Name: **Enrolment No:**	

UPES

End Semester Examination, December 2023

Course: Differential Equations — **Semester: III**

Program: B.Sc. Hons. (Physics, Chemistry & Geology) — **Time: 03 hrs.**

Course Code: MATH 1034G — **Max. Marks: 100**

Instructions: All questions are compulsory and there are internal choices in Q9 and in Q11.

SECTION A

(5Qx4M=20Marks)

S. No.		Marks	CO
Q1.	Find the differential equation of all circles which pass through the origin and whose centers are on the x-axis.	**4**	**CO1**
Q2.	Solve the differential equation, $x(1+p^2)=1$, to find its general solution. Here $p \equiv dy/dx$.	**4**	**CO2**
Q3.	Transform $x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + 2y = x\log x$, $x>0$, to a differential equation with constant coefficients, and find its complementary function.	**4**	**CO3**
Q4.	Form the partial differential equation by eliminating arbitrary constants a and b from the given relation, $2z=(ax+y)^2+b$. Also classify it based on its linearity.	**4**	**CO1**
Q5.	Solve the linear partial differential equation using Lagrange's method: $2p+3q=1$, where $p \equiv \partial z/\partial x$ and $q \equiv \partial z/\partial y$.	**4**	**CO5**

SECTION B

(4Qx10M= 40 Marks)

S. No.		Marks	CO
Q6.	Use the method of variation of parameters to find the general solution of $y''-2y'+y=e^x\tan x$, $x>0$.	**10**	**CO3**
Q7.	Find $f(z)$ such that the total differential equation, $\left\{\frac{y^2+z^2-x^2}{2x}\right\}dx - ydy + f(z)dz = 0$ is integrable. Hence solve it.	**10**	**CO4**
Q8.	Use Charpit's method to find the complete solution of the given nonlinear partial differential equation, $(p+y)^2+(q+x)^2=1$.	**10**	**CO5**
Q9.	Find the characteristics of $y^2r - x^2t = 0$, where $r=\frac{\partial^2 u}{\partial x^2}$ and $t=\frac{\partial^2 u}{\partial y^2}$. **OR** Classify the given partial differential equation, $u_{xx}+u_{yy}=u_{zz}$.	**10**	**CO1**

SECTION-C (2Qx20M=40 Marks)			
Q10.	Form the partial differential equations for the following and find their orders: a) $ax^2 + by^2 + cz^2 = 1$, by eliminating the constants a, b, and c. b) $z = yf(x) + xg(y)$ by eliminating the functions f and g.	**20**	**CO1**
Q11.	Find the characteristic curves and derive the canonical form of the second order partial differential equation, $\frac{\partial^2 z}{\partial x^2} = (1+y)^2 \frac{\partial^2 z}{\partial y^2}$. **OR** Give the governing equation and appropriate boundary conditions for the one-dimensional Wave equation, assuming both the end points of the string to be fixed and the initial displacement and initial velocity are given by the functions $f(x)$ and $g(x)$, respectively. Solve the problem using separation of variables.	**20**	**CO5**