Register Number:……..

B.E., DEGREE EXAMINATIONS MAY/JUNE 2013

Fourth Semester

AERONAUTICAL ENGINEERING

AER104: Aerodynamics - I

Time: Three Hours **Maximum Marks: 100**

Answer ALL Questions:-

PART A (10x1=10 Marks)

1. A flow in which the density is constant is termed as……..

   a) Inviscid flow b) Incompressible flow

   c) Radial flow d) viscous flow

2. The momentum equation is based on ……

   a) Newton's 3rd law b) Newton's 2nd law

   c) Newton's 1st law d) none of the above

3. There is a special, degenerate case of a source-sink pair leads to a singularity is called ……..

   a) vortex b) doublet c) both (a) and (b) d) none of the above

4. If the trailing edge is cusped, then the velocities leaving the top and bottom surfaces at the trailing edge are finite and equal in……..

   a) magnitude b) direction c) both (a) and (b) d) none of the above

5. From thin aerofoil theory assumption, the maximum aerofoil thickness is small compared to its…….

   a) chord length b) camber length c) both (a) and (b) d) none of the above

6. A point at which moment is independent of Angle of attack …….

   a) aerodynamic center b) pressure co-efficient

   c) center of pressure d) both (a) and (b)

7. According to Blasius theorem, the lift acts always at …….

   a) mid chord b) mid camber line c) mid chord line d) none of the above

8. The total amount of vorticity passing through any plane of region within a flow field is called as ……..

   a) vorticity b) circulation c) rotational flow d) both (b) and (c)

9. If the trailing edge is finite, then the trailing edge is a ……

   a) free vortex point b) stagnation point

   c) both (a) and (b) d) none of the above

10. The distance across a boundary layer from the wall to a point where the flow velocity has essentially reached the 'free stream' velocity is termed as …….

a) Boundary layer b) Boundary layer thickness

c) Both (a) and (b) d) None of the above

PART B (10 x 2= 20 Marks)

11. Write energy equation for a steady incompressible flow and name the terms involved in the equation.
12. Write down the significance of continuity equation.
13. Define Circulation.
14. What is uniform flow? Explain.
15. What is Kutta condition and where is it applied?
16. State Blasius Theorem.
17. What is the important features of Karman-Trefftz airfoil profile?
18. What are the limitations of lifting line theory?
19. Define momentum thickness.
20. What do you mean by boundary layer?

PART C (5 x 14= 70 Marks)

21. a) Derive the general x-momentum equation for an unsteady 3-D flow in partial differential form using a control volume approach.

(OR)

b) Derive continuity equation in pde form using a control volume approach.

22. a) (i) Briefly explain the stream function and velocity potential. (10)

(ii) Explain Kutta joukowski's Theorem. (4)

(OR)

b) (i) Explain source and sink with neat sketches. (8)

(ii) What are the characteristics of a vortex flow? (6)

23. a) (i) Clearly explain the method of obtaining the Joukowski transformation to get a cambered airfoil. (10)

(ii) Explain the Velocity field and circulation for the Joukowsky airfoil (4)

(OR)

b) Clearly explain the Pressure distribution on an aerofoil at various incidence.

24. a) (i) Derive the fundamental equation of thin airfoil theory. (10)

(ii) State Biot-Savart law. (4)

(OR)

(b) Explain the terms

(i) Bound vortex (4)

(ii) Starting vortex (4)

(iii) Horse shoe vortex (6)

25. a) Explain the properties of Navier-Stokes equation.

(OR)

b) (i) Explain the boundary layer separation with a neat sketch. (7)

(ii) Explain displacement thickness and momentum thickness in boundary layer theory. (7)

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