CBCS SCHEME

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

15AE832

Eighth Semester B.E. Degree Examination, Feb./Mar. 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. Derive an expression for 3D Navier stokes momentum equation for Newtonian viscous flow in Cartesian coordinates. **(10 Marks)**

b. Discuss the non dimensional parameters used in viscous flow problems. **(06 Marks)**

OR

2 a. Describe the flow phenomena while passing through a circular pipe with useful sketch. **(08 Marks)**

b. Give the boundary conditions used for viscous flow problems. **(08 Marks)**

Module-2

3 a. Show the velocity and shear stress distribution for Couette flow with necessary boundary conditions. **(08 Marks)**

b. Obtain an expression for Poiseuille flow through ducts using required boundary conditions. **(08 Marks)**

OR

4 a. Briefly classify the solutions of viscous flow equations. **(08 Marks)**

b. Give the differential equation free of parameters for plane stagnation flow. **(08 Marks)**

Module-3

5 a. Enumerate the conditions to estimate the boundary layer thickness for a laminar flow. Obtain it with suitable relations. **(06 Marks)**

b. Derive an expression for displacement thickness for laminar boundary layer flow using flat plate integral analysis. **(10 Marks)**

OR

6 a. Show the boundary layer approximation used for Prandtl boundary layer equations. **(06 Marks)**

b. Compute enthalpy thickness using control volume approach for thermal boundary layer equations. **(10 Marks)**

Module-4

7 a. Derive an expression for laminar boundary layer equation for incompressible flow with boundary conditions and give the noticable things from simplified set of equations. **(10 Marks)**

b. Explicate the Reynolds analogy as a function of pressure gradient for laminar boundary layer. **(06 Marks)**

OR

8 a. Determine the Blasius solution for flat plate flow using two dimensional similarity solutions. **(10 Marks)**

b. Obtain a flat plate heat transfer for constant wall temperature using boundary layer equations. **(06 Marks)**

Module-5

9 a. List out the parameters affecting the transition to turbulence. Explain it with required sketch. **(08 Marks)**

b. Illustrate the types of free turbulence with suitable sketch. **(08 Marks)**

OR

10 a. Discuss the physical and mathematical description of turbulence. **(08 Marks)**

b. With the help of neat sketch, explain the Schlieren method for flow visualization. **(08 Marks)**

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