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10AE63

Sixth Semester B.E. Degree Examination, June/July 2019
Aerodynamics - II

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the Non-Lifting flow over arbitrary bodies? The source panel method. **(14 Marks)**

b. Consider the NACA 2412 airfoil, data for which the data are given for two values of Reynolds's number based an chord length for the case where $R_{cc} = 3.1 \times 10^6$ estimate :

i) The laminar boundary layer thickness at the trailing edge for chord length of 1.5 m

ii) the net laminar skin friction drag coefficient for the airfoil. **(06 Marks)**

2 a. Define and Explain

i) Down wash ii) Induced drag iii) Vortex filament iv) Biot-savart law **(08 Marks)**

b. Derive and explain Prandtl's classical lifting line theory and its limitations. **(12 Marks)**

3 a. Describe and explain the linearised velocity potential equation. **(14 Marks)**

b. Explain Prandtl – Glauert compressibility correction. **(06 Marks)**

4 a. Deduce the relation between oblique shock wave angle and the mach angle. **(04 Marks)**

b. Define and explain critical mach number, Drag-divergence mach number, sound Barrier and transonic area rule with neat sketches. **(12 Marks)**

c. Consider an oblique shock wave with a wave angle of 30°. The upstream flow mach number is 2.4. Calculate the deflection angle of the flow, the pressure and temperature ratios across the shock wave, and the mach number behind the wave. **(04 Marks)**

PART – B

5 a. Derive an expression for simplified horseshoe vertex model. **(06 Marks)**

b. Explain the equations the influence of down worth on tail plane. **(08 Marks)**

c. Prove that for monoplane, a rational formula for down worth in degrees, at the tail plane is constant X_{CL}/AR. Determine the numerical value of constant for a point on the center line of the $2^S/3$ behind the gates of pressure, S being the semi-span. **(06 Marks)**

6 a. Describe the subsonic flow past over as thin flat plats at zero incidence. **(14 Marks)**

b. What are the different types of small perturbation flows? Explain with neat sketches. **(06 Marks)**

7 a. What are high lift devices list them and explain this effects an aerodynamics characteristics? **(12 Marks)**

b. Discuss the advantages of swept wing in modern airplane. **(08 Marks)**

8 a. Derive and explain Navier – Stokes equation for two dimensional flows. **(12 Marks)**

b. Consider a float plate at zero angle of attack in an airflow at St. sea level conditions ($P_\infty = 1.01\times10^5 N/m^2$ and $T_\infty = 288K$). The chord length of plate is 2m. The planform area of the plate is $40m^2$. @ Standard sea level conditions, $\mu_\infty = 1.7\ 894\times10^{-5}$ kg/ms. Assume the wall temperature is the adiabatic wall temperature T_∞. Calculate the friction drag on the plate when the free stream velocity is 100m/s. **(08 Marks)**

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