CBCS SCHEME

USN | | | | | | | | | | |

15AE832

Eighth Semester B.E. Degree Examination, June/July 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 viscous flow phenomenon over an aerofoil and prescribe necessary boundary condition of the flow. **(08 Marks)**

b. Describe mathematical characterization of governing equations of viscous flow. **(08 Marks)**

OR

2 a. Explain how boundary layer thickness varies with the direction of a 2D steady flow situation and derive displacement and momentum thickness for a boundary layer formed over a flat plate. **(10 Marks)**

b. Elaborate 'Scale Analysis and Boundary layer approximation'. **(06 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 flow. **(08 Marks)**

b. Explain coquette flow with a reference to non-zero pressure gradient taking suitable equations and suitable diagram. **(08 Marks)**

OR

4 a. Establish the equation for velocity distribution in Poiseuillel's flow. **(08 Marks)**

b. Describe an unsteady flow between plates with bottom injection and top section. **(08 Marks)**

Module-3

5 a. Derive Von Karman momentum integral equation and highlight its significance in laminar boundary layer. **(10 Marks)**

b. What is shape factor and how is it connected with boundary layer thickness? **(06 Marks)**

OR

6 Outline:
a. Thermal Boundary layer
b. Boundary layer approximation of laminar flow
c. Momentum and Energy thickness
d. Applications of Navier-Stokes equation. **(16 Marks)**

Module-4

7 a. Derive Falker–Skan differential equation with a reference to boundary layer equations for a plane steady incompressible flow. **(12 Marks)**

b. What is Reynold's analogy? **(04 Marks)**

OR

8 a. Demonstrate similarity solution to boundary layer equation for steady two dimensional flow. **(08 Marks)**

b. Explain Blasius solution for flat plate. **(08 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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