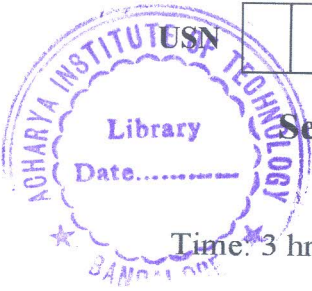


# CBCS SCHEME

15AE72



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Seventh Semester B.E. Degree Examination, July/August 2021

## Computational Fluid Dynamics

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions.

- 1 a. With usual notations and relevant sketches derive time rate of change following a moving fluid element. (06 Marks)  
b. Considering an infinitesimally small moving fluid element, derive momentum equation for x-component and also write the y and z component equation. (10 Marks)
- 2 a. Derive an expression for the divergence of the velocity and explain its physical meaning. (06 Marks)  
b. Considering an infinitesimally small moving fluid element derive energy equation with usual notations. (10 Marks)
- 3 a. Classify a simple system of quasi – linear partial differential equations with relevant sketches and explain. (08 Marks)  
b. Describe the following with sketches:  
(i) Steady inviscid supersonic flow.  
(ii) Steady boundary layer flow. (08 Marks)
- 4 a. With the help of relevant sketches, explain the general behavior of Hyperbolic equations. (08 Marks)  
b. Describe the following with sketches,  
(i) Parabolised viscous flow.  
(ii) Unsteady thermal conduction. (08 Marks)
- 5 a. With the help of relevant sketches, explain boundary fitted co-ordinate system. (08 Marks)  
b. Describe the following:  
(i) Surface Grid Generation.  
(ii) Meshless grids. (08 Marks)
- 6 a. With the help of relevant sketches, explain adaptive grids. List its advantages. (08 Marks)  
b. Describe structured grids. Explain the different methods of structured grid generation. (08 Marks)
- 7 a. Describe the Taylor Sever approach for the construction of finite difference equation. Represent the graphical concept of finite difference methods. (08 Marks)  
b. Explain Explicit and Implicit approaches. List their advantages and disadvantages. (08 Marks)
- 8 a. Describe the following with relevant sketches:  
(i) Up-wind scheme (ii) Numerical and artificial viscosity. (08 Marks)  
b. With the help of relevant sketches and equations, explain the transformation of governing partial differential equations from physical domain to computational domain. (08 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.

- 9 a. With the help of a neat sketch, explain cell centered and cell vertex techniques. (08 Marks)  
b. Describe the following with equations and sketches :  
(i) Temporal discretization. (08 Marks)  
(ii) Spatial discretization. (08 Marks)
- 10 a. Describe high resolution scheme with relevant sketches and equations. (08 Marks)  
b. Explain the following with relevant sketches and equations:  
(i) Flux vector splitting. (08 Marks)  
(ii) Upwind biasing. (08 Marks)

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