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18AE742

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
Wind Tunnel Techniques

Time: 3 hrs.

Max. Marks: 100

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

Module-1

1   a. Write a short note on the sizing and design requirement of wind tunnel. **(10 Marks)**
     b. Find an expression for the drag force on smooth sphere of diameter D, moving with a uniform velocity V in a fluid having density ρ and dynamic viscosity μ. **(10 Marks)**

OR

2   a. Discuss the following similarities:
        i) Geometric similarity   ii) Kinematic similarity   iii) Dynamic similarity. **(10 Marks)**
     b. The pressure difference ΔP in a pipe of diameter D and length *l* due to turbulent flow depends on the velocity V, viscosity μ; density P and roughness factor K using Buckingham's π-theorem. **(10 Marks)**

Module-2

3   a. Explain with neat sketch open circuit low speed wind tunnel. **(10 Marks)**
     b. A subsonic open circuit wind tunnel runs with a test-section speed of 40m/s the temperature of the lab environment is 16°C. If a turbulent sphere measures the turbulence factor of the tunnel as 1.2, determine the sphere diameter. Assume the test-section pressure as the standard sea-level pressure. **(10 Marks)**

OR

4   a. Write a short note on flow irregularities in subsonic wind tunnel. **(10 Marks)**
     b. Explain with neat sketch induction tunnel. **(10 Marks)**

Module-3

5   a. Discuss the calibration procedure for subsonic wind tunnel. **(10 Marks)**
     b. Explain with sketch horizontal buoyancy effects along the test section. **(10 Marks)**

OR

6   a. Explain with neat sketch strain-gauge balance. **(10 Marks)**
     b. Discuss various application of smoke visualization. **(10 Marks)**

Module-4

7   a. Write a short note on thygrid and oil flow visualization technique. **(10 Marks)**
     b. Find the pressure that would be read by a mercury manometer connected to a static pressure tap located at the wall of a convergent nozzle where the flow Mach number is 0.8 and the nozzle is connected to a tank at a pressure of 3 atmospheres absolute (Assume Y = 1.4, for the gas). **(10 Marks)**

OR

8 a. Briefly explain following:
   i)   Three hole yaw probe
   ii) Find-hole yaw probe.   (10 Marks)
   b. With neat sketch explain working principle of laser Doppler anemometer. (10 Marks)

Module-5

9 a. Explain with neat sketch laminar boundary layer on a flat plate experiment. (10 Marks)
   b. Discuss the water channel for reverse transition experiment.   (10 Marks)

OR

10 a. With neat sketch, explain effect of second throat of supersonic wind tunnel. (10 Marks)
   b. Write short note on guide vanes.   (10 Marks)

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