Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, Dec 2022 - Jan 2023

Course: Introduction to CFD **Semester: I**
Program: M.Tech CFD **Time 03 hrs.**
Course Code: ASEG 7001 **Max. Marks: 100**

SECTION A

S. No.		Marks	CO
Q 1	List various steps involved in CFD analysis.	**4**	**CO1**
Q 2	Derive the discretized term for $\frac{\partial}{\partial x}$ second order upwind scheme.	**4**	**CO2**
Q 3	Discuss the importance of discretization in CFD.	**4**	**CO2**
Q 4	Discuss on various error sources in CFD.	**4**	**CO3**
Q 5	Compare finite volume approach with finite element approach for fluid simulations	**4**	**CO4**
	SECTION B		
Q 6	Apply first law of thermodynamic to a control volume and hence derive the energy equation in integral form. Use mathematical theorems to convert it in to differential equation form.	**10**	**CO1**
Q 7	Explain the mathematical behavior of governing equation for unsteady inviscid flow.	**10**	**CO1**
Q 8	Transform the following terms form physical plane (x,y) to computational plane (ε,η): i. $\frac{\partial}{\partial x}$ ii. $\frac{\partial^2}{\partial x^2}$ **OR** Transform the following terms form physical plane (x,y) to computational plane (ε,η): iii. $\frac{\partial}{\partial y}$ iv. $\frac{\partial^2}{\partial x \partial y}$	**10**	**CO2**
Q 9	Formulate the set of mathematical equations using explicit approach for one-dimensional heat conduction equation and hence explain the concept of time marching.	**10**	**CO3**
	SECTION-C		
Q 10	Interpret the application of relaxation technique during a simulation with an example. Illustrate its mathematical behaviour and hence discuss the concept of over-relaxation and under-relaxation. **OR**	**20**	**CO3**

	Formulate the mathematical equations of Alternating-Direction-Implicit (ADI) technique for solving fluid flow problems		
Q 11	i. Emphasis on the formulation of cell-vertex approach for solving fluid flow problems. ii. Explain upwind type discretization of governing equation in finite volume method.	**20 (15+5)**	**CO4**