UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2021

Course: Differential Equations | **Semester : III**
Program: B.Sc.(H)Phy/Chem/Geology | **Duration : 03 hrs.**
Course Code: MATH 1034 | **Max. Marks: 100**

Instructions: All questions are compulsory.

SECTION A
(Scan and upload) **(5Qx 4M = 20 Marks)**

		Marks	COs
Q 1	Find the differential equation for the equation $(x-\alpha)^2+y^2=\alpha^2$, where α is an arbitrary constant. Also find the order of differential equation.	**[4]**	**CO1**
Q 2	Solve the differential equation $xyp^2+p(3x^2-2y^2)-6xy=0$ for p. Here p stands for $\frac{dy}{dx}$.	**[4]**	**CO2**
Q 3	Find the complete solution of the following differential equation: $$\frac{d^2x}{dt^2}-3\frac{dx}{dt}+2x=e^{5t}$$	**[4]**	**CO3**
Q 4	Solve for $x=f(z)$ in the following simultaneous equations $$\frac{dx}{dz}-x+y=z^2, \qquad \frac{dx}{dz}+x-\frac{dy}{dz}=z$$	**[4]**	**CO4**
Q 5	Classify the following partial differential equation (a) $2\frac{\partial^2u}{\partial t^2}+4\frac{\partial^2u}{\partial x\,\partial t}+3\frac{\partial^2u}{\partial x^2}=0$ (b) $\frac{\partial^2u}{\partial t^2}-c^2\frac{\partial^2u}{\partial x^2}=0$	**[4]**	**CO5**

SECTION B
(Scan and upload) **(4Qx10M = 40 Marks)**

Q 1	Show that the differential equation of a curve $a^2x^2+2abxy+b^2y^2+2gx+2fy+c=0$ is $\frac{d^2}{dx^2}\left\{\frac{d^2y}{dx^2}\right\}^{-2/3}=0$	**[10]**	**CO1**
Q 2	Solve the following exact differential equation: $$\left(y+\frac{1}{3}y^3+\frac{1}{2}x^2\right)dx+\frac{1}{4}(x+xy^2)dy=0$$	**[10]**	**CO2**
Q 3	Obtain the solution for the following differential equation for y $y=yp^2+2px$, where $p\equiv\frac{dy}{dx}$.	**[10]**	**CO2**

Q 4	Find the complete solution of $2(z+px+qy)=yp^2$ where $p=\frac{\partial z}{\partial x}$ and $q=\frac{\partial z}{\partial y}$. **OR** Solve $x(x^2+3y^2)\frac{\partial z}{\partial x}-y(3x^2+y^2)\frac{\partial z}{\partial y}=2z(y^2-x^2)$.	**[10]**	**CO5**
SECTION-C **(Scan and upload)** **(2Qx 20M= 40 Marks)**			
Q 1A	Solve the following simultaneous equations: $D^2x-3x-4y=0, \quad D^2y+x+y=0$ D stands for $\frac{d}{dz}$	**[10]**	**CO4**
Q 1B	Solve: $y^2z(x\cos x-\sin x)dx+x^2z(y\cos y-\sin y)dy$ $+xy(y\sin x+x\sin y+xy\cos z)dz=0$	**[10]**	**CO4**
Q 2A	Use Variation of parameter method to solve the following differential equation $(D^2+1)y=\frac{1}{1+\sin x}, D\equiv\frac{d}{dx}$ **OR** Obtain the complete solution of differential equation $(D^2+2)z=t^2e^{3t}\cos 2t\,, D\equiv\frac{d}{dt}$	**[10]**	**CO3**
Q 2B	Solve the differential equation $x^2\frac{d^3y}{dx^3}+2x\frac{d^2y}{dx^2}+3\frac{dy}{dx}-\frac{3}{x}y=x+1$ **OR** Find the solution of differential equation $(D^2-1)y=1$, which vanishes when $x=0$ and tends to a finite limit as $x\to\infty$ and D stands for $\frac{d}{dx}$.	**[10]**	**CO3**