Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII EXAMINATION – SUMMER 2025

Subject Code:3170110 Date:16-05-2025

Subject Name:Introduction to Aeroelasticity

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Define aero elasticity. What are the primary factors that contribute to aero elastic problems?	**03**
	(b)	Explain the distinction between static and dynamic aero elasticity.	**04**
	(c)	Explain the energy method in the context of aero elastic problems.	**07**
Q.2	**(a)**	Explain Wing Loading and its Significance in Aero elastic Deformations.	**03**
	(b)	Describe the one-dimensional aero elastic model of aerofoils.	**04**
	(c)	Explain the geometry of a typical aerofoil section using a drawing and the relevant equation.	**07**
		OR	
	(c)	Explain the Divergence Phenomenon in 2-D Aerofoils and Straight Wings.	**07**
Q.3	**(a)**	What is the impact of swept wing designs on aero elastic behaviour?	**03**
	(b)	What is Control Effectiveness in Aero elasticity?	**04**
	(c)	How does aileron reversal occur, and what are the possible methods to mitigate its effects on aircraft control?	**07**
		OR	
Q.3	**(a)**	Define flutter in the context of aero elasticity.	**03**
	(b)	What is the role of damping in controlling flutter in dynamic aero elastic systems?	**04**
	(c)	Describe the dynamic/flutter model of a 2-D aerofoil in detail.	**07**
Q.4	**(a)**	Briefly describe the behavior of 2-D supersonic flow.	**03**
	(b)	What is unsteady aerodynamics, and how does it differ from steady aerodynamics?	**04**
	(c)	Explain the kernel function approach for subsonic flow and how it helps in solving complex aerodynamic problems.	**07**
		OR	
Q.4	**(a)**	What is a finite state model in unsteady aerodynamics, and why is it important?	**03**
	(b)	What is the Theodorsen theory in the context of unsteady aerodynamics?	**04**
	(c)	How does the 2-D and 3-D supersonic flow dimensionality affect the analysis and design of high-speed aircraft?	**07**
Q.5	**(a)**	Define 3-D Supersonic flow	**03**
	(b)	Explain the U-g method for flutter calculation and its basic application.	**04**
	(c)	Discuss finite state model significance in predicting the dynamic response of aircraft structures.	**07**
		OR	
Q.5	**(a)**	What is the assumed mode method in flutter analysis?	**03**
	(b)	Briefly describe the P-k method and its role in flutter analysis.	**04**
	(c)	Explain the exact treatment of bending-torsion flutter in a uniform wing. How is this analysis crucial for determining the wing's flutter speed?	**07**

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