Register Number:……..

KUMARAGURU
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B.E DEGREE EXAMINATIONS: NOV/ DEC 2023

(Regulation 2018)

Sixth Semester

AERONAUTICAL ENGINEERING

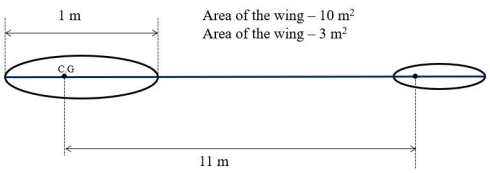
U18AET6001: Flight Dynamics

COURSE OUTCOMES

CO1: Calculate atmospheric properties at various altitudes
CO2: Calculate the performance of an airplane for non-accelerating flight conditions
CO3: Solve accelerated performance equations to get Take-off and landing distances.
CO4: Estimate Longitudinal static stability and trim requirements for an aircraft.
CO5: Assess lateral and directional stability requirements for an aircraft

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-
PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1.	Calculate the temperature at 10 km in the International standard atmosphere.	CO1	[K_3]
2.	Define Equivalent airspeed and give its relation with true airspeed.	CO1	[K_2]
3.	Estimate the $\left(\frac{L}{D}\right)_{max}$ of an aircraft with the drag polar $C_D = 0.015 + 0.08\ C_L^2$.	CO2	[K_3]
4.	Calculate the maximum Range covered over the ground for an aircraft which is at an altitude of 9100m starts gliding and its drag polar of given by $C_D = 0.015 + 0.08\ C_L^2$.	CO2	[K_3]
5.	Explain the significance of Decision speed during Take-off	CO3	[K_1]
6.	State the various ways of decreasing the Landing distance for an aircraft.	CO3	[K_2]
7.	 Calculate the Tail volume ratio for the above configuration.	CO4	[K_3]
8.	State the significance of Neutral point in an aircraft	CO4	[K_2]
9.	Explain the difference between Yaw and Sideslip angle in brief	CO5	[K_1]
10.	State the most stable and an unstable wing configuration in Lateral stability	CO5	[K_2]

Answer any FIVE Questions:-
PART B (5 x 4 = 20 Marks)
(Answer not more than 80 words)

11.	Calculate the Minimum Thrust required and Velocity at minimum drag for an aircraft	CO2	[K_3]

weighing 39420 kg with a planform area of 88m^2 with a drag polar 0.017 + 0.08 C_L^2 flying at sea level condition ρ = 1.2256 kg/m^3.

12.	Calculate the aircraft's climb velocity, if the Rate of climb is 15 m/s and horizontal velocity of the aircraft is 80 m/s.		CO2	[K_3]
13.	Explain V-n diagram in brief with a neat sketch.		CO3	[K_1]
14.	Calculate the load factor experienced by the aircraft, if it is rolled to an angle of 50 degrees. Also calculate the Turn radius taken by the aircraft if the velocity is 100 m/s.		CO3	[K_3]
15.	Calculate the moment coefficient about the center of gravity and also assess the longitudinal stability or a given wing alone configuration with its aerodynamic center lies 0.05 chord length ahead of the center of gravity. The moment coefficient about the aerodynamic center is −0.016 and the lift coefficient is 0.45		CO4	[K_3]
16.	Explain how position of the wing on the fuselage affects the Lateral stability.		CO5	[K_2]

Answer any FIVE Questions:-
PART C (5 x 12 = 60 Marks)
(Answer not more than 300 words)

17.	a)	Derive the equation of motion of a rigid flight vehicle with six degrees of freedom and also simplify it for the steady level flight conditions with proper assumptions stated	12	CO1	[K_4]
18.		Prove that, in straight and level flight show that the velocity corresponding to minimum power condition is 0.76 times the velocity corresponding to minimum thrust required condition	12	CO2	[K_2]
19.		Calculate $\left(\frac{C_L^{\frac{3}{2}}}{C_D}\right)_{max}$, $\left(\frac{C_L^{\frac{1}{2}}}{C_D}\right)_{max}$, Velocity at minimum Drag V_{mD} for an aircraft with a drag polar 0.015 + 0.08 C_L^2 , Weight = 39500 kg and wing planform area of 60 m^2 flying at sea level conditions.	12	CO2	[K_3]
20.	a)	Calculate the Take-off distance for an aircraft at sea-level conditions with the a wing-loading of 3679 N/m^2 and a constant thrust of 132 kN. Maximum lift coefficient of 2.7 with a weight of 36500 kg.	6	CO3	[K_3]
	b)	Derive the Turn radius and Angular rate expression for a pull up and pull down maneuvers	6	CO3	[K_3]
21.	a)	Explain the significance of static margin and Derive the expression for Neutral point and the static margin for a wing plus tail configuration.	12	CO4	[K_2]
22.	a)	Explain Dutch roll , spiral divergence and Directional divergence in detail	6	CO5	[K_2]
	b)	Explain the contribution of swept back wing towards directional stability	6	CO5	[K_2]

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