Code No: 07A42101 **R07** **Set No. 2**

II B.Tech II Semester Examinations,April/May 2012
AERODYNAMICS - I
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Describe a sub-sonic wind tunnel.
   (b) Describe a bank of manometers.
   (c) Describe how drag of a model can be obtained experimentally. [5+5+6]

2. Derive the fundamental equation of thin airfoil theory, $(1/2\pi)\int[\{\gamma(\xi)d\xi\}/\{x-\xi\}] = V\{\alpha-(dz/dx)\}$, where the integration is carried out from the leading edge to the trailing edge of a symmetrical airfoil and prove that the lift coefficient is proportional to angle of attack for a symmetrical airfoil. [16]

3. Describe the flows viscous, inviscid, compressible, incompressible, rotational and irrotational, and the effects on a wing. [16]

4. A solution to the Laplace equation for incompressible potential flow and pressure distribution over a circular cylinder is sought by a numerical technique. Making use 16 numbers of constant source panels develop the procedure for obtaining pressure distribution over a given circular cylinder. [16]

5. Derive how vortex panel method is used for expressing the kutta condition for panels immediately above and below the trailing edge. [16]

6. Explain Kutta-Zhukovsky transformation with the help of one example. [16]

7. Consider a low aspect ratio wing planform with LE and TE taper. Make use of lifting surface theory to develop the following expression (present your work) $\omega(x,y) = 1/4\pi\iint[(x-\xi)\gamma(\xi,\eta)+(y-\eta)\delta(\xi,\eta)]/\left[(x-\xi)^2+(y-\eta)^2\right]^{3/2} d\xi d\eta$ $-1/4\iint[\gamma-\eta\delta(\xi,\eta)]/\left[(x-\xi)+(y-\eta)^2\right]^{3/2} d\xi\, d\eta$ where the terminology is standard for such work in aerodynamics. [16]

8. What is effective aspect ratio? Why does the effective angle of attack change at the local airfoil sections of a wing? Explain induced drag. [16]

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Code No: 07A42101 **R07** **Set No. 4**

II B.Tech II Semester Examinations,April/May 2012
AERODYNAMICS - I
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. What is effective aspect ratio? Why does the effective angle of attack change at the local airfoil sections of a wing? Explain induced drag. [16]

2. Derive the fundamental equation of thin airfoil theory, $(1/2\pi)\int[\{\gamma(\xi)\mathrm{d}\xi\}/\{\mathrm{x}-\xi\}] = \mathrm{V}\{\alpha-(\mathrm{dz/dx})\}$, where the integration is carried out from the leading edge to the trailing edge of a symmetrical airfoil and prove that the lift coefficient is proportional to angle of attack for a symmetrical airfoil. [16]

3. Consider a low aspect ratio wing planform with LE and TE taper. Make use of lifting surface theory to develop the following expression (present your work) $\omega(x,y) = 1/4\pi\iint[(x-\xi)\gamma(\xi,\eta)+(y-\eta)\delta(\xi,\eta)]/\left[(x-\xi)^2+(y-\eta)^2\right]^{3/2} d\xi d\eta$ $-1/4\iint[\gamma-\eta\delta(\xi,\eta)]/\left[(x-\xi)+(y-\eta)^2\right]^{3/2} d\xi\, d\eta$ where the terminology is standard for such work in aerodynamics. [16]

4. Describe the flows viscous, inviscid, compressible, incompressible, rotational and irrotational, and the effects on a wing. [16]

5. (a) Describe a sub-sonic wind tunnel.
   (b) Describe a bank of manometers.
   (c) Describe how drag of a model can be obtained experimentally. [5+5+6]

6. Explain Kutta-Zhukovsky transformation with the help of one example. [16]

7. Derive how vortex panel method is used for expressing the kutta condition for panels immediately above and below the trailing edge. [16]

8. A solution to the Laplace equation for incompressible potential flow and pressure distribution over a circular cylinder is sought by a numerical technique. Making use 16 numbers constant of source panels develop the procedure for obtaining pressure distribution over a given circular cylinder. [16]

