

**337844(37)**

**B. E. (Eighth Semester) Examination, 2020**  
*APR-MAY*  
*λ*  
**(New Scheme)**

**(Mech., Mechatronics Engg. Branch)**

**COMPUTATIONAL FLUID DYNAMICS**

***Time Allowed : Three hours***

***Maximum Marks : 80***

***Minimum Pass Marks : 28***

***Note : Attempt all questions. Part (a) of each questions is compulsory. Attempt any two parts from (b), (c) and (d). The figures in the right hand margin indicate marks.***

**Unit-I**

1. (a) What are governing equations of fluid dynamics? 2
- (b) Discuss briefly the applications of CFD. 7

[ 2 ]

- (c) Derive the continuity equation in differential form for incompressible flow. 7
- (d) Explain three steps of CFD code in detail. 7

### Unit-II

2. (a) Classify boundary value problems. 2
- (b) Explain the discretisation of derivatives in brief. 7
- (c) Explain the strong and weak formulation of boundary value problem. 7
- (d) Derive the second-order central differences for mixed derivatives. (using Taylor's series expansion) 7

### Unit-III

3. (a) What is up-wind formulation/scheme? 2
- (b) What are the four basic rules for discretization using Finite Volume method? Explain briefly each rule. 7
- (c) Explain briefly about the principle of Cell Vertex formulation-multistage time stepping. 7
- (d) Explain Runge-Kutta time stepping in detail. 7

**Unit-IV**

4. (a) What is meant by Boundary-Layer? 2
- (b) Derive the expression of Crank-Nicolson method for implicit scheme. 7
- (c) Explain different viscous compressible flows with suitable example. 7
- (d) Explain briefly the concept of numerical dissipation. 7

**Unit-V**

5. (a) Name at least three grid topologies used in structured grid generation. 2
- (b) Explain body fitted grid generation using elliptic type equations. 7
- (c) Explain C— and H— grid topology with neat sketch. 7
- (d) Draw suitable grid and the type of the coordinate system to investigate flow over an airfoil. 7