Code No: R05410306 **Set No.1**

IV B.Tech. I Semester Regular Examinations, November -2008
COMPUTATIONAL FLUID DYNAMICS
(Mechanical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Write an algorithm for solving a system of simultaneous linear algebraic equations using Gauss Elimination Method iteration method.
   (b) Solve the following equations by Gauss-Siedel iteration Method:
   x+2y+2z = 4
   2x-y+3z = 9
   3x-y-z = 2. [8+8]

2. Explain the steps to solve a fluid dynamics problem. [16]

3. (a) Consider a long rectangular bar which experiences two-dimensional steady state heat conduction. Obtain the governing equation. Discuss various types of possible boundary conditions.
   (b) Obtain the finite difference equation for the above problem and describe a method of solving the above equations. [8+8]

4. Distinguish and compare the differences between explicit and implicit methods and explain the difference with a suitable example. [16]

5. Explain the terms consistency, stability, convergence and Lax's equivalence theorem. [16]

6. Derive the concept of artificial equation with integral approach in conservation form and from this obtain non conservation integral form. [16]

7. Explain the concept of artificial viscosity in the finite difference schemes. Is it a friend or a trouble maker in dealing with CFD problems. [16]

8. Explain the need for turbulence modeling in dealing with CFD problems. What are the various turbulence models used in CFD problems. [16]

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Code No: R05410306 **Set No.2**

IV B.Tech. I Semester Regular Examinations, November -2008
COMPUTATIONAL FLUID DYNAMICS
(Mechanical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Write an algorithm for obtaining the inverse of a matrix.
   (b) Solve the following equations by Gauss-Elimination method: [8+8]
   x+3y+6z =2
   3x-y+4z =9
   x-4y+2z =7.

2. Consider steady state heat loss through a straight long fin with temperature of the fin base and the surrounding fluid and Tb and Tf respectively. Assume the heat loss from the end face of to be negligible. Derive the governing equation for the problem. [16]

3. Distinguish between discretization and round-off errors. Compare them with suitable examples. [16]

4. Show that forward time and central space differencing for first order wave equation results in unstable scheme using Von Neumann stability criterian and comment. [16]

5. Derive the continuity equation with integral approach in non conservation form and from this obtain conservation integral form. [16]

6. Express the complete Navier-Stokes equations and derive Bernoulli's equation from it explaining the assumptions made in the process. [16]

7. Discuss the various relaxation techniques. [16]

8. Derive the Quasi one-dimensional compressible flow equations for flow through a nozzle. Explain the method of capturing the shock in dealing with the nozzle. [16]

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Code No: R05410306 **Set No.3**

IV B.Tech. I Semester Regular Examinations, November -2008
COMPUTATIONAL FLUID DYNAMICS
(Mechanical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Compare and contrast direct methods and iteration methods in solving a system simultaneous linear algebraic equations.
   (b) Solve the following equations by Gauss-Siedel Iteration Method: [8+8]
   5x+2y+z =12
   x+4y+2z =15
   x+2y+5z =20.
2. Explain the steps to solve a fluid dynamics problem. [16]
3. Derive the stability condition for CTCS discretization of second order wave equation using Von Neumann stability analysis. [16]
4. Derive the finite difference expressions for a second order derivative with forward, backward and central difference approximations. [16]
5. Obtain the CFL condition for Lax method of discretization of first order wave equation. [16]
6. Derive the continuity equation with differential approach in conservation form and from this obtain non conservation differential form. [16]
7. Explain the various computer graphic techniques used in CFD. [16]
8. Explain the need for turbulence modeling in dealing with CFD problems. What are the various turbulence models used in CFD problems. [16]

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Code No: R05410306 **Set No.4**

IV B.Tech. I Semester Regular Examinations, November -2008
COMPUTATIONAL FLUID DYNAMICS
(Mechanical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Write an algorithm for solving a system of simultaneous linear algebraic equations using Gauss-Siedel Iteration method.
   (b) Solve the following equations by Gauss-Elimination method: [8+8]
   2x+y+z =10
   3x+2y+3z =18
   X+4y+9z =16.

2. Consider steady state heat loss through a straight long fin with temperatures of the fin base and the surrounding fluid are Tb and Tf respectively. Assume the heat loss from the end face of to be negligible. Derive the governing equation for the problem. [16]

3. (a) Obtain the finite difference scheme for the steady one-dimensional heat conduction equation using Dufort-Franket scheme.
   (b) Check for the consistency of the above scheme and obtain the conditions for consistency. [8+8]

4. (a) Obtain the forward time and central space finite difference equation for unsteady one dimensional heat conduction equation without heat generation.
   (b) Analyze the stability of the above scheme using Von Neumann stability analysis. [8+8]

5. Derive the equation of conservation of energy from the first principles. 16]

6. Derive the Navier-Stokes equations in conservation form. [16]

7. Explain the reasons for adapting Alternate Direction Implicit methods in dealing with multi-dimensional problems. Describe the method with a suitable heat transfer problem. [16]

8. Derive the Quasi one-dimensional compressible flow equations for flow through a nozzle. Explain the method of capturing the shock in dealing with the nozzle flows. [16]

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