q.10	(a)	L3	CO2	PO10
	(b)	L4	CO3	PO5

Bloom's Taxonomy Levels	**Lower order thinking skills**		
	Remembering(knowledge):L_1	Understanding Comprehension): L_2	Applying (Application): L_3
	Higher order thinking skills		
	Analyzing (Analysis): L_4	Valuating (Evaluation): L_5	Creating (Synthesis): L_6

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Fifth Semester B.E. Degree Examination

AIRCRAFT STRUCTURES-I

TIME: 03 Hours **Max. Marks: 100**

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.

		Module – 1	
Q.1	**(a)**	Explain the following. (i) Normal Stress (ii) Stress Tensor (iii) True Stress (iv) Principal Planes (v) Factor of Safety	10
	(b)	Write a short note on Indian Standard Designation of Low, Medium and High Alloy Steels.	10
		OR	
Q.2	**(a)**	A mild steel shaft of 50mm diameter is subjected to a bending moment of 2000 N-m and a torque T. If the yield point of the steel in tension is 200 MPa, find the maximum value of this torque without causing yielding of the according to the (i) Maximum Principal Stress (ii) Maximum Shear Stress (iii) Maximum Distortion Strain Energy Theory.	10
	(b)	Why Failure Theory is important for Aircraft Structures? Explain all the Theories of Failures.	10
		Module – 2	
Q.3	**(a)**	Define Fatigue. Explain the importance of Fatigue Strength in detail.	08
	(b)	Draw and Explain S-N Curve in detail.	08
	(c)	Define Impact Strength the Endurance Limit.	04
		OR	
Q.4	**(a)**	Illustrate the Goodman and Soderberg relationship and explain with relevant Equation.	10
	(b)	Explain stresses due to combined loading and cumulative fatigue damage in detail.	10
		Module – 3	
Q.5	**(a)**	Draw and Explain the structural nomenclature of Aircraft Wing and Fuselage.	10
	(b)	An aircraft having a total weight of 45kN lands on the deck of an aircraft carrier and is brought to rest by means of a cable engaged by an arrester hook as shown in the Figure 5. If the deceleration induced by the cable is 3g, determine the tension, T, in the cable, the load on an undercarriage strut, and the shear and axial loads in the fuselage at the section A-A; the weight of the aircraft aft of AA is 4.5kN. Calculate also the length of deck covered by the aircraft before it is brought to rest if the touch-down speed is 25 m/s.	10

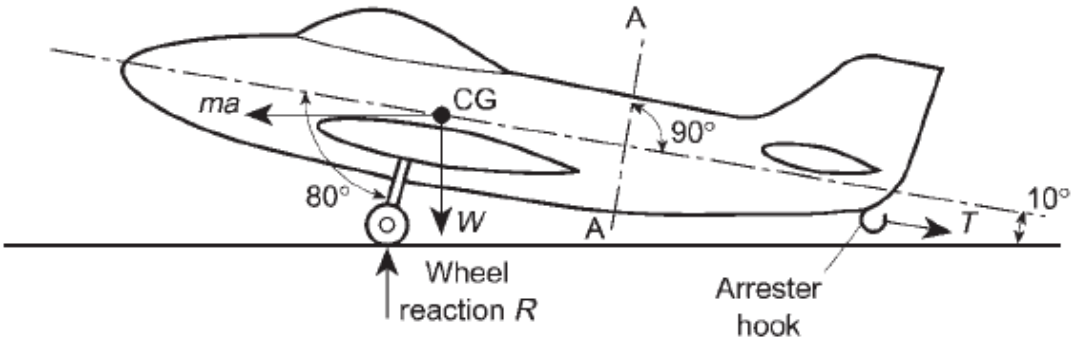
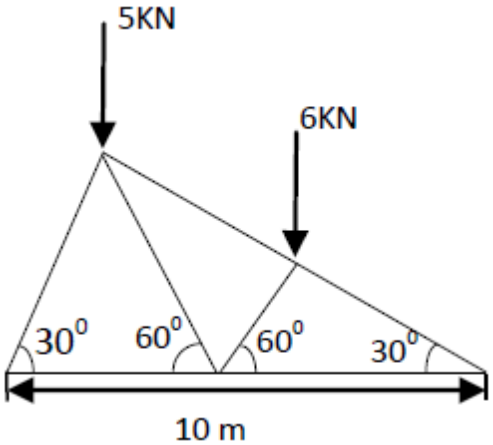


Fig 5.

		OR	
Q.6	**(a)**	With neat sketch explain Flight Envelope in detail.	10
	(b)	What are desirable properties for selecting the materials for Aircraft application	10
		Module – 4	
Q.7	**(a)**	Derive the equations of equilibrium	10
	(b)	A plane element in a boiler is subjected to tensile stresses of 400 MPa on one plane and 150 MPa on the other at right angles to the former. Each of the above stresses is accompanied by a shear stress of 100 MPa such that when associated with the minor tensile stress tends to rotate the element in anticlockwise direction. Find (i) Principal Stresses and their directions. (ii) Maximum shearing stresses and the directions of the planes on which they act.	10
		OR	
Q.8	**(a)**	Derive the Clapeyron's Theorem of three moments.	10
	(b)	A truss of span 10 meters is loaded as shown in Figure 8. Find the forces in all the members of the truss.  Fig 8.	10
		Module – 5	
Q.9	**(a)**	Derive Castigliano's theorem.	10
	(b)	State and Explain the Maxwell's Reciprocal theorem	10
		OR	
Q.10	**(a)**	Draw and explain South-Well Plot.	8
	(b)	Find the Euler's Crippling Load for a hollow cylindrical steel column of 38mm external diameter and 2.5mm thick. Take length of the column as 2.3m and hinged at its both ends. Take E=205 GPa. Also, determine crippling load by Rankine's formula using constants as 335 MPa and 1/7500.	12

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Q.1	(a)	L1	CO1	PO1
	(b)	L2	CO1	PO6,PO7
Q.2	(a)	L3,L4	CO1	PO3,PO4
	(b)	L2,L3	CO1	PO2,PO4
Q.3	(a)	L2,L4	CO2	PO4,PO5
	(b)	L2,L4	CO2	PO4,PO5
	(c)	L2	CO2	PO1,PO3
Q.4	(a)	L3,L4	CO2	PO2,PO4,PO6
	(b)	L2,L4	CO2	PO2,PO4
Q.5	(a)	L2,L3	CO1, CO3	PO2,PO3
	(b)	L4,L5	CO3	PO4,PO5
Q.6	(a)	L2,L3	CO1,CO2	PO2,PO3
	(b)	L2,L3	CO3	PO2,PO7
Q.7	(a)	L2,L3	CO1,CO2	PO1,PO3
	(b)	L2,L5	CO1,CO2	PO3,PO4
Q.8	(a)	L3,L4	CO1,CO2	PO3,PO4
	(b)	L4,L5	CO1,CO2	PO3,PO5
Q.9	(a)	L4,L5	CO1,CO2	PO3,PO5
	(b)	L4,L5	CO1,CO2	PO3,PO5
Q.10	(a)	L4,L5	CO1,CO2	PO1,PO2
	(b)	L3,L4	CO2	PO3,PO4,PO6

Bloom's Taxonomy Levels	**Lower order thinking skills**		
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	Higher order thinking skills		
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