Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, December 2020

Course: Flight Mechanics I **Semester: V**
Program: B. Tech ASE/ASE+AVE **Time 03 hrs.**
Course Code: ASEG 3001 **Max. Marks: 100**

Instructions: a) All questions are compulsory.
b) Assume any suitable value for the missing data

SECTION A

S. No.		Marks	CO
Q 1	Calculate pressure, temperature, density of the air at geopotential altitude of 18 kms. Assume sea level conditions at 0 km.	**5**	**CO1**
Q2.	At sea level, the total drag of an aircraft of mass 6500 kg is 7.0 kN at a speed of 195 knots. Calculate the rate of climb and angle of climb at an indicated airspeed of 170 knots at 12000 ft, if the power available is 980 kW and the relative air density is 0.859.	**5**	**CO4**
Q3	If an airplane is flying at an altitude where the actual temperature and pressure are 255.7K and 4.72×10^4 N/m^2, respectively. What are the pressure temperature and density altitudes?	**5**	**CO1**
Q4.	Lift to drag ratio of a glider is 14. If it is taken to an altitude of 3 km and released , its descent angle would be(in degrees)	**5**	**CO4**
Q5	i). A propeller driven aircraft takes off with 10% less fuel than usual. What happens to its range? **(3M)** a) Decreases by 10% b) Decreases by more than 10% c) Decreases by less than 10% d) Data is insufficient ii). What happens to the range if the aircraft in above question was a jet aircraft? **(2M)** a) Decreases by 10% b) Decreases by more than 10% c) Decreases by less than 10% d) Data is insufficient	**5**	**CO4**
Q6	State the need of using “Standard Atmosphere” in flight mechanics.	**5**	**CO1**

SECTION B

Q 7	Consider an airplane patterned after the twin-engine Beechcraft Queen Air executive transport. The airplane weight is 38,220 N, wing area is 27.3 m^2, aspect ratio is 7.5, Oswald efficiency factor is 0.9, and parasite drag coefficient $C_{D,o}$ = 0.04. Calculate the thrust required to fly at a velocity of 340 km/h at (a) standard sea level and (b) an altitude of 6 km.	**10**	**CO3**
Q8.	Liftoff distance for a given aircraft of weight W is S_{Lo}. If the takeoff weight is reduced by 10%, calculate the magnitude of percentage change in the lift off distance.	**10**	**CO5**
Q9.	Explain about delta wing aerodynamics in subsonic and supersonic speeds respectively. **OR** Justify the use of sweptback wings in passenger aircrafts over rectangular wing. Also, discuss the effect of aspect ratio, wing twist, wing planform and taper ratio on aerodynamic characteristics of a subsonic aircraft.	**10** **10**	**CO2**
Q10.	Derive the equation of motion for a climbing and accelerated flight. In addition, simplify it for steady and level flight condition. Use the appropriate diagram.	**10**	**CO4**
Q11.	Lift-off distance is very sensitive to the weight of the airplane, varying directly as W^2. Justify the statement by deriving the Lift off distance expression.	**10**	**CO5**
SECTION-C			
Q12	Consider an airplane patterned after the Fairchild Republic A-10, a twin-jet attack aircraft. The airplane has the following characteristics: wing area = 47 m, aspect ratio = 6.5, Oswald efficiency factor = 0.87, weight = 103.047 N. and parasite drag coefficient = 0.032. The airplane is equipped with two jet engines with 40,298 N of static thrusts each at sea level. Assume a paved runway also, during the ground roll, the angle of attack is restricted by the requirement that the tail not drag the ground. Hence, assume C_{Lmax} during the ground roll is limited to 0.8. Also, when the airplane is on the ground, the wings are 5 ft above the ground. Estimate the sea-level lift-off distance for the airplane. **OR** An airplane weighing 13250N is powered by a single piston engine delivering 230 BHP at all altitudes. Its SFC is 0.2kg/ (hp-h). Other parameters of interest are wing span b= 11 m, wing area S=16.2 m^2, C_{Do} =0.025, e= 0.8, propeller efficiency =0.85. If this airplane is required to fly nonstop over a distance of 1850km, determine the fuel load to be carried for this case.	**20**	**CO5**