

CBCS SCHEME

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17AE/AS72

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

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. With a neat sketch, explain different models of the flow. (06 Marks)
- b. Derive the momentum equation for infinitesimally small fluid element moving with flow for unsteady 3D compressible and various flow. (14 Marks)

OR

- 2 a. Derive an expression for divergence of velocity and explain its physical meaning. (10 Marks)
- b. Explain:
 - (i) Shock fitting method
 - (ii) Shock capturing method(10 Marks)

Module-2

- 3 a. Describe the external features of hyperbolic equation and explain its impact on physical behaviour of CFD problems. (10 Marks)
- b. For the following system of PDE
$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0, \quad \frac{\partial u}{\partial y} - \frac{\partial v}{\partial x} = 0$$
classify the PDE based on Cramer's method. (10 Marks)

OR

- 4 Describe the general behaviour of the different classes of partial differential equations. (20 Marks)

Module-3

- 5 a. With the help of relevant sketch, explain the Elliptic grid generation. (10 Marks)
- b. Define grid quality. List the measures of quality and explain in detail. (10 Marks)

OR

- 6 a. List the advantages and disadvantages of structured and unstructured grids. Explain in brief. (10 Marks)
- b. Write short notes on:
 - (i) Adaptive grids
 - (ii) Meshless grids(10 Marks)

Module-4

- 7 a. Explain the steps involved for numerical using relaxation technique for inviscid 2D incompressible irrotational flow in Cartesian space. (10 Marks)
- b. Explain explicit and implicit approach with its advantages and disadvantages for solving CFD problems. (10 Marks)

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.

OR

- 8 a. Write short notes on:
(i) Time and space marching in CFD (10 Marks)
(ii) Upwind schemes in CFD
b. Demonstrate the transformation of governing PDE from physical domain to computational domain. (10 Marks)

Module-5

- 9 a. Explain cell-centered and cell vertex technique. (10 Marks)
b. Explain dual-control technique in finite volume discretization. (10 Marks)

OR

- 10 a. Explain Flux Vector Splitting Finite volume technique with its application. (10 Marks)
b. Describe spatial discretization in finite volume technique. Also list its applications. (10 Marks)
