Roll No. | | | | | | | | | | | | |

Total No. of Pages : 02

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B.Tech.(ANE)/(Aerospace Engg.) (2012 Onwards) (Sem.–3)

AERODYNAMICS-I

Subject Code : ANE-203

M.Code : 60502

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. a) Differentiate between compressible and incompressible flows.

b) What instrument is used to measure air speed over an airfoil?

c) Define mach number and Reynolds number.

d) What is Reynolds Transport theorem?

e) Define Helmholtz laws of vortex motion.

f) For what type of flow, Euler's equation is valid?

g) For what type of flow, Navier-Stoke equation is used?

h) What is condition on Velocity for incompressible flow?

i) Differentiate between laminar and turbulent boundary layer.

j) Draw velocity profile of laminar and turbulent boundary layer.

SECTION-B

2. A 2-D body is placed in a 2-D steady flow with free stream velocity of V_∞ and angle of attack α. Derive the expression for normal and axial force per unit span.

3. Consider the velocity field given by $u = y/(x^2 + y^2)$ and $\upsilon = -x/(x^2 + y^2)$. Calculate the equation of streamline passing through point (0, 5).

4. A uniform flow with free stream velocity v_∞ is superimposed on a source of strength k located at the origin. The uniform flow is moving from left to right. Draw the resultant flow pattern over the semi-infinite body and obtain the expressions for velocity components v_r and v_θ.

5. Explain the poiseuille flow. Obtain the expression for velocity variation across the flow, maximum velocity and shear stress at the walls.

6. Explain boundary layer formation over a flat plate and derive the expressions for displacement thickness and momentum thickness.

SECTION-C

7. The velocity field over a wavy wall is given as

$$U = V_\infty \left[1 + \frac{h}{\beta}\frac{2\pi}{l}\left(\cos\frac{2\pi x}{l}\right)e^{-2\pi\beta y/l}\right]$$

$$\upsilon = -V_\infty h\frac{2\pi}{l}\left(\sin\frac{2\pi x}{l}\right)e^{-2\pi\beta y/l}$$

Prove that the flow is irrotational.

8. A uniform flow with free stream velocity V_∞ and a doublet of strength k are superimposed on a vortex of strength Γ. Determine the stream function, velocity components V_r, V_θ and expression for lift per unit span over the resulting cylinder.

9. Consider the incompressible, 2-D flow over a flat plate at zero angle of attack. Obtain Blasius solution of boundary layer equations and discuss the solution.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.