Name: **Enrolment No:**	UPES

UPES
End Semester Examination, May 2024

Programme Name: M. Tech (PE) **Semester : II**
Course Name : Computational Fluid Dynamics (CFD) **Time : 03 hrs**
Course Code : PEAU7023 **Max. Marks: 100**
Nos. of page(s) : 1
Instructions: *The question paper consists of three sections. Answer the questions section wise in the answer booklet.
Note: Assume suitable data wherever necessary

S. No.		Marks	CO
	SECTION A **Answer all questions**		
Q1	Write a short note on structures and unstructured grid.	**4**	**CO2**
Q2	Describe the important features of Finite Volume method.	**4**	**CO1**
Q3	Classify the following linear second order partial differential equations (PDEs) with solution u(x,y) in the xy-plane. 1. $u_{xx} + u_{yy} = 0$ 2. $u_{xx} + yu_{yy} + ½ u_y = 0$	**4**	**CO4**
Q4	What do you mean by cell centered finite volume discretization.	**4**	**CO4**
Q5	Explain the Crank Nicolson scheme.	**4**	**CO3**
	SECTION B **Answer all questions**		
Q6	Solve $\frac{\partial^2 y}{\partial x^2} + 4y = 0$, $0 \leq x \leq 1.0$. Boundary conditions y(0) = 0, y(1) =1. Assume Δx = 0.2. Use finite difference scheme.	**10**	**CO2**
Q7	Derive Continuity Equation in cartesian coordinates.	**10**	**CO4**
Q8	Explain the features of TDMA algorithm	**10**	**CO2**
Q9	Describe the concept of upwind interpolation technique.	**10**	**CO1**
	SECTION C **Answer the question.**		
Q10	The property ϕ is transported by means of convection and diffusion through the one-dimensional domain. The boundary conditions are $\phi_0 = 1$ at x = 0, and $\phi_L = 0$ at x = L. Using 5 equally spaced cells and the hybrid differencing scheme for convection and diffusion calculate the distribution of ϕ as function of x for velocity u = 2.5 m/s. Length = 1.0 cm, ρ = 1.0 kg/m^3, Γ = 0.1 kg/ms.	**20**	**CO1**
Q11	A thin plate is initially at a uniform temperature of 200^{o}C. At a certain time t=0 the temperature of the east side of the plate is suddenly reduced to 0^{o}C. The other surface is insulated. Use the fully implicit finite volume method in conjunction with a suitable time step size of 8s to calculate the transient temperature distribution of the slab. Plate thickness L=2 cm, thermal conductivity, k = 10 W/mK, $\rho C_p = 10^6$ J/m^{3}K.	**20**	**CO3**