CBCS SCHEME

USN | | | | | | | | | | |

15AE42

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Aerodynamics – I

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Derive energy equation in terms of integral and differential form using control volume approach. **(12 Marks)**

b. The flowfield of a fluid is given by $V = xy\vec{i} + 2yz\vec{j} - (yz + z^2)\vec{k}$. Verify whether the flow is incompressible (or) compressible flow. Also verify rotational or irrotational flow. **(04 Marks)**

OR

2 a. Explain the following terms:
i) Pathlines
ii) Stream lines
iii) Mass flux
iv) Circulation
v) Angular velocity
vi) Vorticity
If required with sketch. **(12 Marks)**

b. At a point in an airflow, the temperature and velocity are 320K and 1000m/s. Calculate speed of sound and Mach number of the flow. **(04 Marks)**

Module-2

3 a. Explain the types of drag. **(08 Marks)**

b. Calculate the airfoil moment from measured surface pressure distribution. **(08 Marks)**

OR

4 a. Explain the following terms:
i) Aerodynamic centre
ii) Centre of pressure
iii) Stall. **(06 Marks)**

b. Calculate the lift and drag of the airfoil from measured surface pressure distribution. **(10 Marks)**

Module-3

5 a. Explain D'Alemberts paradox and the Magnus effect. **(04 Marks)**

b. Derive an expression for surface pressure coefficient over a circular cylinder using non-lifting flow. **(12 Marks)**

OR

6 a. Derive an expression for classical thin airfoil theory for symmetric airfoil and write its advantages. **(12 Marks)**

b. For a thin flat plate at 5 degree angle of attack. Calculate:
i) Lift coefficient
ii) Moment coefficient about leading edge. **(04 Marks)**

Module-4

7 a. Derive Prandtl's classical lifting line theory and explain the applications. **(12 Marks)**

b. Explain: i) Downwash ii) Induced drag. **(04 Marks)**

OR

8 a. Find the velocity induced by infinite and semi-infinite vortex filaments using biot-Savart law. **(08 Marks)**

b. Explain the advantage of extended lifting line theory. **(04 Marks)**

c. Explain about vortex lattice numerical methods and its applications. **(04 Marks)**

Module-5

9 a. Describe about ground effects and simplified horse shoe vortex. **(08 Marks)**

b. Explain the concept of swept wing and sweep effects. Write the advantages of sweep. **(08 Marks)**

OR

10 a. With neat sketch explain trailing edge high lift devices. **(08 Marks)**

b. Explain:

i) Critical Mach Number

ii) Drag Divergence Mach Number

iii) Transonic Area Rule. **(08 Marks)**

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