B.E DEGREE EXAMINATIONS: NOV 2015

(Regulation 2009)

Seventh Semester

AERONAUTICAL ENGINEERING

AER135: Industrial and Experimental Aerodynamics

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. By momentum theory, Betz's law gives the maximal achievable extraction of wind power by a wind turbine as _____ of the total kinetic energy of the air flowing through the turbine

   a) 45%   b) 59%

   c) 67%   d) 33%

2. The C_D of cars is typically in the range of _____

   a) 0.05 to 0.1   b) 0.5 to 0.7

   c) 1.0 to 1.8   d) 0.22 to 0.35

3. Vortex shedding frequency is expressed as _____.

   a) Weber number   b) Strouhal number

   c) Knudsen number   d) Froude number

4. Stall flutter is a _____ degree(s) of freedom oscillation of airfoils in torsion.

   a) single   b) three

   c) six   d) two

5. The maximum acceptable blockage for wind tunnel model testing is around

   a) 12%   b) 0.5%

   c) 6%   d) 1%

6. In model testing involving liquid with free surface, the important non dimensional number is

   a) Froude number   b) Strouhal number

   c) Prandtl number   d) Reynolds number

7. The variation of static pressure along the test-section produces a drag force known as

   a) horizontal buoyancy   b) solid blocking

   c) wake blocking   d) All the above

8. Downwash correction is generally applicable to

   a) Lifting surfaces
   b) 3 D wings
   c) Circular cylinders
   d) Both a and b

9. Perforated test section walls are special feature of

   a) Supersonic tunnels
   b) Transonic tunnels
   c) Boundary layer tunnels
   d) Hypersonic tunnels

10. Schlieren system of flow visualization is applicable for flow field of

    a) Under expanded nozzle jet
    b) High density gradient
    c) Over expanded nozzle jet
    d) All the above

PART B (10 x 2 = 20 Marks)

11. Define power coefficient of a wind turbine.

12. What are the effects of cut back angle?

13. Define the term Galloping.

14. Differentiate between streamlined and bluff bodies.

15. List out various wind tunnel balances used.

16. List out the four sources of error in wind tunnel tests.

17. What is the need for downwash correction?

18. Define the term horizontal buoyancy.

19. What is the criterion for deciding the area of the second throat in supersonic wind tunnels?

20. What is the basic principle of optical supersonic flow visualization?

PART C (5 x 14 = 70 Marks)

21. a) (i) With a neat sketch, discuss the working principle of a horizontal axis wind turbine.   (7)

    (ii) Write a brief note on Aerodynamics of trains and hovercrafts.   (7)

    (OR)

    b) Based on momentum theory derive an expression for power coefficient and obtain the Betz limit.

22. a) Write short notes on the following:

    (i) Building ventilation and Architectural Aerodynamics   (7)

    (ii) Special problems of tall buildings and building codes   (7)

    (OR)

b) Write short notes on the following:

(i) Reynolds number effect on wake of bluff bodies (7)

(ii) Vortex induced vibrations (7)

23. a) (i) With a neat sketch, explain the working principle of an internal balance. (7)

(ii) Discuss in detail data reduction and data correction in wind tunnel testing. (7)

(OR)

b) Discuss in detail model mounting and various techniques of lift and drag measurements of 3-D wings.

24. a) Write short notes on

(i) Effect of lateral boundaries and buoyancy (7)

(ii) Method of images (7)

(OR)

b) Write short notes on

(i) Solid blocking (7)

(ii) Wake blocking (7)

25. a) With a neat sketch, discuss the types of supersonic tunnels and their relative merits and demerits.

(OR)

b) With a neat sketch, discuss the Schlieren method of supersonic flow visualization.

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