U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme : B.E. **Semester: VII**

Branch : Aerospace Engineering **Duration: 3 hrs.**

Course Code : 22AS7PCACD **Max Marks: 100**

Course : Aircraft Design

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)	What are the different stages in aircraft design? Explain the various studies and calculations carried out and performed in each stage.		CO1	PO 1,2	**10**
	b)	The empty mass fraction of an aircraft is 0.52, Fuel mass fraction is 0.35 and maximum take-off weight is 80900 kg. calculate the pay load in Kg if the crew mass is 517 Kg.		CO1	PO 1,2, 3	**10**
		OR				
2	a)	With the help of neat sketch, describe the design wheel in conceptualizing and modifying the aircraft design.		CO1	PO 1,2	**10**
	b)	Describe the steps for the aircraft gross weight estimation.		CO1	PO 1,2	**10**
		UNIT - II				
3	a)	Explain the impact of airfoil geometry on aircraft performance.		CO2	PO 1,2	**7**
	b)	Describe the NACA 4 and 5 digit numbering system		CO2	PO 1,2	**8**
	c)	Illustrate the effect of Reynolds number on airfoil performance.		CO2	PO 1,2	**5**
		OR				
4	a)	Illustrate conventional tail and T-tail configuration and explain the characteristics of each one with merits and demerits.		CO2	PO 1,2	**10**
	b)	Compare merits and demerits between high wing and low wing configuration.		CO2	PO 1,2	**10**
		UNIT - III				
5	a)	Define thrust to weight ratio and explain the selection process of wing loading for a passenger aircraft for every mission segments.		CO3	PO 1,2	**15**
	b)	Describe thrust matching.		CO3	PO 1,2	**5**

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			OR			
	6	a)	A propeller aircraft having the following design data W= 50,000 N, V_{TO} = 1.2 Vstall, η_p = 75% Power = 2500 BHP/engine, No. of Engines: 02 C_{Lmax} = 2.4 For 1000 meter takeoff distance, Take off Parameter = 120. Determine the wing loading required for take-off at sea-level in a standard atmosphere.	CO3	PO 1,2,3	**10**
		b)	(i) Explain the effect of wing loading on take-off performance. (ii) Describe the expression of wing loading based on stall velocity.	CO3	PO 1,2	**10**
			UNIT - IV			
	7	a)	An unmanned aerial vehicle (UAV) is being designed with the following specifications: Payload weight = 15 kg Maximum take-off weight (MTOW) = 35 kg Wing area (S) = 12 m² Wing span (b) = 8 m Fuselage length = 4 m Tail volume coefficient (V_T) = 0.12 Determine the horizontal tail surface area and control surface area.	CO4	PO 1,2	**10**
		b)	Write a short note on conic lofting. Describe conic shape parameter.	CO4	PO 1,2	**10**
			OR			
	8	a)	Explain the process of wetted area determination in aircraft design and the effect of wetted area on aerodynamic drag and overall aircraft performance.	CO4	PO 1,2	**15**
		b)	Explain the importance of control surface sizing in aircraft design.	CO4	PO 1,2	**5**
			UNIT - V			
	9	a)	Describe any five propulsion systems which are used in aircraft industry.	CO4	PO 1,2	**15**
		b)	Explain the thrust-drag book keeping concept in aircraft performance analysis.	CO4	PO 1,2	**5**
			OR			
	10	a)	Explain how maneuver loads, gust loads, and air loads on lifting surfaces contribute to structural design considerations.	CO4	PO 1,2	**15**
		b)	Explain the concept of installed thrust methodology.	CO4	PO 1,2	**5**

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