Name: **Enrolment No:**	

UPES

End Semester Examination, May 2025

Course: Mathematics II **Semester : II**

Program: B.Tech. (Biotech./ BioMed./Food Tech.) **Duration : 3 Hours**

Course Code: MATH1061 **Max. Marks: 100**

Instructions: Scientific Calculator is Permitted

S. No.	Section A Short answer questions/ MCQ/T&F (20Qx1.5M= 30 Marks)	Marks	COs
Q 1	Find the order and degree of the following differential equation. $\frac{d^3y}{dx^3} - x\left(\frac{dy}{dx}\right)^4 = 0$	**1.5**	**CO1**
Q 2	Find the solution of differential equation y′ - 2y = 0 by roots method.	**1.5**	**CO1**
Q 3	Obtain the auxiliary equation for the second order differential equation y'' - 2y -1 = 0	**1.5**	**CO1**
Q 4	Show that $y = x^2 + c$ is the solution for the differential equation y′ = 2x	**1.5**	**CO1**
Q 5	Explain briefly about double integration.	**1.5**	**CO1**
Q 6	Give an example of differential equation which is of order 2 and degree 3.	**1.5**	**CO1**
Q 7	Discuss briefly about any one application of complex number	**1.5**	**CO2**
Q 8	Discuss briefly about any one application of differential equation	**1.5**	**CO2**
Q 9	Obtain the roots of equation $x^2 + 1 = 0$. Comment whether they are real or imaginary.	**1.5**	**CO2**
Q 10	What is the value of i^3 ?	**1.5**	**CO2**
Q 11	Describe Euler's Equation for complex numbers.	**1.5**	**CO2**
Q 12	The integrating factor for the differential equation y′ + y = x is given by____	**1.5**	**CO2**
Q 13	The integrating factor for the differential equation y′ + 2xy = x is given by____	**1.5**	**CO2**

Q 14	Polar form of complex number is given as _____	**1.5**	**CO2**
Q 15	Define Modulus and Argument of a complex number.	**1.5**	**CO1**
Q 16	Describe briefly why Cauchy-Rieman equations are used.	**1.5**	**CO3**
Q 17	Solve $\int_0^1 (1+i)\ dt$	**1.5**	**CO3**
Q 18	Solve $\int_0^1 it\ dt$	**1.5**	**CO4**
Q 19	Solve $e^{i\pi/2}$ using Euler's Equation	**1.5**	**CO4**
Q 20	Solve $e^{i\pi}$ using Euler's Equation.	**1.5**	**CO4**
	Section B **(4Qx5M=20 Marks)**		
Q 1	Obtain the auxiliary equation for the differential equation $y'' + 2y' - 1 = 0$. Obtain the roots of auxiliary equation as well.	**5**	**CO1**
Q 2	If $4x + i(3x - y) = 3 + i\,(-6)$, where x and y are real numbers, then find the values of x and y.	**5**	**CO2**
Q 3	Express each of the complex numbers given in the form $a + ib$. *i)* $i^9 + i^{19}$ *ii)* $(5i)\left(-\frac{3}{5}i\right)$	**5**	**CO3**
Q 4	Solve the following differential equation by Variable Separable method. $\frac{dy}{dx} = xy$	**5**	**CO4**
	Section C **(2Qx15M=30 Marks)**		
Q 1	Solve the following Case Study: Let $C(x,y)$ mg/cm^2 represents the drug concentration at any point (x,y) on a tissue. Calculate the total drug usage D present in the tissue using **double integration** if $C(x,y) = 5 - x - y$ is the drug concentration for the rectangular region $0 \le x \le 1$ cm and $0 \le y \le 2$ cm.	**15**	**CO3**
Q 2	In food safety, Newton's Law of Cooling models how food cools over time. It states that the rate of temperature change is proportional to the difference between the food temperature and ambient temperature by the differential equation $$\frac{dT}{dt} = -K(T - T_{room})$$ where: T(t)= food temperature T_{room} =25 degrees Celsius K=0.1 per minute = cooling rate	**15**	**CO4**

	Initial condition: T(0) = 90 degrees Celsius Problem Statement: A freshly cooked meal at 90°C is placed in a room at 25°C. Solve for T(t) Determine the temperature after 20 minutes.		
Section D **(2Qx10M=20 Marks)**			
Q 1	Check Differentiability for the following complex valued functions through Cauchy-Rieman equations i) $f(z) = x^2 + iy^2$ (2.5) ii) $f(z) = e^{x+iy}$ (2.5) Evaluate the following integrals for following complex valued functions. iii) $\int_0^1 (1 + it)^2$ (2.5) iv) $\int_0^1 \frac{i}{t} dt$ (2.5)	**10**	**CO1**
Q 2	Solve the linear differential equation using integrating factor method. Find both the general and the particular solution. $x\frac{dy}{dx} - 2y = x^2$; y(1) = 2	**10**	**CO2**