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10AE63

Sixth Semester B.E. Degree Examination, Jan./Feb. 2021
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 with a neat sketch, source panel distribution over the surface of a body of arbitrary shape and their expression for normal and tangential induced velocity mention the expression for pressure co-efficient at the i^{th} control point. **(10 Marks)**

b. Consider lifting flow over an arbitrary body and device an expression for total surface velocity induced at the i^{th} control point employing vertex point method, mention the total circulation and lift for unit open. **(10 Marks)**

2 a. Derive the expression for the induced AOA and induced drag coefficient using elliptical lift distribution. **(10 Marks)**

b. Derive an expression for lift coefficient and induced drag coefficient in terms of circulation strength $\Gamma(y)$ for a finite wing using through general lift distribution. **(10 Marks)**

3 a. Explain the assumptions made in linerized velocity potential equation and derive an expression for pressure co-efficient for an inviscid, compressible, irrotational subsonic flow using linerazied velocity potential equation. **(12 Marks)**

b. The theoretical lift co-efficient for a, thin, symmetric airfoil in a incompressible flow is $C_L = 2\pi\alpha$. Calculate the lift co-efficient for $M_\infty = 0.7$. **(04 Marks)**

c. For given airfoil, the critical mach number is 0.8. Calculate the value of $\frac{p}{p_\infty}$ at the minimum pressure point when $M_\infty = 0.8$. **(04 Marks)**

4 a. In low speed incompressible flow, the pressure co-efficient (at the minimum pressure point of an airfoil is -0.41.) Estimate the critical Mach number for thin airfoil, using the Prandtl-Glavert rule (using graphical method). **(08 Marks)**

b. What is critical Mach number and derive the relation for critical pressure co-efficient in terms of free stream Mach number. **(06 Marks)**

c. Describe the effects of airfoil thickness on critical Mach number. **(06 Marks)**

PART – B

5 Write short notes on the following:

a. Simplified horse shoe vortex model.

b. Formation of flight.

c. Influence of downwash on tail place.

d. Ground effects. **(20 Marks)**

6 a. What are the different types of small perturbation flow? Briefly explain with relevant sketches. **(10 Marks)**

b. Describe the subsonic flows past an axial body of revolution with relevant sketches. **(10 Marks)**

7 a. What are high lift devices? List them and explain their effects on aerodynamic characteristics. **(10 Marks)**

b. Describe the advantages of script wings in modern airplanes. **(10 Marks)**

8 a. Define total drag with reference to pressure and skin friction drag. **(02 Marks)**

b. Explain with a neat sketch, the boundary layer flow transition over a flat plate. **(08 Marks)**

c. For the velocity profile for laminar boundary layer $\frac{u}{U} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}\left(\frac{y}{\delta}\right)^2$. Determine the boundary layer thickness, shear stress, drag force and co-efficient of drag interms of Reynolds number. **(10 Marks)**

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