Name: **Enrolment No:**	

UPES

Supplementary Examination, Dec 2023

Course: Finite Element Methods for Fluid Dynamics **Semester: I**
Program: M. Tech CFD **Time 03 hrs.**
Course Code: ASEG7022 **Max. Marks: 100**

SECTION A

S. No.		**Marks**	**CO**
Q 1	Discuss the primary considerations when choosing FDM, FEM and FVM methods for solving engineering problems.	**4**	**CO1**
Q 2	Briefly explain Neumann and Dirichlet boundary conditions. Provide an example for each condition.	**4**	**CO1**
Q 3	Discuss the significance of finite element interpolation functions.	**4**	**CO2**
Q 4	Discuss the key steps involved in the Newton-Raphson iteration method.	**4**	**CO3**
Q 5	Differentiate the Generalized Galerkin method from the Standard Galerkin method in the solution of linear problems.	**4**	**CO4**

SECTION B

Q 6	Discuss the advantages and limitations of triangular, rectangular, and quadrilateral isoparametric elements.	**10**	**CO2**
Q 7	Explain the role of Conjugate Gradient Methods in solving linear problems using finite element formulations. Provide a step-by-step illustration of the CGM algorithm. **OR** Investigate the significance of Element-by-Element methods in solving linear problems Discuss the advantages and challenges associated with it.	**10**	**CO3**
Q 8	Explain the concept of numerical diffusion test functions and discuss its significance.	**10**	**CO4**
Q 9	Explore the characteristics and applications of vortex methods in the context of incompressible viscous flows. Comment on its effectiveness in solving physical instabilities.	**10**	**CO5**

SECTION-C			
Q 10	Analyze the challenges and numerical techniques involved in solving convection-dominated problems, both in incompressible and compressible flows. Discuss the role of stability and accuracy in handling these nonlinear problems, providing specific examples.	**20**	**CO4**
Q 11	Compare and contrast the various primitive variable methods used for solving incompressible viscous flows. Discuss the strengths and limitations of mixed, penalty, pressure correction, operator splitting, and semi-implicit pressure correction methods, providing examples of their application. **OR** Explore the governing equations and numerical methods employed in solving compressible viscous flows. Discuss the advantages and challenges associated with discontinuous Galerkin methods and flowfield-dependent variation methods, with illustrative examples.	**20**	**CO5**