Name:

Enrolment No:

End Semester Examination, December 2023

Course: Flight Mechanics **Semester: V**

Program: B.Tech Aerospace Engineering **Time : 03 hrs.**

Course Code: ASEG3028 **Max. Marks: 100**

Instructions: Assume any missing DATA.

SECTION A
5Qx4M=20Marks

S. No.		Marks	CO
Q 1	Differentiate between gradient and isothermal layer of atmosphere.	**4**	**CO1**
Q 2	Compare different types of Drag forces acting on different parts of aircraft.	**4**	**CO2**
Q 3	Show that lift curve slope for high aspect ratio wing at compressible subsonic speed is given by $\frac{a_0}{\sqrt{1-M_\infty^2}+a_0/(\pi e_1 \mathrm{AR})}$ Where a_0 is 2-D lift curve slope	**4**	**CO3**
Q 4	Show that unpowered glide angle of aircraft depends on L/D ratio.	**4**	**CO4**
Q5	Show that Endurance of Jet Engine aircraft is given by $E = \frac{1}{c_t}\frac{C_L}{C_D}\ln\frac{W_0}{W_1}$ Where c_t SFC, W_0 initial Weight and W_1 final Weight of Aircraft.	**4**	**CO5**

SECTION B
4Qx10M= 40 Marks

Q6	Derive the relation between geopotential altitude (h) and geometric altitude (h_G).	**10**	**CO1**
Q7	Consider an aircraft that has a wing span of 14 m, a wing area of 35 m^2, and a gross weight of 90000 N. In level flight, the lift equals the weight. The aircraft is flying at 100 m/s. Also the Oswald efficiency factor is 0.85, and the zero-lift drag coefficient is 0.021. Determine the following: a) lift coefficient b) induced drag coefficient c) total drag coefficient d) induced drag (N)	**10**	**CO2**

	e) zero-lift drag (N) f) total drag (N)		
Q8	Show that turn radius of an aircraft during level turn is given by $$R = \frac{V^2}{g\sqrt{n^2 - 1}}$$	**10**	**CO3**
Q9	An airplane weighs 150000 N and has a wing area of 42 m^2. At a flight speed of 100 m/s the engine gives thrust of 27000 N. If the aircraft drag polar is $C_D = 0.014 + 0.05C_L^2$. Find the angle and rate of climb at sea level at 100 m/s flight speed.	**10**	**CO4**
SECTION-C **2Qx20M=40 Marks**			
Q10	Consider our executive jet, W = 45000 N, S =20 m^2, T = 9000 N and the parabolic drag polar is, $C_D = 0.016 + 0.065C_L^2$. a) Find the max angle of climb, and the climb rate under that condition b)find the max rate of climb, and the angle of climb under that flight condition.	**20**	**CO4**
Q11	An airplane weighing 15000 N is powered by a single piston engine delivering 130 HP. Its specific fuel consumption is 7.3×10^{-7} N/w.s, wing span b 10 m, wing area 16.2 m^2, $Cd_0 = 0.03$ e=0.95, prop eff. 0.85. If this airplane is loaded with 1450 N fuel weight, estimate maximum range and endurance. OR Consider an aircraft with the following properties: W/S = 292 kg/m^2, $W = 4500\ kg$, $S = 15m^2$, $C_{Lmax} = 1.5$, $\mathbf{n}_{max} = 6$, $C_D = 0.018 + 0.064\,C_L^2$, and T_{max} = 22000 N. Find the extreme turn rate and turn radius, and the speed at which they occur. Are these sustainable turn rates?	**20**	**CO5**