Code No: R09222101 | R09 | SET-1

B.Tech II Year - II Semester Examinations, April-May, 2012
AERODYNAMICS - I
(Aeronautical Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

1. Derive the Energy equation in integral form, considering a control volume in fluid flow. [15]

2. Define stream function and velocity potential. Establish the conditions under which these satisfy Laplace equation. [15]

3. Write short notes on
   a) boundary layer
   b) surface friction drag
   c) Reynolds analogy. [5 + 5 + 5]

4. State and explain
   a) Kutta condition
   b) Kelvin's circulation theorem
   c) Starting and bound vortices. [5 + 5 + 5]

5. Derive the fundamental equation of Prandtl's lifting line theory. [15]

6. Derive an expression for the velocity of incompressible flow over a sphere. [15]

7.a) Define Reynolds number and its effect on boundary layer thickness.
  b) Describe power augmented lift.
  c) Describe winglets. [8+3+4]

8. Derive an expression for the thrust generated by a propeller using blade element theory. [15]

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Code No: R09222101 | R09 | SET-2

B.Tech II Year - II Semester Examinations, April-May, 2012
AERODYNAMICS - I
(Aeronautical Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

1. Explain dimensional analysis and define aerodynamic force and moment coefficients. [15]

2. Define the terms source and sink. Obtain the expressions for the velocity components in a flow which is a combination of uniform flow, a sink and a source and a vortex. [15]

3.a) Explain the concept of thermal boundary layer.
b) State the solutions for the thickness of laminar and turbulent boundary layers and compare. [8+7]

4. Derive the fundamental equation of thin airfoil theory. [15]

5. Explain
a) Biot – Savart Law
b) Helmholtz's theorems
c) Starting, bound and trailing vortices. [5+5+5]

6. Describe subsonic flows over delta wings. [15]

7. Write short notes on
a) NACA airfoils
b) Drag polar
c) Multi-element airfoils. [5+5+5]

8. Derive an expression for the thrust generated by a propeller based on momentum theory. [15]

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Code No: R09222101 | R09 | SET-3

B.Tech II Year - II Semester Examinations, April-May, 2012
AERODYNAMICS - I
(Aeronautical Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

1. Considering a control volume, derive the momentum equation for a fluid in integral form. [15]

2. Derive the expression for the coefficient of pressure over a right circular cylinder in a uniform flow and bring out D'Alembert's Paradox. [15]

3. Write the Navier – Stokes equations and explain all the terms in the equations. [15]

4. Derive an expression for the lift slope of a symmetrical airfoil with the help of the fundamental equation of thin airfoil theory. [15]

5. Write short notes on
   a) Vortex filament
   b) Lift over a wing
   c) Moment coefficient about the quarter chord point. [5+5+5]

6. Compare the theoretical and real flows over a sphere with the help of neat sketches. [15]

7. Explain the different components of drag and explain how they can be reduced for a wing. [15]

8. Write short notes on
   a) Geometry of propeller
   b) Vortex system of an airscrew
   c) Geometric pitch of a propeller
   d) Power coefficients. [4+3+4+4]

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Code No: R09222101 | R09 | SET-4

B.Tech II Year - II Semester Examinations, April-May, 2012
AERODYNAMICS - I
(Aeronautical Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

1. Derive the continuity equation for the mass of a fluid in a finite control volume in a flow in the integral form. From this derive the continuity equation relating the flow field variables at a point in a fluid flow in the form of a differential equation. [15]

2. Define vorticity and prove that the curl of the velocity is equal to the vorticity in a velocity field. [15]

3.a) State the approximate solutions for the thicknesses of the laminar, turbulent boundary layers and explain.
b) Describe transition. [9+6]

4. Describe the vortex panel method of estimating the lift coefficient. [15]

5. State the fundamental equation of Prandtl's lifting line theory and explain all the terms clearly. Making necessary assumptions, find an expression for the induced drag over a wing. State the assumptions clearly. [15]

6. Define three dimensional source and doublet. Derive the expressions for an incompressible flow over a sphere. [15]

7. Explain
a) NACA airfoils
b) Leading edge extensions to wings
c) Critical Reynolds number. [5 + 5 + 5]

8. Derive an expression for the thrust generated by a propeller. Explain all the terms used very clearly. [15]

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