U.S.N.										

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

Autonomous Institute Affiliated to VTU

January / February 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)		Describe three phases of Aircraft design. Describe the requirements and constraints for aircraft design.	CO1	PO1	**10**
	b)		Describe the steps for the gross weight estimation using the block diagram.	CO1	PO1	**10**
			OR			
2	a)		Describe the expression of range for propeller-driven aircraft. Prove that, the maximum range will be achieved at (Cl/Cd)max.	CO1	PO2	**10**
	b)		Describe the expression of range for jet-driven aircraft.	CO1	PO2	**10**
			UNIT - II			
3	a)		Describe the desirable characteristics of an airfoil in aircraft design, highlighting the advantages and consequences of incorporating high camber.	CO2	PO1	**10**
	b)		Describe the laminar bucket and the disadvantages of laminar airfoils, along with the geometry and advantages of supercritical airfoils.	CO2	PO1	**10**
			OR			
4	a)		Describe how airfoil thickness to chord ratio affects the aircraft design. Briefly explain “Fat” airfoil, “thinner” airfoil, and “very thin” airfoil.	CO2	PO1	**10**
	b)		Write down the advantages and undesirable consequences associated with (i) a higher wing aspect ratio and (ii) a higher wing sweep.	CO2	PO1	**10**
			UNIT - III			
5	a)		“Wing loading and thrust-to-weight ratio are closely interconnected for most performance calculations”- Justify the statement with appropriate example	CO3	PO2	**10**
	b)		What do you understand by power loading and thrust loading? Derive the expression to relate power loading with thrust loading.	CO3	PO2	**10**
			OR			

	6	a)	What do you mean by wing loading? Derive the expression for the wing loading for maximum endurance of jet-driven aircraft.	CO3	PO2	**10**
		b)	Write down the advantages and disadvantages associated with a higher thrust-to-weight ratio. Derive the expression for the wing loading for maximum endurance of propeller-driven aircraft.	CO3	PO2	**10**
			UNIT - IV			
	7	a)	Write short notes on (i) fixed size engine and (ii) rubber engine.	CO4	PO1	**10**
		b)	Consider designing an aircraft that executes a normal mission profile consisting of takeoff, climb, cruise, and land. Describe the aircraft size estimation procedure with the help of an equation and block diagram when there is a provision of payload drop at some point during the cruise operation.	CO4	PO1	**10**
			OR			
	8	a)	Demonstrate the procedure for estimating the takeoff gross aircraft weight for the fixed engine when no negotiation is allowed in aircraft performance.	CO4	PO1	**10**
		b)	Based on the initial estimate of takeoff gross weight, demonstrate the aircraft wing, tail, fuselage, and control-surface sizing procedures. Mention all the important parameters you must concentrate on while calculating geometric sizing.	CO4	PO1	**10**
			UNIT - V			
	9	a)	Describe two major aerodynamic forces that you must concentrate on for aircraft design.	CO4	PO1	**10**
		b)	Explain the need for thrust-drag bookkeeping in aircraft design and briefly describe the installed thrust methodology.	CO4	PO1	**10**
			OR			
	10	a)	Write short notes on (i) maneuver loads, and (ii) gust loads. Use the appropriate diagrams to describe both the loads.	CO4	PO1	**10**
		b)	Describe air loads on the lifting surface and air loads due to control deflections.	CO4	PO1	**10**

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