Code No: R05322104 **R05** **Set No. 2**

III B.Tech II Semester Examinations,December 2010
COMPUTATIONAL AERODYNAMICS
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain Von Newmann stability analysis with an example. [16]
2. Derive integral and differential forms of continuity equations on the basis of flow models of control volume moving with the fluid and infinitesimally small element moving with the fluid respectively. [16]
3. Explain the mathematical and physical nature of flows governed by hyperbolic equations with an illustration of steady, inviscid, supersonic flow over a two-dimensional circular-arc airfoil. [16]
4. Write short notes on the following:
   (a) Strong and weak conservation forms of governing equations.
   (b) Shock capturing method. [8+8]
5. (a) What is CFD? Explain the reasons for the present growth of CFD in aerospace applications.
   (b) Explain briefly finite control volume approach and infinitesimal fluid element approach of models of fluid flow. [8+8]
6. (a) What are the available structured grid generation techniques?
   (b) Explain the algebraic grid generation technique. [8+8]
7. What are metrics and derive the relationship between the direct and inverse metrics. [16]

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

8. Explain the two methods available to develop hyperbolic grid generator. [16]

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Code No: R05322104 **R05** **Set No. 4**

III B.Tech II Semester Examinations,December 2010
COMPUTATIONAL AERODYNAMICS
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is CFD? Explain the reasons for the present growth of CFD in aerospace applications.
   (b) Explain briefly finite control volume approach and infinitesimal fluid element approach of models of fluid flow. [8+8]

2. Explain the mathematical and physical nature of flows governed by hyperbolic equations with an illustration of steady, inviscid, supersonic flow over a two-dimensional circular-arc airfoil. [16]

3. (a) What are the available structured grid generation techniques?
   (b) Explain the algebraic grid generation technique. [8+8]

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. Explain Von Newmann stability analysis with an example. [16]

6. Write short notes on the following:
   (a) Strong and weak conservation forms of governing equations.
   (b) Shock capturing method. [8+8]

7. Derive integral and differential forms of continuity equations on the basis of flow models of control volume moving with the fluid and infinitesimally small element moving with the fluid respectively. [16]

8. Explain the two methods available to develop hyperbolic grid generator. [16]

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Code No: R05322104 **R05** **Set No. 1**

III B.Tech II Semester Examinations,December 2010
COMPUTATIONAL AERODYNAMICS
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What are the available structured grid generation techniques?
   (b) Explain the algebraic grid generation technique. [8+8]
2. What are metrics and derive the relationship between the direct and inverse metrics. [16]

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

3. (a) What is CFD? Explain the reasons for the present growth of CFD in aerospace applications.
   (b) Explain briefly finite control volume approach and infinitesimal fluid element approach of models of fluid flow. [8+8]
4. Explain Von Newmann stability analysis with an example. [16]
5. Derive integral and differential forms of continuity equations on the basis of flow models of control volume moving with the fluid and infinitesimally small element moving with the fluid respectively. [16]
6. Explain the two methods available to develop hyperbolic grid generator. [16]
7. Write short notes on the following:
   (a) Strong and weak conservation forms of governing equations.
   (b) Shock capturing method. [8+8]
8. Explain the mathematical and physical nature of flows governed by hyperbolic equations with an illustration of steady, inviscid, supersonic flow over a two-dimensional circular-arc airfoil. [16]

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Code No: R05322104 **R05** **Set No. 3**

III B.Tech II Semester Examinations,December 2010
COMPUTATIONAL AERODYNAMICS
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain the two methods available to develop hyperbolic grid generator. [16]

2. What are metrics and derive the relationship between the direct and inverse metrics. [16]

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

3. Explain the mathematical and physical nature of flows governed by hyperbolic equations with an illustration of steady, inviscid, supersonic flow over a two-dimensional circular-arc airfoil. [16]

4. Derive integral and differential forms of continuity equations on the basis of flow models of control volume moving with the fluid and infinitesimally small element moving with the fluid respectively. [16]

5. Explain Von Newmann stability analysis with an example. [16]

6. (a) What is CFD? Explain the reasons for the present growth of CFD in aerospace applications.
   (b) Explain briefly finite control volume approach and infinitesimal fluid element approach of models of fluid flow. [8+8]

7. (a) What are the available structured grid generation techniques?
   (b) Explain the algebraic grid generation technique. [8+8]

8. Write short notes on the following:
   (a) Strong and weak conservation forms of governing equations.
   (b) Shock capturing method. [8+8]

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