Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2022

Course: Flight Mechanics I **Semester: V**
Program: B.Tech ASE/ASE+AVE **Time : 03 hrs.**
Course Code: ASEG3001 **Max. Marks: 100**

Instructions: Assume any missing DATA appropriately.

SECTION A
5Qx4M=20Marks

S. No.		Marks	CO
Q 1	Differentiate between geopotential and geometric altitudes.	**4**	**CO1**
Q 2	How Induced Drag of aircraft can be minimized?	**4**	**CO2**
Q 3	An aircraft of mass 2500 kg in straight and level flight at a constant speed of 100 m/s has available excess power of 1.0×10^6 Watt, Calculate the steady rate of climb, it can attain at that speed.	**4**	**CO3**
Q 4	An aircraft is performing a coordinated turn at a bank angle of 30 deg and forward speed of 100 m/s. Assume g=9.81 m/s^2. Calculate *load factor* and *turn radius* of turn.	**4**	**CO4**
Q 5	Compare effect of altitude on Power available and Power required vs velocity graphs in steady level flight for *jet engine* and *propeller driven* aircrafts.	**4**	**CO5**

SECTION B
4Qx10M= 40 Marks

Q1	Derive expressions for P, T and ρ in gradient layer of atmosphere.	**10**	**CO1**
Q2	The altimeter on a low-speed airplane reads 2 km. The airspeed indicator reads 50 m/s. If the outside air temperature is 280 K and pressure is 79480 Pa, what is the true velocity of the airplane?	**10**	**CO2**
Q3	Compare *radius* (R) and *rate* (ω) during **pull-up** with **pull-down** maneuvers for civil and military aircrafts.	**10**	**CO3**
Q4	In steady level turning flight of an aircraft at a load factor n, show that the ratio of the horizontal component of lift and aircraft weight is given by $\sqrt{n^2-1}$	**10**	**CO4**

SECTION-C
2Qx20M=40 Marks

Q 1	Consider our executive jet, W = 45000 N, S = 20 m^2, T = 9000 N and the parabolic drag polar is, $C_D=0.02+0.05\ C_L^2$ Calculate the max angle of climb, and the climb rate under that condition, and find the max rate of climb, and the angle of climb under that flight condition.	**20**	**CO4**

Q2	Derive *Brequet Range and Endurance* formula for Propeller driven aircraft. OR An airplane weighing 13250 N is powered by piston engine delivering 230 HP. Its SFC is 7.3 $x10^{-7}$ N/w.s. Other parameters are wing span 11m, wing area 16 m^2 C_{D0}=0.025, e=0.8, prof eff. 0.85. Determine the fuel required to fly non-stop over a distance of 1850 km.	**20**	**CO5**