Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

UPES

End Semester Examination, May 2023

Course: High Performance and parallel Computing **Semester: II**
Program: M.Tech CFD **Time : 03 hrs.**
Course Code: ASEG 7046 **Max. Marks: 100**
Instructions: Attempt all questions.

SECTION A

S. No.		Marks	CO
Q 1	An approximate value of π is given by 3.1428571 and true value is 3.1415926. Find the absolute and relative errors.	**04**	**CO1**
Q 2	Perform three iterations of Newton-Rapshon s method to find the root of the equation $f(x) = x^4 - x - 10 = 0$ and starting approximation as 1.5.	**04**	**CO1**
Q 3	Illustrate the MATLAB code for Newton Rapshon method, which could find the root of the equation $x^4 - x - 10 = 0$ and starting approximation as 1.5.	**04**	**CO2**
Q 4	Apply mid RK (second order) method to solve the initial value problem. $$\frac{dy}{dx} = yx^3 - 1.5y$$ From $x = 0$ to 2 where $y(0) = 1$ by using h = 1.	**04**	**CO1**
Q 5	The following data represents the function $f(x) = e^x$ x — $f(x)$ 0 — 2.1783 1.5 — 4.4817 2.0 — 7.3891 2.5 — 12.1825 Estimate the value of f(2.25) using Newton's forward difference interpolation and compare with the exact value.	**04**	**CO1**

SECTION B

S. No.		Marks	CO
Q 6	Explain the bisection method for computing the roots of equation f(x) = 0. Perform three iterations of the Bisection method in the interval (1,2) to obtain roots of the equation $f(x) = x^3 - x - 1 = 0$.	**10**	**CO1**
Q 7	Solve the linear system Ax = b using Gaussian elimination with pivoting $$A = [6\ 2\ 2\ 6\ 2\ 1\ 1\ 2\ \ -1\ ] \text{ and } b = [0\ 5\ 0\ ]$$	**10**	**CO2**
Q 8	Find the approximate value of	**10**	**CO3**

	$$I = \int_0^1 \frac{1}{1+x^2}\,dx$$ Using Trapezoidal rule and Simpson's 3/8 rule		
Q 9	Apply Euler method to approximate the solution of initial value problem and calculate $y(1.3)$ by using h= 0.1 $$\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2} \text{ with } y(1) = 1$$	**10**	**CO2**
SECTION-C			
Q 10	Three-dimension wave equation is defined in the form of linear homogenous differential equation as $$\frac{\partial^2 P}{\partial t^2} = C^2 \nabla^2 P$$ Where ∇ is Laplace operator and C is the speed of wave, P is defined as pressure. The solution of given equation can be estimated using variable separable form with assuming the solution as $$P = XYZT$$ Where X, Y, Z and T are the function of x, y, z and t respectively. If the wave numbers in x, y and z is kx, ky and kz, then proved. $$k_x{}^2 + k_y{}^2 + k_z{}^2 = k^2$$ $k = \omega/C$ with neglected $e^{-i\omega t}$ term. The solution of X, Y, and Z can be written in the form of cosine and sine terms with suitable constant terms. (Ex: - $X = Acos(x) + Bsin(x)$). Express solution of P in terms of x, y, z and t.	**20**	**CO3**
Q 11	If the wave is propagated at rectangular duct (Size $L \times h \times w$), follow the Q10, which has rigid boundary at $y = \frac{-h}{2}, \frac{h}{2}$ and $y = \frac{-w}{2}, \frac{w}{2}$. The pressure input (Pin) is given at x = 0. Find out the final expression for pressure P inside in rectangular duct with assuming zero mode in y and z directions for one of the following conditions. The boundary condition at x = L could be taken as rigid termination **OR** The boundary condition at x = L could be taken as zero pressure For finding the constant value in the final expression use the Orthogonality Principle as $$A = \frac{\int_{y1}^{y2} \int_{z1}^{z2} P\, cos(k_y y)\, cos(k_z z) dy\, dz}{\int_{y1}^{y2} \int_{z1}^{z2} cos^2(k_y y)\, cos^2(k_z z) dy\, dz}$$	**20**	**CO3**