



# CBGS SCHEME

15AE42

## Fourth Semester B.E. Degree Examination, Jan./Feb. 2021 Aerodynamics - I

Time: 3 hrs.

Max. Marks: 80

**Note:** Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. Derive the Integral form of momentum equation by Control Volume Approach. (10 Marks)  
b. Define i) Circulation ii) Mach cone iii) Mach angle. (06 Marks)

OR

- 2 a. Explain the following : i) Path lines ii) Stream lines iii) Streak lines. (06 Marks)  
b. Define and explain Compressibility. (06 Marks)  
c. Obtain the relation between stream function and velocity potential function stating its Inference. (04 Marks)

### Module-2

- 3 a. With a neat sketch, explain in detail the Airfoil Nomenclature. (08 Marks)  
b. With a neat sketch, explain the wing plan form geometry. (08 Marks)

OR

- 4 a. What is Center of pressure and explain the pressure distribution over an airfoil at various degrees of angle of attack, with neat sketches. (10 Marks)  
b. Explain the types of drag. (06 Marks)

### Module-3

- 5 a. Write short notes on the following :  
i) Kutta condition ii) Kelvin's Circulation Theorem. (08 Marks)  
b. What is D'Alembert's Paradox? (04 Marks)  
c. State Kutta – Joukowski Theorem. (04 Marks)

OR

- 6 a. Obtain an expression for the following for a lifting flow over cylinder :  
i) Stream function ii) Location of stagnation points iii) Pressure coefficients.  
Also explain with a neat sketch, the location of stagnation points for different values of " $\Gamma$ ". (12 Marks)  
b. Define Doublet flow. (04 Marks)

### Module-4

- 7 a. Write short notes on the following :  
i) Biot – Savart law ii) Helmholtz's Theorem. (08 Marks)  
b. Using Biot – Savart law compute the Induced velocity at a point in the field. (08 Marks)

OR

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- 8 a. What are limitations of Prandtl's lifting theory. (06 Marks)  
b. Derive the Prandtl's classical lifting line theory. (10 Marks)

**Module-5**

- 9 a. Explain the Horst – shoe Vortex system over a lifting wing. (06 Marks)  
b. Explain in detail about Subsonic and Supersonic leading edges. (04 Marks)  
c. Explain in detail about High – lift systems. (06 Marks)

**OR**

- 10 a. Explain in detail about Lift and Drag divergence. (06 Marks)  
b. Explain briefly about the Transonic – Area rule. (04 Marks)  
c. What are Critical Mach Number and Tip effects? (06 Marks)

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