Register Number:………….

B.E DEGREE EXAMINATIONS: NOV/DEC 2014

(Regulation 2009)

Fourth Semester

AERONAUTICAL ENGINEERING

AER104**:** Aerodynamics I

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1.   _____ refers conservation of mass.

   a)   Continuity equation   b)   Energy equation

   c)   Momentum equation   d)   Newton's law of viscosity

2.   The momentum equation for an inviscid flow is also called as

   a)   Euler equation   b)   Navier stokes equation

   c)   Energy equation   d)   Blasius equation

3.   _____ is a curve whose tangent at any point in the direction of the velocity vector at that point.

   a)   Streak line   b)   Path line

   c)   Stream line   d)   Cure line

4. Γ is used to indicate

   a)   Strength of the vortex flow   b)   Strength of the compressible flow

   c)   Strength of viscous flow   d)   Strength of the incompressible flow

5.   The Kutta- Joukowski's theorem is a way of expressing the consequences of

   a)   Mass flow   b)   Volume pressure distribution

   c)   Surface pressure distribution   d)   Heat distribution

6.   The net force acting on an airfoil can be found by using

   a)   Blasius theorem   b)   Bernoulli's theorem

   c)   Pythagoras theorem   d)   Joukowski's theorem

7. According to Helmholtz's theorem
   a) A vortex filament cannot end in the fluid
   b) A vortex filament cannot end in the solid fluid
   c) A vortex filament cannot end in the gas
   d) A vortex filament cannot end in the air

8. Vortex sheets and filaments are useful in modeling the aerodynamics of
   a) Infinite wing
   b) Semi infinite wing
   c) Finite wing
   d) Infinite fuselage

9. ____ that describes the behavior of some fluid under a limited range of conditions.
   a) Gravitational law
   b) Newton's law
   c) Empirical law
   d) Biot-Savart law

10. The concept of momentum thickness is useful in the prediction of
   a) Lift co-efficient
   b) Moment co-efficient
   c) Drag co-efficient
   d) Side force co-efficient

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. Define Circulation.

13. Write down the significance of continuity equation.

14. What is the important feature of Karman-Trefftz airfoil profile?

15. What are the limitations of lifting line theory?

16. What is uniform flow?

17. How is horse shoe vortex formed?

18. What do you mean by boundary layer?

19. What is Kutta condition and where is it applied?

20. Define: Newton's law of Viscosity.

PART C (5 x 14 = 70 Marks)

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

(OR)

b)   Derive continuity equation in polar coordinates.

22. a) (i) Briefly explain the stream function and velocity potential. (7)

    (ii) Explain Kutta condition. (7)

(OR)

    b) (i) Explain source and sink with neat sketches. (10)

    (ii) What are the characteristics of a vortex flow? (4)

23. a) Explain the method of obtaining Cambered airfoil using Joukowski transformation.

(OR)

    b) Explain the Pressure distribution on an aerofoil at various incidents.

24. a) (i) Derive Blasius theorem for an incompressible flow over flat plate. (10)

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

(OR)

    b) (i) Define

        (i) Bound vortex, (ii) Starting vortex & (iii) Horse shoe vortex (6)

    (ii) Derive the fundamental equation of thin airfoil theory. (8)

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 (7) theory

****