Register Number:……..

KUMARAGURU college of technology
character is life

B.E/B.TECH DEGREE EXAMINATIONS: APRIL /MAY 2024

(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.	Explain how the induced drag is reduced in an aircraft.	CO1	[K_2]
2.	Define Calibrated airspeed.	CO1	[K_L]
3.	Calculate the power available for an aircraft with the power required as 2000 Watts and R/C as 12 m/s and weight of the aircraft as 25000 N.	CO2	[K_3]
4.	Calculate the minimum drag coefficient C_{Dmin} for an aircraft with a drag polar $0.03 + 0.06\ C_L^2$.	CO2	[K_3]
5.	Define maneuvering point in a V-n diagram.	CO3	[K_1]
6.	Calculate the load factor induced on an aircraft during a level turn taken at 55 degrees of roll angle.	CO3	[K_3]
7.	Define static margin.	CO4	[K_1]
8.	Define Elevator control effectiveness.	CO4	[K_1]
9.	State the purpose of Dorsal fin.	CO5	[K_1]
10.	State the purpose of Anhedral angle in an aircraft.	CO5	[K_1]

Answer any FIVE Questions:-

PART B (5 x 4 = 20 Marks) (Answer not more than 80 words)

11.	Calculate the temperature at 10 km altitude in International standard atmosphere	CO1	[K_3]
12.	Calculate the Range and minimum glide angle during glide of an aircraft starts at an altitude of 6000m and a (L/D)max of 15.	CO2	[K_3]

13.		Derive the expression for Radius and Angular rate for a typical pull up maneuver.		CO3	[K1]
14.		Calculate the moment coefficient about the center of gravity for a given wing alone configuration, the aerodynamic center lies 0.05 chord length ahead of the center of gravity. The moment coefficient about the aerodynamic center is −0.016. If the lift coefficient is 0.45,. Also assess the longitudinal stability of this configuration.		CO4	[K3]
15.		Explain how dihedral angle provides lateral stability with a neat vector diagram.		CO5	[K2]
16.		Calculate the Radius and Angular rate for an aircraft taking a level turn with a velocity of 100 m/s with a load factor of 2.		CO3	[K3]

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

17.		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	[K1]
18.	a)	Calculate the minimum power speed for a steady level flight with a weight of 25000 kg and wing area of 40 m^2 flying at an altitude with a density of 0.56 kg/m^3.Drag polar of the aircraft is $0.04+0.05\ C_L^2$.	6	CO2	[K3]
	b)	Derive the rate of climb expression from aircraft climb equation of motion.	6	CO2	[K2]
19.	a)	Discuss the significance of various velocity phase in a typical take off condition.	6	CO3	[K2]
	b)	Calculate the Take off distance needed for an aircraft with a wing loading of 6200 N/m^2 and a thrust to weight ratio of 0.2 at sea level conditions $\rho = 1.2256\ kg/m^3$ operating at a maximum lift coefficient of 1.4.	6	CO3	[K3]
20.	a)	Calculate the neutral point location for a typical wing plus tail combination with the normalized location of aerodynamic center of wing is 0.24 and a tail volume coefficient of 0.34, tail lift curve slope as 0.1 and wing lift curve slope as 0.08 and the downwash derivative $\frac{\partial \epsilon}{\partial \alpha} = 0.35$.	6	CO4	[K3]
	b)	$\delta_{trim} = \frac{C_{M,0} + (\partial C_{M,cg}/\partial \alpha_n)\alpha_n}{V_H(\partial C_{L,t}/\partial \delta_e)}$ Derive the above elevator angle to trim expression from longitudinal control.	6	CO4	[K2]
21.	a)	Explain Dutch roll, spiral divergence and Auto rotation in brief.	6	CO5	[K1]
	b)	Explain Adverse yaw and state the three methods to reduce adverse yaw.	6	CO5	[K2]
22.		Prove that, in straight and level flight, the velocity corresponding to minimum power condition is 0.76 times the velocity corresponding to minimum thrust required condition.	12	CO3	[K2]

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