Exam. Code: 0944
Sub. Code: 7081

(24)

1059

B. Engg. (Mechanical Engg.)

8th Semester

MEC-803: Computational Fluid Dynamics

Time allowed: 3 Hours | Max. Marks: 50

NOTE: ***Attempt five questions in all, including Q. No. 1 which is compulsory and selecting atleast two questions from each Unit.***

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I. **Attempt the following: -**

a) Distinguish between conservation and non-conservation forms of fluid flow.

b) Define discretization and round off error. Explain the difference between them.

c) Give an example of each elliptic and parabolic partial differential equation.

d) State the disadvantages of first order upwind scheme.

e) Write down the methods available for grid generation. Why is staggered grid adopted for incompressible flows? (5×2)

UNIT-I

II. (a) Discuss couple of examples where CFD can be used to solve a design problem and couple of other cases where it cannot be used.

(b) State important features of governing equations used as basis for problem formulation for fluid cases. (5+5)

III. Derive the Navier-Stokes equations for a viscous flow in partial differential non-conservative form. (10)

IV. (a) With suitable examples, explain the physical significance of elliptic, parabolic and hyperbolic partial differential equations.

(b) What are the discretization techniques and how do you discretize the equations for subsonic and supersonic flows? (4+6)

UNIT-II

V. (a) Write a note on Explicit and Implicit approaches in discretization of PDEs with a suitable example.

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(b) Describe (i) consistency, (ii) stability and convergence of numerical solutions of any fluid flow problem. (5+5)

VI. (a) List out differences between finite difference and finite volume methods.

(b) Discuss the properties of discretization schemes and explain upwind discretization applied to finite volume method. (5+5)

VII. (a) Show how the staggered grid is implemented for the pressure equation.

(b) Write down the steps involved in SIMPLE-R algorithm. Also list the advantages and disadvantages of SIMPLE-R. (4+6)

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