Code No: 07A72102 **R07** **Set No. 2**

IV B.Tech I Semester Examinations,NOVEMBER 2010
COMPUTATIONAL AERO DYNAMICS
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Write short notes on
   (a) Conservation form
   (b) Non-conservation form of governing flow equations. [8+8]
2. (a) Draw suitable mesh and type of the coordinate system to investigate the flow over airfoil.
   (b) Write a short notes on direct and invese transformations. [8+8]
3. Let $y=x^2$:
   (a) Calculate $\frac{dy}{dx}$ using forward difference scheme with $\Delta x=0.1$ at $x=1$
   (b) Find exact value
   (c) % error. [8+4+4]
4. Compare algebric and partial differential equation methods for grid generation.[16]
5. Explain conservation and non-conservation forms of governing flow equations with illustrations from continuity equation. Comment on Integral versus differential form of the governing flow equations. [16]
6. (a) How Computational Fluid Dynamics is helpful as a research tool? Illustrate with an example?
   (b) How Computational Fluid Dynamics is useful as a design tool? Illustrate with an example? [8+8]
7. Explain the significance of the grid clustering in compressible fluid flow applications. [16]
8. Explain the mathematical and physical nature of flows governed by parabolic equations with an illustration of a steady boundary layer flow. [16]

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Code No: 07A72102 **R07** **Set No. 4**

IV B.Tech I Semester Examinations,NOVEMBER 2010
COMPUTATIONAL AERO DYNAMICS
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain the use of boundary fitted co-ordinate system to define the boundary conditions on the surface of airfoil. [16]
2. Write short notes on the following:
   (a) Well-posed problems.
   (b) Characteristic curves. [8+8]
3. (a) Explain shock capturing method and state its advantages and disadvantages.
   (b) Explain shock fitting method and state its advantages and disadvantages. [8+8]
4. How does the grid clustering helps in capturing shock waves? [16]
5. Explain Von Newmann stability analysis with an example. [16]
6. (a) What is Computational Fluid Dynamics? Explain its advantages and disadvantages?
   (b) Define vector processors and parallel processors and explain their role in Computational Fluid Dynamics. [8+8]
7. What are the available structured grid generation techniques and explain the conformal mapping method. [16]
8. Derive the energy equation in terms of total energy for a viscous flow on the basis of flow model of infinitesimally small fluid element moving with the flow. [16]

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Code No: 07A72102 **R07** **Set No. 1**

IV B.Tech I Semester Examinations,NOVEMBER 2010
COMPUTATIONAL AERO DYNAMICS
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Compare relative advantages and disadvantages of theoretical, experimental and computational approaches in solving fluid flow problems.
   (b) Discuss any one application of computational fluid dynamics in aerospace industry. [8+8]
2. How shock capturing and shock fitting techniques are helpful in handling shocks? Discuss their relative merits and demerits. [16]
3. Enumerate grid clustering with any two applications. [16]
4. What are metrics and derive the relationship between the direct and inverse metrics. [16]

$$i.e. \quad \frac{\partial \xi}{\partial x} = \frac{1}{J}\frac{\partial y}{\partial \eta} \qquad \frac{\partial \eta}{\partial x} = -\frac{1}{J}\frac{\partial y}{\partial \xi}$$
$$\frac{\partial \xi}{\partial y} = -\frac{1}{J}\frac{\partial x}{\partial \eta} \qquad \frac{\partial \eta}{\partial y} = \frac{1}{J}\frac{\partial x}{\partial \xi}$$

5. (a) Explain the implicit formulation with an example.
   (b) What is the use of Thomas algorithm. [12+4]
6. What are the available structured grid generation techniques and explain elliptic grid generation. [16]
7. Discuss the mathematical and physical nature of flows governed by elliptic equations with an illustration of incompressible, inviscid flow. Explain Newmann and Dirichlet boundary conditions. [16]
8. Derive the energy equation in terms of internal energy for a viscous flow on the basis of flow model of infinitesimally small fluid element moving with the flow.[16]

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Code No: 07A72102 **R07** **Set No. 3**

IV B.Tech I Semester Examinations,NOVEMBER 2010
COMPUTATIONAL AERO DYNAMICS
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Use the second-order accurate central difference approximation and the first-order forward difference approximation to evaluate $\frac{\partial e^x}{\partial x}$ at x= 1,a step size of $\Delta x = 0.1$ is to be employed . Recall that e= 2.71828. [16]
2. Write a short notes on the role of mathematics to reduce the governing equations in to transformed form. [16]
3. What is the importance of fine mesh very close to he boundary in viscous fluid flow application. [16]
4. Write short notes on the following:
   (a) Strong and weak conservation forms of governing equations.
   (b) Shock capturing method. [8+8]
5. Discuss the mathematical and physical behavior of flows governed by parabolic equations with an example of unsteady thermal conduction in two and three dimensions. [16]
6. Explain the elliptic grid generation with simply connected domain and doubly connected domain. [16]
7. Derive energy equation in integral form. [16]
8. (a) What is CFD? Explain the reasons for the present growth of CFD in aerospace applications.
   (b) Define vector processors and parallel processore and explain their role in CFD. [8+8]

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