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Eighth Semester B.E. Degree Examination, July/August 2022

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. Explain each term in the governing equation for conservation of mass, momentum and energy for viscous flow. (08 Marks)
b. Characterize the basic flow equation in its mathematical form. (08 Marks)

OR

- 2 a. Demonstrate the viscous flow phenomenon over an aerofoil and a cylinder. (08 Marks)
b. What are the kinematic properties of viscous flow? Explain. (08 Marks)

Module-2

- 3 a. Derive the velocity profile in Couette flow. (06 Marks)
b. Explain different types of drag for an incompressible viscous flow. (10 Marks)

OR

- 4 a. Explain how boundary layer thickness varies with the direction of a 2D steady flow situation. (08 Marks)
b. Derive the Poiseuille parabola. (08 Marks)

Module-3

- 5 a. Explain Scale analysis and Boundary layer approximation. (08 Marks)
b. How do velocity boundary layer and thermal boundary layer develop? Explain it numerically. (08 Marks)

OR

- 6 a. Derive displacement thickness and momentum thickness and explain what is shape factor. (08 Marks)
b. Describe the transition of laminar flow to turbulent flow over a flat plate and what factors affect it. (08 Marks)

Module-4

- 7 a. Show how shear stress at a wall is limited to the momentum thickness of boundary layer. (08 Marks)
b. Develop Blasius solution over flat plate flow for boundary layer. (08 Marks)

OR

- 8 a. What is the significance of Falkner – Skan wedge flow and develop Reynolds analogy in a boundary layer. (08 Marks)
b. Demonstrate the approximation method of getting solution of boundary layer equation. (08 Marks)

Module-5

- 9 a. Draw and explain the free turbulent flows such as jets wakes and mixing layer. (08 Marks)
b. Give mathematical description of turbulent flow. (08 Marks)

OR

- 10 a. Explain the working principle of measurement of flow using.
i) Hotwire and hot film anemometer ii) Schlieren method of flow visualization. (08 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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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.