Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 50087

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Sixth Semester

Aeronautical Engineering

AE 8602 — EXPERIMENTAL AERODYNAMICS

Gas Tables Permitted.

(Regulations 2017)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Determine the viscosity of air at 5°C using Sutherland formula.

2. What are the important components of any measuring instrument?

3. List any four special purpose wind tunnels.

4. Mention the instruments required to check the flow quality in wind tunnels.

5. What are desired properties of smoke for flow visualization?

6. What is the basic principle behind interferometer?

7. What is 'seebeck effect'? Also mention its application.

8. Differentiate between CCA and CTA.

9. State 'Taylor Proudman theorem'.

10. Differentiate error from uncertainty.

PART B — (5 × 13 = 65 marks)

11. (a) Explain the various performance terms associated with measurement systems with suitable example.

Or

    (b) Explain the principle and operation of continuous supersonic wind tunnel with a neat sketch. Also mention its merits and demerits.

12. (a) An open circuit subsonic wind tunnel runs by drawing standard sea level air, If a U-tube mercury manometer connected to a pressure tap in the test-section wall measures 260 mm suction, (i) calculate the test-section velocity, and (ii) estimate the error in the velocity, calculated by assuming the test-section flow as incompressible.

Or

(b) Determine the minimum possible diffuser contraction ratio and the power required for a two-stage compressor to run a closed-circuit supersonic tunnel at M = 2.2. The efficiency of the compressor is 85 percent, $p_{01} = 4$ atm, $T_0 = 330$ K and $A_{TS} = 0.04 m^2$.

13. (a) Explain the principle and operation of the schlieren flow visualization. Also Prove that the schlieren is sensitive to the first derivative of the density.

Or

(b) What is Heleshaw analogy? Also prove that 'The Hele-Shaw apparatus produces a flow pattern which is similar to that of potential flow'.

14. (a) Explain with neat sketch, principle and operation of Constant Temperature Anemometer. Also mention its advantages and disadvantages.

Or

(b) Explain the principle and operation of the following with a neat sketch.

(i)   Pressure Transducers   (6)

(ii) Bimetallic Thermometers   (7)

15. (a) Explain the different multiplexing systems used in data acquisition system with neat sketch.

Or

(b) (i) Write down the general procedure for estimating the uncertainties in the calculated quantities using measured data.   (9)

(ii) List out the uses of uncertainty analysis.   (4)

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PART C — (1 × 15 = 15 marks)

16. (a) Flow in the test-section of a subsonic wind tunnel is at an angle to the tunnel axis. Because of this angularity a pitot-static probe measures the test section velocity as 19.9 m/s, instead of the correct value of 20 m/s. Determine the test-section dynamic pressure that would be indicated by the pitot-static probe, in mm of water, and the flow angularity. The stagnation pressure and temperature of the test-section are standard sea level values.

Or

(b) A supersonic tunnel is designed for Mach 1.6, with isentropic theory. In the actual operation, the friction causes 2 percent error to the test-section Mach number, When the test-section pressure is 143 kPa, (i) what will be the error in the test-section total pressure measured by a pitot probe? (ii) If the mass flow rate per unit throat area is 1412.5 kg/ (m² s), find the test-section velocity.

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