CBCS SCHEME

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15AE832

Eighth Semester B.E. Degree Examination, Jan./Feb. 2023
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. Describe both Couette flow and Poiscuille flow steady flow through duct and derive the necessary velocity profile in each case. **(10 Marks)**

b. What is plane stagnation flow? Give its differential equation free of parameters. **(06 Marks)**

OR

4 a. Develop boundary layer equation for a steady laminar flow over a flat plate. **(08 Marks)**

b. Explain unsteady duct flow between plates with bottom injection and top suction. **(08 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. Derive a two dimensional laminar boundary layer equation for a incompressible flow with boundary conditions and give the noticeable things from simplified set of equations. **(10 Marks)**

b. Show the Reynolds analogy as a function of pressure gradient. **(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. List down steps followed by small disturbance stability analysis. (08 Marks)

b. How do you characterize the turbulence for a physical fluid flow? Explain it. (08 Marks)

OR

10 a. Describe the type of free turbulent flow with useful flow profiles. (06 Marks)

b. Illustrate the Schlieren flow visualization technique with neat sketch. (10 Marks)

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