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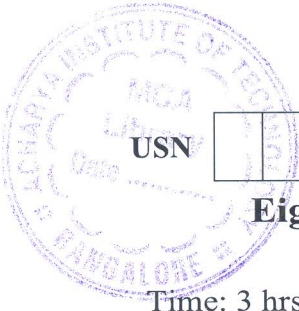
17AE832

Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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 n 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 equation 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. Derive the velocity profile in Couette flow.   (12 Marks)
   b. Explain different types of drag for an incompressible viscous flow.   (08 Marks)

OR

4 a. Explain how boundary layer thickness varies with the direction of 2D steady flow situations.   (08 Marks)
   b. Derive the Poisellille Parabola.   (12 Marks)

Module-3

5 a. Derive displacement thickness and momentum thickness and explain what is a shape factor.   (10 Marks)
   b. Describe the transition of laminar flow to turbulent flow over a flat plate and what factors affect it.   (10 Marks)

OR

6 a. Explain Scale analysis and Boundary layer approximation.   (10 Marks)
   b. How do velocity boundary layer and thermal boundary layer develop? Explain its numerically.   (10 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 limited 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 Reynolds analogy in a boundary layer.   (12 Marks)

Module-5

9 a. Draw and explain the free turbulent flows such as jets works and mixing layer.   (10 Marks)
   b. Give mathematical description of turbulent flow.   (10 Marks)

OR

10 a. Explain the working principle of measurement of flow using
    i) Hot wire and hot film anemometer   ii) Schliren method of flow visualization.   (12 Marks)
    b. Deduce the basic formula on how to model fluctuations and time averaging in governing equations used for the computation of flow.   (08 Marks)

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