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

UPES

End Semester Examination, December 2025

Course: Mathematical Science-1 **Semester** : 01

Program: B.Sc. (Computer Science) **Time** : 03 hrs.

Course Code: MATH1060 **Max. Marks**: 100

Instructions: Attempt all questions from Section A (each carrying 4 marks); attempt all questions from Section B (each carrying 10 marks) and attempt all questions from Section C (each carrying 20 marks). Questions 9 and 11 have internal choice.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Using Lagrange's mean value theorem, determine the value of c for the following function $f(x) = e^x$ in $[0, 1]$.	**04**	**CO1**
Q 2	Find the unit vector normal to the surface $x^2y + 2xz = 8$ at the point (1, 0, 2).	**04**	**CO2**
Q 3	If $\vec{A} = (ax^2y + yz)\hat{\imath} + (xy^2 - xz^2)\hat{\jmath} + (2xyz - 2x^2y^2)\hat{k}$ is solenoidal, then find the value of the constant *a*.	**04**	**CO2**
Q 4	The fish population in the lake grows according to the logistic model. The lake can support a maximum of 10,000 fish (carrying capacity). The initial population is 1,000 fish, and the intrinsic growth rate is 0.4 per year. a) Write the logistic differential equation for the fish population. b) Find the fish population after 5 years.	**04**	**CO4**
Q 5	Solve the following difference equation: $y_{n+2} - 2y_{n+1} - 3y_n = 0$, given that $y_1 = 0,\ y_2 = 1$.	**04**	**CO4**

SECTION B
(4Qx10M= 40 Marks)

Q 6	Using the transformation $x^2 - y^2 = u,\ 2xy = v$, evaluate the integral $\iint (x^2 + y^2)\, dxdy$ over the region in the first quadrant bounded by the curves $x^2 - y^2 = 1,\ x^2 - y^2 = 2,\ xy = 4$, and $xy = 2$.	**10**	**CO1**

Q 7	Show that $\vec{F} = 2xyz\hat{\imath} + (x^2z + 2y)\hat{\jmath} + x^2y\hat{k}$ is a conservative vector field. Also, find the scalar potential ϕ of $\vec{F}$.	**10**	**CO2**
Q 8	Solve the following differential equation $\frac{d^2y}{dx^2} + 2y = x^3 + x^2 + e^{-2x} + cos(3x)$.	**10**	**CO3**
Q 9	Using Green's theorem, evaluate $\oint_c[(x^2 - 2xy)dx + (x^2y + 3)dy]$, where *C* is boundary of the region bounded by the parabola $y = x^2$ and the line $y = x$. **OR** Find $\vec{\nabla} \times (\vec{\nabla} \times \vec{A})$, if $\vec{A} = xy^2\hat{\imath} + yz^2\hat{\jmath} + zx^2\hat{k}$ at the point (1,1,1).	**10**	**CO2**
SECTION-C **(2Qx20M=40 Marks)**			
Q 10	Evaluate the triple integral $\iiint x^2\, yz\, dxdydz$ over the region bounded by the planes $x = 0, y = 0, z = 0, x + y + z = 1$.	**20**	**CO1**
Q 11	An emf $e = 12$ volts is applied to a series circuit in which the inductance (L) is 0.5 henry and the resistance (R) is 10 ohms. Determine the value of current $i(t)$ at any time *t.* Given that $i(0) = 0$. **OR** Using variation of parameter method, solve the following differential equation: $\frac{d^2y}{dx^2} + y = cosec(x)$.	**20**	**CO3**