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CBCS SCHEME

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17AE/AS72

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022
Computational Fluid Dynamics

Time: 3 hrs. Max. Marks: 100

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

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.

Module-1

1 a. Derive an equation for substantial derivative and quote its physical significance. **(12 Marks)**

b. Explain shock fitting and shock capturing technique. **(08 Marks)**

OR

2 a. Derive divergent form of 3d momentum equation with a neat sketch. **(14 Marks)**

b. Explain different models of flow. **(06 Marks)**

Module-2

3 a. A flow field is identified by the following system of PDE's. Identify the type of PDE using Gamer's Rule method.

$$\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}=0 \qquad \frac{\partial u}{\partial y}-\frac{\partial v}{\partial x}=0$$ **(10 Marks)**

b. Discuss briefly about the general behavior of hyperbolic, parabolic and elliptic PDE's in the computational flow field domain with suitable examples. **(10 Marks)**

OR

4 a. Apply Cramer's rule to classify mathematically a quasilinear partial differential equation into hyperbolic, parabolic and elliptic. **(12 Marks)**

b. Explain Neumann and Dirichlet boundary conditions. **(04 Marks)**

c. Differentiate between ill posed and well posed problems. **(04 Marks)**

Module-3

5 a. Explain different types of Grids. **(14 Marks)**

b. Explain essential properties of Grids. **(06 Marks)**

OR

6 a. Define Grid quality and also explain factors which effect Grid quality. **(08 Marks)**

b. Explain structured Grid generation techniques. **(12 Marks)**

Module-4

7 a. Obtain an expression of the strong conservation form of governing equation in transformed space for a two dimensional case. **(12 Marks)**

b. For a 2d steady flow, continuity equation in Cartesian co-ordinates obtain the transformation from physical plane to computational plane using direct and inverse transformations. **(08 Marks)**

OR

8 a. Differentiate between explicit and implicit approach of finite difference. List the advantages and disadvantages. **(12 Marks)**

b. Derive forward, backward and central difference approximations to the first derivative along with error terms. **(08 Marks)**

Module-5

9 a. Explain cell centered and cell vortex finite volume technique. **(10 Marks)**

b. Describe flux vector splitting with an example. **(10 Marks)**

OR

10 a. With a suitable expression explain explicit time stepping scheme. **(07 Marks)**

b. Explain spatial discretization finite volume technique with its applications. **(07 Marks)**

c. Explain upwing scheme with neat sketch. **(06 Marks)**

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