UPES

End Semester Examination, May, 2018

Roll No: ----------

Program Name: B.Tech ASE, ASE+AVE **Semester –IV**
Course Name : Aerodynamics-I **Max. Marks : 100**
Course Code : ASEG 211 **Duration : 3 Hrs**
No. of page/s:04

Instructions: Make use of *sketches/plots* to elaborate your answer. Brief and to the point answers are expected. **The Question paper has three sections: Section A, B and C, Section B and C have internal choices.**

	Section A (Attempt ALL questions) **5x4=20 Marks**	Marks	Course Outcomes
Q1.	Distinguish between Newtonian and Non-Newtonian Fluid.	**4**	**CO1**
Q2.	Define the term vorticity and circulation in two-dimensional flow and show how they are related to each other.	**4**	**CO2**
Q3.	Prove that in a two-dimensional, stream lines and equipotential lines intersect orthogonally.	**4**	**CO3**
Q4.	What do you understand by the term boundary layer: Illustrate with reference to flow over a flat plate.	**4**	**CO4**
Q5.	Explain the following a) Zone of action and b) Zone of Silence	**4**	**CO5**
	Section B (Attempt ALL questions) **(5 X 8 =40 Marks)**		
Q6.	a) Define Specific gravity and Specific Volume. b) 2 litre of petrol weighs 14 N. Calculate the specific weight, mass density, specific volume and specific gravity of petrol with respect to water.	**3** **5**	**CO1**
Q7.	An idealized flow is given by $\vec{V} = 2x^3 i - 3x^2 yj$ Is the flow Steady or unsteady? Is it two or three dimensional? Make calculation for the velocity, local acceleration and convective acceleration of a fluid particle in this flow field at point P(x,y,z) = (2,1,3).	**8**	**CO2**
Q8.	Derive the Navier –Stokes equations of motion. What are the assumptions made in arriving at Navier –Stokes equations.	**8**	**CO4**

Q9.	Bring out the concept of stagnation properties and derive expressions connecting stagnation to static properties in terms of Mach number (h_0 , T_0, P_0 , ρ_0 , **(or)** A sonic velocity air jet has a temperature of 280 K. Determine (i) velocity of sound in the jet (ii) stagnation temperature and stagnation enthalpy of the jet (iii) stagnation velocity of sound (iv) stagnation to static pressure ratio (v) maximum isentropic speed.	**8**	**CO5**
Q10.	Prove that in a doublet the stream lines are circles tangential to x-axis and equipotential lines are circle tangential to y-axis. **(or)** Obtain the flow pattern and expression for stream lines and velocity potential for a Rankine oval by superimposing source, sink and uniform flow.	**8**	**CO 3**
Section C (2 X 20M =40 Marks) (Attempt ALL questions)			
Q11.	Find the ratio of the displacement thickness to the momentum thickness for the velocity distribution in the boundary layer given by $$\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$$ Where u is the velocity at a vertical distance y from the solid surface. U is the free stream velocity distribution and δ is the boundary layer thickness. Also find the energy thickness in terms of δ. **Or** Based on the Von-Karman momentum equation, get expression for boundary layer thickness, wall shear stress and drag coefficient for the velocity profile prescribed by $$\frac{u}{U} = a + b\eta + c\eta^2 + d\eta^3$$ Where $\frac{u}{U}$ is the non-dimensional velocity and $\eta = \frac{y}{\delta}$ is the non-dimensional distance along the boundary layer.	**20**	**CO4**
Q12.	a) For an Isentropic Flow in passage of varying cross-section, derive the generalized relation for the velocity change in terms of the area change in a divergent duct. b) Explain how flow velocity change in the duct when i) the entry Mach number is subsonic and ii) when the entry Mach number is supersonic.	**10** **10**	**CO5**