CBCS SCHEME

USN

17AE832

Eighth Semester B.E./B.Tech. Degree Examination, June/July 2025
Boundary Layer Theory

Time: 3 hrs. Max. Marks:100

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

Module-1

1 a. Demonstrate the viscous flow phenomenon over an aerofoil and a cylinder. **(10 Marks)**

b. What are the kinematic properties of viscous flow? Explain. **(10 Marks)**

OR

2 a. Explain each term in the governing equations for conservation of mass, momentum and energy for viscous flow. **(12 Marks)**

b. Characterize the basic flow equation in its mathematical form. **(08 Marks)**

Module-2

3 a. Define the stagnation point flow and state equations for
i) Velocity distribution
ii) Pressure distribution, in the case of two dimensional flows. **(10 Marks)**

b. Explain Couette flow with a reference to non-zero pressure gradient taking suitable equations and suitable diagram. **(10 Marks)**

OR

4 a. Establish the equation for velocity distribution in Poiseuille's flow. **(10 Marks)**

b. Describe an unsteady flow between plates with bottom injection and top suction. **(10 Marks)**

Module-3

5 a. Derive expression for displacement thickness, momentum thickness and energy thickness for a boundary layer in a two dimensional flow. **(14 Marks)**

b. Discuss about thermal boundary layer in comparison with velocity boundary layer. **(06 Marks)**

OR

6 a. Derive Von-Karman Momentum Integral equation. **(12 Marks)**

b. Discuss about shape factor and explain about approximation of boundary layer equation. **(08 Marks)**

Module-4

7 a. Develop Blasius solution over flat-plate flow for boundary layer. **(08 Marks)**

b. Show how shear stress at a wall is linked to the momentum thickness of boundary layer. **(12 Marks)**

OR

8 a. Demonstrate the approximation method of getting solution for boundary layer equation. **(08 Marks)**

b. What is the significance of Falkner-Skan Wedge flow and develop Reynold's analog in a boundary layer. **(12 Marks)**

Module-5

9 a. Explain the following:
   i) Temporal Instability
   ii) Spatial Instability. **(10 Marks)**

b. Explain the averaging and fluctuation in a neat diagram. **(10 Marks)**

OR

10 a. Draw a neat diagram of hot wire anemometer and explain the principle of measurement of turbulence. **(12 Marks)**

b. Write short notes on:
   i) Schlieren method
   ii) Pressure probe. **(08 Marks)**

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