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

17AE832

Eighth Semester B.E. Degree Examination, June/July 2023
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.   Discuss about the viscous flow over an airfoil and a circular cylinder with relevant sketch.
        (12 Marks)
    b.   Write about types of boundary considered for a fluid flow problems and explain conditions for solid surface boundary condition.   **(08 Marks)**

OR

2   a.   Derive the expression of Navier-Stokes equation for incompressible flow.   **(10 Marks)**
    b.   Write the mathematical characterization of governing equations of viscous flow.   **(10 Marks)**

Module-2

3   a.   Draw the velocity profile and write the relation for Couette flow and Poiseullie flow for steady flow through duct.   **(12 Marks)**
    b.   Derive the expression for boundary layer equation for a steady laminar flow over a flat plate.
        (08 Marks)

OR

4   a.   Explain about unsteady duct flow between plates with bottom injection and top suction.
        (10 Marks)
    b.   Derive the expression for plane stagnation flow with relevant sketch.   **(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.   Write about dimensionless numbers used in laminar flow problems.   **(10 Marks)**
    b.   Derive Blasius solution for flat-plate flow.   **(10 Marks)**

OR

8 a. Write about Reynold's Analogy and prove that it is a function of pressure gradient.(10 Marks)
   b. Write about Falkner-Skan potential flow and obtain the expressions for wedge.   (10 Marks)

Module-5

9 a. Explain about Reynold's averaging technique.   (10 Marks)
   b. Explain the phenomena of transition of boundary layer from laminar to turbulent flow with the help of Reynold's number.   (10 Marks)

OR

10 a. Explain about principle of hot wire anemometer and its operation in measurement of turbulence.   (10 Marks)
    b. Draw and explain about operation of Mach-Zhender Interferometer used in flow visualization.   (10 Marks)

* * * * *