


Name:			
Enrolment No:			
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES End Semester Examination, December 2022			
Course: Differential Equations Program: B. Sc. (Hons.) Physics/Chemistry/Geology & Integrated B.Sc.-M.Sc. Physics/Chemistry Course Code: MATH1034G Instructions: All questions are compulsory.		Semester: III Time : 03 hrs. Max. Marks: 100	
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	Construct a differential equation by the elimination of the arbitrary constants a and b from the equation $ax^2 + by^2 = 1$.	4	CO1
Q 2	Solve the differential equation $y = 3x + \log p$ for p . Here p stands for $\frac{dy}{dx}$.	4	CO2
Q3	Find the complete solution of the following differential equation: $\frac{d^3y}{dx^3} - \frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 5y = e^x \cos x$	4	CO3
Q4	Solve the following simultaneous equations: $\frac{dy}{dx} + y = z + e^x, \quad \frac{dz}{dx} + z = y + e^x$	4	CO4
Q5	Classify the following partial differential equation (a) $2\frac{\partial^2 u}{\partial x^2} + 4\frac{\partial^2 u}{\partial x \partial y} + 3\frac{\partial^2 u}{\partial y^2} = 2$ (b) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} + \frac{\partial^2 u}{\partial y \partial z} + \frac{\partial^2 u}{\partial z \partial y} = 0$	4	CO5
SECTION B (4Qx10M= 40 Marks)			
Q6	Solve the following differential equation: $(2xy^4e^y + 2xy^3 + y)dx + (x^2y^4e^y - x^2y^2 - 3x)dy = 0$	10	CO2
Q7	Find the complete solution of the differential equation: $x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 5y = \sin(\log x)$.	10	CO3

Q8	Solve the following simultaneous equations: $D^2x - Dy = 2x + 2t, Dx + 4Dy = 3y$ Where D stands for $\frac{d}{dt}$	10	CO4
Q9	Find the general solution of the partial differential equation $\{my(x + y) - nz^2\} \frac{\partial z}{\partial x} - \{lx(x + y) - nz^2\} \frac{\partial z}{\partial y} = (lx - my)z$ OR Find the integral surface of the partial differential equation $(x - y) \frac{\partial z}{\partial x} + (y - x - z) \frac{\partial z}{\partial y} = z$ through the circle $z = 1, x^2 + y^2 = 1$.	10	CO5
SECTION-C (2Qx20M=40 Marks)			
Q10	(a) Use variation of parameter method to solve the following differential equation $\frac{d^2y}{dx^2} + a^2y = \tan ax$ (b) Find the complete solution of the following differential equation: $(D^2 + 9)y = x \sin x, D \equiv \frac{d}{dx}$ OR (a) Evaluate the solution of the initial value problem $(D^2 + 1)^2 = 24x \cos x$ given that $y = Dy = D^2y = 0$ and $D^3y = 12$ when $x = 0$. (b) Solve the following differential equation $(3x + 2)^2 \left(\frac{d^2y}{dx^2} \right) + 3(3x + 2) \left(\frac{dy}{dx} \right) - 36y = 3x^2 + 4x + 1$	10+10	CO3
Q11	(a) Using Charpit's method, find a complete integral of $p^2 - y^2q = y^2 - x^2, p = \frac{\partial z}{\partial x}$ and $q = \frac{\partial z}{\partial y}$ (b) Solve the partial differential equation $(2x^2 + y^2 + z^2 - 2yz - zx - xy) \frac{\partial z}{\partial x}$ $+ (x^2 + 2y^2 + z^2 - yz - 2zx - xy) \frac{\partial z}{\partial y}$ $= (x^2 + y^2 + 2z^2 - yz - zx - 2xy)$	10+10	CO5