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15AE832

Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Boundary Layer Theory

Time: 3 hrs.

Max. Marks : 80

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

Module-1

1   a. Develop mathematical characterization of governing equations of viscous flow.   (08 Marks)
    b. Describe viscous flow phenomenon over an airfoil and prescribe the necessary foundations of the flow.   (08 Marks)

OR

2   a. Write the fundamental momentum equations for both viscous and inviscid flows in a steady state conditions.   (08 Marks)
    b. Describe different dimensionless parameters in viscous flow and their significance.(08 Marks)

Module-2

3   a. Obtain a relation for steady flow between a fixed and moving plates?   (08 Marks)
    b. With help of suitable relation, explain a unsteady flow between plates with top suction and bottom injection.   (08 Marks)

OR

4   a. What is meant by Poiseuille flow? Derive an expression for Poiseuille flow through ducts.   (10 Marks)
    b. Illustrate the plane stagnation flow with suitable relations?   (06 Marks)

Module-3

5   a. Draw a laminar boundary layer and derive the equations in it.   (08 Marks)
    b. Derive displacement thickness and momentum thickness for a boundary layer of a two dimensional flow.   (08 Marks)

OR

6   a. Derive momentum integral equation.   (10 Marks)
    b. Define :
       i) thermal boundary layer
       ii) forced convection.   (06 Marks)

Module-4

7 a. What is meant by Poiseuille flow? Derive an expression for Poiseuille flow through ducts.

   (10 Marks)

  b. Illustrate the plane stagnation flow with suitable relations?   (06 Marks)

OR

8 a. What is meant by similarity solutions? Give the Blasius solution for flat plate flow.

   (10 Marks)

  b. With help of Falkner-Skan similarity solution, obtain a boundary layer equation for wedge flows.   (06 Marks)

Module-5

9 a. Explain the following :
   i) Temporal instability
   ii) Spatial instability.   (08 Marks)
  b. Explain time averaging and fluctuation in a neat diagram.   (08 Marks)

OR

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

  b. Write short notes on :
   i) Schlieren methods
   ii) Pressure probe.   (06 Marks)

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