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Code No: 07A42101 **R07** **Set No. 1**

II B.Tech II Semester Examinations,April/May 2012
AERODYNAMICS - I
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Describe a sub-sonic wind tunnel.
   (b) Describe a bank of manometers.
   (c) Describe how drag of a model can be obtained experimentally. [5+5+6]

2. Derive the fundamental equation of thin airfoil theory, $(1/2\pi)\int[\{\gamma(\xi)d\xi\}/\{x-\xi\}] = V\{\alpha-(dz/dx)\}$, where the integration is carried out from the leading edge to the trailing edge of a symmetrical airfoil and prove that the lift coefficient is proportional to angle of attack for a symmetrical airfoil. [16]

3. Explain Kutta-Zhukovsky transformation with the help of one example. [16]

4. A solution to the Laplace equation for incompressible potential flow and pressure distribution over a circular cylinder is sought by a numerical technique. Making use 16 numbers of constant source panels develop the procedure for obtaining pressure distribution over a given circular cylinder. [16]

5. What is effective aspect ratio? Why does the effective angle of attack change at the local airfoil sections of a wing? Explain induced drag. [16]

6. Consider a low aspect ratio wing planform with LE and TE taper. Make use of lifting surface theory to develop the following expression (present your work) $\omega(x,y) = 1/4\pi\iint[(x-\xi)\gamma(\xi,\eta)+(y-\eta)\delta(\xi,\eta)]/\left[(x-\xi)^2+(y-\eta)^2\right]^{3/2} d\xi d\eta$ $-1/4\iint[\gamma-\eta\delta(\xi,\eta)]/\left[(x-\xi)+(y-\eta)^2\right]^{3/2} d\xi\, d\eta$ where the terminology is standard for such work in aerodynamics. [16]

7. Describe the flows viscous, inviscid, compressible, incompressible, rotational and irrotational, and the effects on a wing. [16]

8. Derive how vortex panel method is used for expressing the kutta condition for panels immediately above and below the trailing edge. [16]

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Code No: 07A42101 **R07** **Set No. 3**

II B.Tech II Semester Examinations,April/May 2012
AERODYNAMICS - I
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Derive the fundamental equation of thin airfoil theory, $(1/2\pi)\int[\{\gamma(\xi)\mathrm{d}\xi\}/\{\mathrm{x}-\xi\}] = \mathrm{V}\{\alpha - (\mathrm{dz/dx})\}$, where the integration is carried out from the leading edge to the trailing edge of a symmetrical airfoil and prove that the lift coefficient is proportional to angle of attack for a symmetrical airfoil. [16]

2. Derive how vortex panel method is used for expressing the kutta condition for panels immediately above and below the trailing edge. [16]

3. What is effective aspect ratio? Why does the effective angle of attack change at the local airfoil sections of a wing? Explain induced drag. [16]

4. (a) Describe a sub-sonic wind tunnel.
   (b) Describe a bank of manometers.
   (c) Describe how drag of a model can be obtained experimentally. [5+5+6]

5. Consider a low aspect ratio wing planform with LE and TE taper. Make use of lifting surface theory to develop the following expression (present your work)
   $\omega(x,y) = 1/4\pi \iint [(x-\xi)\gamma(\xi,\eta) + (y-\eta)\delta(\xi,\eta)] / \left[(x-\xi)^2 + (y-\eta)^2\right]^{3/2} d\xi d\eta$
   $-1/4 \iint [\gamma - \eta\delta(\xi,\eta)] / \left[(x-\xi) + (y-\eta)^2\right]^{3/2} d\xi\, d\eta$ where the terminology is standard for such work in aerodynamics. [16]

6. Describe the various flows viscous, inviscid, compressible, incompressible, rotational and irrotational, and the effects on a wing. [16]

7. Explain Kutta-Zhukovsky transformation with the help of one example. [16]

8. A solution to the Laplace equation for incompressible potential flow and pressure distribution over a circular cylinder is sought by a numerical technique. Making use 16 numbers of constant source panels develop the procedure for obtaining pressure distribution over a given circular cylinder. [16]

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