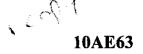
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Sixth Semester B.E. Degree Examination, Dec.2014/Jan.2015 Aerodynamics – II

Time: 3 hrs. Max. Marks:100

Note: Answer FIVE full questions, selecting at least TWO questions from each part.

PART - A

- 1 a. Derive the velocity potential at a point P at a distance r from a source sheet of strength λ per unit length. (10 Marks)
 - b. Consider lifting flow over an arbitrary body and derive an expression for total surface velocity induced at the ith control point employing vortex panel method. (10 Marks)
- 2 a. Explain the following:
 - i) Downwash and induced drag
 - ii) Biot-Savarth law
 - iii) Helmholtz's vortex theorem

(06 Marks)

- b. Explain and derive Prandtl's lifting line theory and its limitations. (06 Marks)
- c. Derive expressions for lift, induced drag and downwash for elliptic lift distribution. (08 Marks)
- 3 a. Derive the governing velocity potential equation for an inviscid, compressible, irrotational subsonic flow over a body immersed in a uniform stream. (10 Marks)
 - b. Derive and explain the Prandtl Glauset compressibility correction formula. (06 Marks)
 - c. At a given point on the surface of an artfail, the C_p is -0.3 at very low speeds. If the free stream mach no. is 0.6, calculate C_p at this point? (04 Marks)
- 4 a. Define: i) Mach waves and expansion waves, ii) Normal and oblique shocks. (04 Marks)
 - b. What is critical mach no.? Derive an expression for critical pressure coefficient in terms of critical mach no.? (10 Marks)
 - c. Explain: i) Drag-Divergence Mach number, ii) Sound barrier and iii) Transonic area rule.

PART – B

5 a. Explain in detail the influence of downwash on tail plane.

- (08 Marks)
- b. Explain with figure the formation flying effect and ground effect.
- (06 Marks)
- c. Prove that for a monoplane a rotational formula for the downwash, in degrees at the tail plane is $\epsilon = {\rm constant} \times \frac{CL}{AR}$. Determine the numerical value of the constant for a point on the center line of the machine 2s/3 behind the centre of pressure, s being the semi-span (96 Marks)
- 6 a. What are cylindrical coordinates used for bodies of revolution and velocity potential in cylindrical coordinates? (06 Marks)
 - b. Derive linearised supersonic pressure coefficient formula.

(14 Marks)

- 7 a. What are swept back wings? How the performance of an airplane is improved by the application of swept back wing's concept? (10 Marks)
 - b. What are high lift devices? Explain. Describe the functions of different types of flaps with figures. (10 Marks)
- With neat sketch, describe the process of flow over a flat plate, also stating the assumptions explain the phenomenon of turbulent boundary layer properties over the same flat plate at low speeds.

 (20 Marks)

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