CBCS SCHEME

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18AE72

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
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. What is CFD? Mention its application with example. **(04 Marks)**

b. Derive an expression for the divergence of the velocity and explain its physical meaning. **(06 Marks)**

c. Considering an infinitesimally small moving fluid element derive energy equation with usual notations. **(10 Marks)**

OR

2 a. With a neat sketch, derive the generic form of momentum equation for x-component and also write the Y and Z component equations. **(10 Marks)**

b. Explain the following:
i) Physical Boundary conditions
ii) Shock fitting and shock capturing methods. **(10 Marks)**

Module-2

3 a. Explain the general behavior of hyperbolic equations with a neat sketch. **(10 Marks)**

b. Describe the eigen value method of determining the classification of partial differential equation. **(10 Marks)**

OR

4 a. Discuss different types of boundary conditions in CFD problems. **(05 Marks)**

b. Differentiate between Ill-posed and well-posed problem. **(05 Marks)**

c. Describe the following with neat sketches:
i) Steady inviscid supersonic flow
ii) Unsteady thermal conduction. **(10 Marks)**

Module-3

5 a. Enumerate elliptic grid generation with boundary fitted co-ordinate system. **(10 Marks)**

b. Describe structured grid. Explain the different methods of structured grid generation. **(10 Marks)**

OR

6 a. With the help of neat sketch, explain the concept of adaptive grids. List its advantages. **(10 Marks)**

b. Discuss different unstructured grid generation process in detail. **(10 Marks)**

Module-4

7 a. Describe the essence of discretization. Obtain an expression for finite difference quotient using Taylor series approach. **(10 Marks)**

b. Explain the transformation of governing partial differential equations from physical domain to computational domain. **(10 Marks)**

OR

8 a. Explain explicit and implicit approaches. List their advantages and disadvantages. **(10 Marks)**

b. Describe the following:
   i) Numerical dissipation and numerical dispersion
   ii) Lax-Wendroff method. **(10 Marks)**

Module-5

9 a. Describe High Resolution Finite volume upwind scheme. **(10 Marks)**

b. Briefly explain Alternating Direction Implicit (ADI) scheme in CFD. **(10 Marks)**

OR

10 Write a short notes on:
a. Finite volume method
b. Flux vector splitting
c. Temporal descretization
d. Spatial descretization. **(20 Marks)**

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