Reg.No. _____

Karunya UNIVERSITY

(Karunya Institute of Technology & Sciences)
(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

End Semester Examination – April/May – 2017

Code : 14AE2006 **Duration : 3hrs**
Sub. Name : Aerodynamics **Max. marks : 100**

ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)

Q. No.	Sub Div.	Questions	Course Outcome	Marks
1.	a.	List down the major aerodynamic facilities available in Karunya university to test the airfoil.	2	3
	b.	Derive the three dimensional continuity equation for catesian coordinate system and explain its importance.	1	17
		(OR)		
2.	a.	State the first law of Thermodynamics and its importance.	1	4
	b.	Derive the three dimensional energy equation for catesian coordinate system and expand it to viscous terms.	1	16
3.	a.	Define Stream function and potential function and prove that steamlines and potential lines perpendicular to each other.	1	5
	b.	Explain and derive the stream function, potential function of doublet flow.	1	15
		(OR)		
4.	a.	Consider the velocity field given by $u = -\frac{y}{(x^2+y^2)}$ and $= \frac{x}{(x^2+y^2)}$. Calculate the equation of the streamline passing through point (0,5).	1	5
	b.	Explain and derive the stream function, potential function for Rankine Full Body problem.	2	15
5.	a.	State and derive the Kutta –Joukowski Theorem.	1	5
	b.	Consider an NACA 2412 airfoil with a chord of 0.64m in an airstream at standard sea level conditions. The freestream velocity is 70 m/s. The lift per unit span is 1254 N/m. Calculate the lift coefficient and drag per unit span. Assume c_d is 0.0068	2	5
	c.	State the Bernoulli's principle and derive the Pressure coefficient formula.	1	10
		(OR)		
6.	a.	Explain in detail about the stream and potential function of non- lifting flow over a circular cylinder.	1	15
	b.	Explain the concept behind the D'Alembert's Paradox.	1	5
7.	a.	Define vortex sheet and Classify the types of vortex produced by finite wing.	2	6
	b.	Derive the Lift coefficient of cambered airfoil by using thin airfoil approximation.	2	14
		(OR)		
8.	a.	Define center of pressure and aerodynamic center.	2	4
	b.	Consider an airfoil NACA 23012. The mean camberline for this airfoil is given by $\frac{z}{c} = 2.6\left[\left(\frac{x}{c}\right)^3 - 0.6\left(\frac{x}{c}\right)^2 + 0.15\left(\frac{x}{c}\right)\right]$ for $0 \le \frac{x}{c} \le 0.2025$ and $\frac{z}{c} = 0.02\left[1 - \frac{x}{c}\right]$ for $0.2025 \le \frac{x}{c} \le 1.0$ Calculate (a) Angle of attack at zero lift, (b) the lift coefficient when $\alpha=4^\circ$, (c) the moment coefficient about quarter chord , and (d) the location of the center of pressure in terms of x_{cp}/c, when $\alpha=4^\circ$.	2	16
		Compulsory:		

9.	a.	Explain about the following terms 1. Starting vortex 2. Horse-shoe Vortex	1	6
	b.	Derive the Prandtl's lifting line theory and prove that drag coefficient is directly proportional to square times lift coefficient and inverslely proportional to 3.14 times Aspect Ratio of the elliptic wing.	1	14

ALL THE BEST