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10AE752

Seventh Semester B.E. Degree Examination, Dec.2016/Jan.2017
Computational Fluid Dynamics

Time: 3 hrs.

Max. Marks:100

**Note: Answer FIVE full questions, selecting
at least TWO questions from each part.**

PART – A

- 1 a. Describe the four models of fluid flow for continuum fluid. (10 Marks)
b. What is computational fluid dynamics? List the applications with examples. (10 Marks)
- 2 a. Derive the continuity equation by considering the model of finite control volume fixed in space. (10 Marks)
b. Write the comment on the integral versus differential form of the equations. (04 Marks)
c. Write the comments on the governing equations. (06 Marks)
- 3 a. How partial differential equations can be classified? (08 Marks)
b. Discuss briefly about the general behavior of hyperbolic, parabolic and elliptic PDE in the computational flow field domain. (12 Marks)
- 4 a. Briefly explain explicit and implicit approaches with advantages and disadvantages. (10 Marks)
b. Derive the forward, backward and central difference approximations to the first derivative along with leading error terms. (10 Marks)

PART – B

- 5 a. List the essential properties of the grids. (05 Marks)
b. What is grid generation? Briefly explain different types of grids. (08 Marks)
c. Explain adaptive grid generation. (07 Marks)
- 6 a. Derive the expression for a Jacobian (J) in the following form:

$$J = \frac{\partial(x, y)}{\partial(\xi, \eta)} = \begin{vmatrix} \frac{\partial x}{\partial \xi} & \frac{\partial y}{\partial \xi} \\ \frac{\partial x}{\partial \eta} & \frac{\partial y}{\partial \eta} \end{vmatrix}$$
(10 Marks)
b. Explain the grid stretching, with a typical example. (10 Marks)
- 7 a. What is a finite volume method? Explain and list the important features of an FVM. (10 Marks)
b. Briefly explain cell vertex formulation. (10 Marks)
- 8 a. Determine the amplification factor and stability requirement of Lax-Wendroff technique applied to the convection equation. (10 Marks)
b. Explain the procedure of ADI technique considering 2D, unsteady heat conduction equation in Cartesian space. (10 Marks)

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.