GUJARAT TECHNOLOGICAL UNIVERSITY
Bachelor of Engineering - SEMESTER - VII EXAMINATION - WINTER 2025

Subject Code: 3170110   **Date: 20-11-2025**

Subject Name: **Introduction to Aeroelasticity**

Time: 10:30 AM TO 01:00 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 aeroelasticity and explain the interaction of aerodynamic, elastic, and inertial forces.	**03**
	(b)	What are the major types of aeroelastic problems? Briefly describe each with examples.	**04**
	(c)	Explain the steps involved in analyzing a simple aeroelastic problem using the energy method.	**07**
Q.2	**(a)**	What is aileron reversal? Explain briefly.	**03**
	(b)	Describe the effect of wing sweep on static aeroelastic behavior.	**04**
	(c)	Derive the divergence speed for a 2D straight wing using a simplified model.	**07**
		OR	
	(c)	Explain the concept of control effectiveness and how it is affected by aeroelasticity.	**07**
Q.3	**(a)**	Define flutter in the context of aeroelasticity.	**03**
	(b)	Explain the concept of the dynamic aeroelastic model for a 2D airfoil.	**04**
	(c)	Derive the equations of motion for a 2D airfoil under dynamic aeroelastic forces.	**07**
		OR	
	(a)	List factors affecting dynamic aeroelastic stability.	**03**
	(b)	Describe the role of structural damping in dynamic aeroelasticity.	**04**
	(c)	Explain the procedure for flutter analysis using assumed mode method.	**07**
Q.4	**(a)**	Define unsteady aerodynamics.	**03**
	(b)	Explain how unsteady aerodynamic forces affect dynamic stability.	**04**
	(c)	Explain supersonic unsteady flow for a 2D airfoil and its effect on flutter.	**07**
		OR	
	(a)	List assumptions of Theodorsen theory.	**03**
	(b)	Describe the finite state model in unsteady aerodynamics.	**04**

(c)	Apply kernel function approach to calculate aerodynamic forces on a thin airfoil in subsonic flow.	**07**
Q.5 (a)	Differentiate between static divergence and flutter.	**03**
(b)	Describe flutter analysis using assumed mode method.	**04**
(c)	Compare U-g method and P-k method for flutter prediction.	**07**

<div align="center">**OR**</div>

(a)	What is the U-g method?	**03**
(b)	Explain the significance of exact treatment in flutter analysis.	**04**
(c)	Determine the flutter frequency and speed using assumed mode method for a given wing.	**07**

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