CBCS SCHEME

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18AE/AS742

Seventh Semester B.E. Degree Examination, June/July 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. Consider an airfoil is at an angle of attack α. The Resultant aerodynamic force 'F' depends on Free Stream Velocity 'V_∞', Free Stream density 'ρ_∞', Visocosity of Fluid 'μ', Chord length of airfoil 'C' and the speed of sound 'a'. Using Buckingham's π-theorem. Obtain the relation for aerodynamic force 'F'. **(10 Marks)**

b. Define the following and write the expression :
(i) Reynold's number
(ii) Froude's number
(iii) Weber's number
(iv) Euler's number
(v) Mach number **(10 Marks)**

OR

2 a. Draw and explain the parts and function of open circuit low speed subsonic wind tunnel. **(10 Marks)**

b. Sketch the layout of Hypersonic Tunnel and explain the operation. **(10 Marks)**

Module-2

3 a. Explain about Horizontal Buoyancy in wind tunnels. **(08 Marks)**

b. Explain the calibration of subsonic wind tunnel in detail. **(12 Marks)**

OR

4 a. Discuss about Turbulence measurement techniques used in wind tunnels. **(10 Marks)**

b. Explain the importance of calibration and the calibration of supersonic wind tunnel. **(10 Marks)**

Module-3

5 a. Discuss the applications of Three component Balance and Six-component Balance systems in wind tunnel. **(10 Marks)**

b. Explain the operation of Pitot-static tube with neat sketch and obtain expression for velocity in a simple pressure head. **(10 Marks)**

OR

6 a. Describe the methods used for low speed flow visualization techniques. **(10 Marks)**

b. Draw the layout and explain the working of,
(i) Schlieren system.
(ii) Mach-Zhender Interferometer. **(10 Marks)**

Module-4

7 a. Discuss about the following :
   (i) Store Seperation test.
   (ii) Intake test. **(10 Marks)**

b. With neat sketch, explain about the following :
   (i) Laser Doppler Axemometry.
   (ii) Particle Image Velocimetry. **(10 Marks)**

OR

8 a. Draw and explain the principle of Flush mounted pressure Transducers. **(10 Marks)**

b. Discuss about unsteady pressure measurement technique in wind tunnel. **(10 Marks)**

Module-5

9 a. Explain the general design criteria for each part of supersonic wind tunnel with neat sketch. **(16 Marks)**

b. Explain the purpose of settling chamber. **(04 Marks)**

OR

10 a. Obtain the expression for power economy by choice of working fluid and its limitations. **(08 Marks)**

b. With neat sketch, explain the design considerations for a subsonic closed circuit wind tunnel. **(12 Marks)**

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