Name:	
Enrolment No:	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, April – May, 22

Course: Aerodynamics – I | **Semester: IV**
Program: B.Tech, ASE/ASE+AVE | **Time 03 hrs.**
Course Code: ASEG 2002 | **Max. Marks: 100**

SECTION A

S. No.		Marks	CO
Q1.	In low-speed, incompressible flow, the following experimental data are obtained for an airfoil section at an angle of attack of 4°: $c_l = 0.85$ and $c_{m,c/4} = -0.09$. Calculate the location of the center of pressure.	**4**	**CO1**
Q2.	Explain the physical meaning of divergence of velocity.	**4**	**CO2**
Q3.	Prove that the streamlines and equipotential lines are always perpendicular to each other.	**4**	**CO3**
Q4.	Discuss Kelvin's circulation theorem and hence explain the reason for generation of lift.	**4**	**CO4**
Q5.	Explain the phenomenon of formation flying and ground effect.	**4**	**CO5**

SECTION B

S. No.		Marks	CO
Q6.	Explain different types of drag an aircraft experiences during its flight.	**10**	**CO1**
Q7	Apply Newton's second law of motion on a fixed finite control volume and hence derive momentum eqaution.	**10**	**CO2**
Q8	Explain the concept of pathline, streamline and streakline. Consider a velocity field where the x and y components of velocity are given by u = cx and v = −cy, where c is a constant. Obtain the equations of the streamlines.	**10**	**CO2**
Q9	Derive the fundamental equation of Prandtl's lifting line theory.	**10**	**CO5**

SECTION-C

S. No.		Marks	CO
Q 10	Derive stream function for uniform, source and sink flow. Superimpose these elementary flow to model flow over rankine oval and hence find out following for the resulting flow: i. Radial and tangential velocities ii. Location of stagnation point iii. Equation of streamline passing through stagnation point. **OR** Generate mathematical model for lifting flow over circular cylinder by superimposing elementary flows. Find out following for the resulting flow: i. Stream function and velocity potential function ii. Radial and tangential velocities iii. Location of stagnation point	**20**	**CO3**
Q 11	The equation of mean camber line of an airfoil is given as: $\frac{z}{c} = 0.25\left[0.8\left(\frac{x}{c}\right)-\left(\frac{x}{c}\right)^2\right]$ for $0<\left(\frac{x}{c}\right)<0.4$ $\frac{z}{c} = 0.11\left[0.2+0.8\left(\frac{x}{c}\right)-\left(\frac{x}{c}\right)^2\right]$ for $0.4<\left(\frac{x}{c}\right)<1$ Apply thin airfoil theory to estimate following: i. $\alpha_{L=0}$ ii. c_l at $\alpha = 3^0$	**20**	**CO4**