

Reg. No. :

Question Paper Code : 90077

B.E. / B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Sixth Semester

Aeronautical Engineering

AE 8602 – EXPERIMENTAL AERODYNAMICS

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Derive the dimensional formula for viscosity.
2. What do you mean by repeatability, reliability and reproducibility of measurement instruments.
3. What do you mean by open jet and closed jet wind tunnel.
4. What do you mean by yaw probes. Name some commonly used yaw probes.
5. Briefly explain some methods of flow visualization used for subsonic flow.
6. What kind of analogy is used in an Electrolytic Tank.
7. Explain briefly how test section velocity in a low-speed wind tunnel is calculated.
8. A substance / material used in measurement of temperature undergoes certain changes and must admit a constant repetition without deterioration. Mention some of the commonly seen changes on temperature measuring substances.
9. What do you understand by Ekman boundary Layer and Ekman suction.
10. What is the sequence of operation involved in any data acquisition system.

PART B — (5 × 13 = 65 marks)

11. (a) (i) What are the different types of measurements in the field of experimental fluid mechanics. (9)

(ii) Define pathline and streamlines. (4)

Or

(b) (i) What are the main components of any measuring system? (9)

(ii) Define Mach Number and Reynolds Number. (4)

12. (a) What is turbulence factor? How it is measured using a sphere?

Or

(b) With the help of a neat figure, explain the arrangement and functioning of a wire – type force balance.

13. (a) Explain how shadowgraph is used in visualization of compressible flows.

Or

(b) What do you understand by Hydraulic analogy? Explain with the help of governing equations.

14. (a) Explain the principle and functioning of pressure transducers. What are their advantages and disadvantages over other pressure gauges and instruments.

Or

(b) Explain the principle and operation of Laser Doppler Anemometry. What are its advantages.

15. (a) Using appropriate equations, describe Taylor - Proudman theorem. Briefly describe the experiments on Taylor - Proudman theorem.

Or

(b) What are the main uses of uncertainty analysis. Formulate an expression for estimating the uncertainties in any calculated value from measured data.

PART C — (1 × 15 = 15 marks)

16. (a) The ratio of lengths of a submarine and its model is 30:1. The speed of submarine is 10m/s. The model is to be tested in a wind tunnel. Find the speed of air in the wind tunnel. Also determine the ratio of drag between the model and its prototype.

(Take the value of kinematic viscosities for sea water and air to be $1.2 \times 10^{-6} \text{ m}^2/\text{s}$ and $1.6 \times 10^{-6} \text{ m}^2/\text{s}$, respectively. Density of sea water and air is given as 1030 kg/m^3 and 1.24 kg/m^3 , respectively.)

Or

- (b) (i) Derive an expression for coefficient of loss in cylindrical section of a wind tunnel.
- (ii) An open-circuit subsonic wind tunnel of test – section $1.2 \text{ m} \times 0.9 \text{ m}$ is run by a 110 kW motor. If the test – section speed is 90m/s, calculate the energy ratio of the tunnel. Also, find the total loss in the tunnel in terms of test – section kinetic energy. Take the air density as the standard sea-level value.

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