



CBCS SCHEME

15AE752

Seventh Semester B.E. Degree Examination, Aug./Sept.2020 Wind Tunnel Techniques

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. For a steady fully developed laminar flow through a duct, the pressure drop per unit length of the duct $\frac{\Delta P}{L}$ is constant in the direction of flow and depends on the average flow velocity V , the hydraulic diameter of the duct D_h , the density ρ and viscosity μ of the fluid. Find out the pertinent dimensionless groups governing the problem using Buckingham's π theorem. (08 Marks)
- b. Define Inertia force, Viscous force, Pressure force, Gravity force and Elastic force. Write the relation for Euler's number, Reynolds number, Mach number and Froude number. (08 Marks)

OR

- 2 a. Drag force F on a high speed aircraft depends on the velocity of flight V , the characteristic geometrical dimension of the aircraft L , the density ρ , viscosity μ and Isentropic bulk modulus of elasticity E_s of ambient air. Using Buckingham's π theorem, find out the dimensionless quantities which describe the phenomenon of drag on the aircraft. (08 Marks)
- b. Explain the concept of physical similarity and different types of similarities in detail. (08 Marks)

Module-2

- 3 a. With a neat sketch explain open circuit subsonic wind tunnel and write its advantages and disadvantages. (08 Marks)
- b. List out the design parameters that should be considered for the construction of a test section. (08 Marks)

OR

- 4 a. With a neat sketch explain closed-circuit continuous flow supersonic wind tunnel. (08 Marks)
- b. What are the different kinds of wind tunnel used in Aeronautical Industry? Classify and explain it based on its purpose. (08 Marks)

Module-3

- 5 a. Explain in detail how the air speed of a test section can be calibrated in a wind tunnel. (08 Marks)
- b. Write short notes on Horizontal buoyancy, Flow angularities and Flow uniformity. (08 Marks)

OR

- 6 a. Explain the structure of Turbulent Boundary Layer. (08 Marks)
- b. What is turbulence factor? Explain the drag sphere and pressure sphere methods to find turbulence. (08 Marks)

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.

Module-4

- 7 a. What are the different types of pressure measuring devices? Explain any two of them. (08 Marks)
b. Name the different types of external balances and explain any two. (08 Marks)

OR

- 8 a. Explain the principle and operation of a Hot Wire Anemometer, both constant current and constant temperature methods. (08 Marks)
b. With a neat sketch explain Shadowgraph method and Schlieren method for flow visualization. (08 Marks)

Module-5

- 9 a. List out and explain the basic requirements of a wind tunnel model design in detail. (08 Marks)
b. Explain the techniques used for generating stall separation data. (08 Marks)

OR

- 10 a. What are the factors to be considered for measuring inlet performance in a wind tunnel? Explain. (08 Marks)
b. What are the flow properties that are associated with the study of unsteady flow in wind tunnel? List and explain. (08 Marks)
