

CBCS SCHEME



17AE832

Eighth Semester B.E. Degree Examination, July/August 2021

Boundary Layer Theory

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

- 1 a. Demonstrate the viscous flow phenomenon over an aerofoil and a cylinder. (10 Marks)
b. What are the kinematic properties of viscous flow? Explain. (10 Marks)
- 2 a. Explain each term in the governing equations for conservation of mass, momentum and energy for viscous flow. (12 Marks)
b. Characterize the basic flow equation in its mathematical form. (08 Marks)
- 3 a. Derive the velocity profile in Couette flow. (12 Marks)
b. Explain different types of drag for an incompressible viscous flow. (08 Marks)
- 4 a. Explain how boundary layer thickness varies with the direction of a 2D steady flow situation. (08 Marks)
b. Derive the Poiseuille Parabola. (12 Marks)
- 5 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 affects it? (12 Marks)
- 6 a. Explain scale analysis and boundary layer approximation. (10 Marks)
b. How do velocity boundary layer and thermal boundary layer develop? Explain it numerically. (10 Marks)
- 7 a. Develop Blasius solution over flat-plate flow for boundary layer. (08 Marks)
b. Show how shear stress at a wall is linked to the momentum thickness of boundary layer. (12 Marks)
- 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 Reynold's analog in a boundary layer. (12 Marks)
- 9 a. Draw and explain the free turbulent flows such as jets wakes and mixing layers. (10 Marks)
b. Give mathematical description of turbulent flow. (10 Marks)
- 10 a. Explain the working principle of measurement of flow using:
(i) Hot wire and Hot film anemometer
(ii) Schlieren 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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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.