Hall Ticket No | | | | | | | | | | | Question Paper Code: AAE004

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

B.Tech IV Semester End Examinations (Supplementary) - July, 2018

**Regulation: IARE–R16**

## LOW SPEED AERODYNAMICS

**Time: 3 Hours** **(AE)** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Define velocity potential and derive the relationship between the stream function and velocity potential. **[7M]**
   (b) Define stream function and write the expressions in Cartesian and Polar coordinates. **[7M]**
2. (a) Derive the expressions for streamlines in doublet flow with neat sketch. **[7M]**
   (b) Explain Kutta-Joukowski theorem with an appropriate sketch. Write down the assumptions. **[7M]**

### UNIT – II

3. (a) Sketch the airfoil and explain its nomenclature. Differentiate between symmetric and cambered airfoil. **[7M]**
   (b) Derive the expression to calculate the aerodynamic center. What is the physical significance of it? **[7M]**
4. (a) Explain the thin airfoil theory with neat sketch. Write down the assumptions taken to derive it. **[7M]**
   (b) Explain the high lift devices with appropriate diagram. **[7M]**

### UNIT – III

5. (a) Briefly explain the vortex system with relevant diagrams. **[7M]**
   (b) Explain the following **[7M]**
      i. Helmholtz's theorem
      ii. The Biot-Savart law
6. (a) Explain Prandtl's classical lifting theory and write the fundamental equation for circulation distribution. **[7M]**
   (b) Explain the source panel and vortex panel methods and write the governing equations. **[7M]**

## UNIT – IV

7. (a) Explain the effect of wing body interference with neat sketch. **[7M]**

   (b) Define D-Alembert Paradox. Is there any lift produced without viscous effect? **[7M]**

8. (a) Explain the method of singularities using Prandtl-Glauret singularity method. **[7M]**

   (b) Discuss the effects of propeller on the aircraft wing and airplane dynamics. **[7M]**

## UNIT – V

9. (a) Sketch the boundary layer on a flat plate and mention the velocity profile and temperature profile. **[7M]**

   (b) Sketch and explain the laminar and turbulent boundary layer. Which one has more skin friction drag? **[7M]**

10. (a) Derive the expressions for **[7M]**
    i. Kinetic energy thickness
    ii. Momentum thickness

    (b) Write the expression for displacement thickness. What is the purpose of finding displacement thickness? **[7M]**

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