UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2021

Course: Aero-Elasticity   **Semester: VIII**
Program: B.Tech ASE   **Time 03 hrs.**
Course Code: ASEG 4010   **Max. Marks: 100**
Note: Section A and B is compulsory. Attempt any **ONE** Questions from Section-C. Assume any **MISSING** data accordingly. Brief and to the point, answers are expected.

	SECTION A (30 Marks)		
S. No.		**Marks**	**CO**

Q 1	1A: In which type of vibrations, amplitude of vibration goes on decreasing every cycle?
	   (a) Damped vibrations (b) Undamped vibrations (c) Both a. and b
	   (d)None of the above
	
	 1B: Longitudinal vibrations are said to occur when the particles of a body moves
	   (a) perpendicular to its axis (b) parallel to its axis
	   (c) in a circle about its axis (d) none of the mentioned
	
	 1C: Frequency of vibrations is usually expressed in
	   (a) Number of cycles per hour (b) Number of cycles per minute
	   (c) Number of cycles per second (d) Millimeters
	
	 1D: What is the effect of a rotating mass of a shaft on a system?
	   (a)Bend the shaft (b)Twist the shaft (c)Extend the shaft (d)Compress the shaft
	
	 1E: What is meant by coupled differential equation?
	   (a) The differential equation in which only rectilinear motions exit
	   (b) The differential equation in which only angular motions exit
	   (c) The differential equation in which both rectilinear and angular motions exit
	   (d) The differential equation in which both rectilinear and angular motions not exit.
		5	**CO1**

Q 2	2A: Control effectiveness is the inability of a control surface such as an aileron or a rudder to produce aerodynamic forces and moments to control airplane orientation and maneuver along a flight path. (TRUE/FALSE) 2B: Sweeping back a wing or a tail surface exacerbates the control reversal problem created by torsional flexibility. (TRUE/FALSE).	**5**	**CO4**

	2C: Aero-elastic phenomena such as aileron reversal have been exploited to create actively controlled, light-weight structures.(TRUE/FALSE) 2D: Aero-elastic interactions not impact airplane loads and influence flight performance in primary areas (TRUE/FALSE). 2E: Flutter is not forced resonant response (TRUE/FALSE)		
Q 3	3A: Efficient wing and tail surface structural design permits substantial structural ------ ------ and ----------- deformation during flight. 3B: Wing twist produces changes in ---------------. 3C: One common limit cycle flutter with one degree of freedom is ---------------. 3D: At speeds above the ----------, aileron produces a roll rate, but in the opposite direction to that intended. 3E: The Aero-elastic problem -------------------- may be alleviated by proper positioning of the tailplane and clean aerodynamic design.	5	CO2
Q 4	What is vibration? List its 5 main causes of vibration and methods to prevent them?	5	CO1
Q 5	5A: What is meant by degree of freedom. [1 Marks] 5B: What do you know about resonance. [2 Marks] 5C: Define the term Elastic axis? [2 Marks]	5	CO1
Q 6	6A: What do mean by aero-elastic instability. [2 Marks] 6B: What is the difference between classical and non-classical flutter. [3 Marks]	5	CO3
SECTION B (5 x 10 = 50 Marks)			
Q 7	7A: Define aero-elasticity and explain its broad divisions. [5 Marks] 7B: Explain Collars Aero-Elastic triangle. [5 Marks]	10	CO2
Q 8	8A: Distinguish between resonance and flutter. [4 Marks] 8B: Briefly discuss the different methods of flutter prevention. [6 Marks]	10	CO3
Q 9	9A: What is Buffeting? How do you avoid tail plane buffeting? [5 Marks]	10	CO4

	9B: What do you mean by Classical Flutter, Stall Flutter and Aileron buzz? Also, explain how to prevent the Aileron Buzz. [5 Marks		
Q 10	What are Inertial coupling, Aerodynamic coupling and Elastic coupling? How can you overcome these problem in aero-structures?	**10**	**CO3**
Q 11	Consider a 2-d wing with aileron attached. Derive and obtain an expression for the aileron control reversal speed.	**10**	**CO4**
	Section – C (20 Marks)		
Q12	Explain the cause/failure due to Aero-Elastic effect of any ONE of the following (use any one picture given below). Also, Mention the effects of failure and methods to reduce the effects. TACOMA NAROW BRIDGE **OR** **1964 Savage Mountain B-52 crash**	**20**	**CO5**