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15AE72

Seventh Semester B.E. Degree Examination, July/August 2022
Computational Fluid Dynamics

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Write about governing equations used in CFD. Also write the governing equations in Integral and differential form. (08 Marks)
b. Explain about CFD and parallel computing. Also write its advantages and disadvantages. (08 Marks)

OR

- 2 a. Derive the expression for divergence of velocity and its physical meaning. (06 Marks)
b. Explain the following:
i) Dirichlet and Neumann boundary conditions. (04 Marks)
ii) Shock-Capturing and shock fitting methods. (04 Marks)
iii) Viscous flow and In viscid flow. (02 Marks)

Module-2

- 3 a. Explain the general behavior of hyperbolic equation with neat sketch. (08 Marks)
b. Explain Cramer rule and Eigen value methods for classification of partial differential equations. (08 Marks)

OR

- 4 a. Describe the general behavior of different classes of partial differential equation. (10 Marks)
b. Find the type of partial differential equations:
i) $\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0$
ii) $\frac{\partial T}{\partial t} = \alpha \frac{\partial^2 T}{\partial x^2}$ (α is constant)
iii) $\frac{\partial^2 u}{\partial t^2} + C^2 \frac{\partial^2 u}{\partial x^2} = 0$ (C is constant). (06 Marks)

Module-3

- 5 a. Explain the need for grid generation and body fitted coordinate system. (08 Marks)
b. Explain Adaptive grids with neat sketch and write its advantages. (08 Marks)

OR

- 6 a. Explain the features of structured grid and unstructured grids. (10 Marks)
b. Explain about algebraic grid generation. (06 Marks)

Module-4

- 7 a. Compare and differentiate between Explicit and Implicit approach of Finite difference equations. (10 Marks)
- b. Write about following with sketch:
- i) Up-wind scheme
 - ii) Numerical and artificial viscosity. (06 Marks)

OR

- 8 a. Explain time marching and space marching technique in CFD. (10 Marks)
- b. Write about following:
- i) Lax-Wendroff technique
 - ii) Errors and stability analysis. (06 Marks)

Module-5

- 9 a. Explain about cell centered and cell vertex techniques. (08 Marks)
- b. Write about the following:
- i) Numerical dissipation
 - ii) Numerical dispersion. (08 Marks)

OR

- 10 a. Explain about following with neat sketch:
- i) Upwind biasing
 - ii) Flux vector splitting. (08 Marks)
- b. Using explicit and Implicit scheme explain about temporal discretization. (08 Marks)

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