Reg. No .... Name **22U349**

B. Sc. DEGREE END SEMESTER EXAMINATION : OCTOBER 2022

SEMESTER 3 : COMPLEMENTARY MATHEMATICS FOR B Sc PHYSICS/CHEMISTRY

COURSE : **19U3CPMAT3 : DIFFERENTIAL EQUATIONS, MATRICES AND TRIGONOMETRY**

(For Regular - 2021 Admission and Improvement / Supplementary - 2020 / 2019 Admissions)

Time : Three Hours Max. Marks: 75

PART A

Answer any 10 (2 marks each)

1. Explain the term normal form with examples.
2. Explain elementary transformation.
3. Show that $\sin 6x = 6\cos^5 x \sin x - 20\cos^3 x \sin^3 x + 6\cos x \sin^5 x$.
4. Expand $\sin^6 x$ in a series of cosine of multiples of x.
5. Define homogeneous equation and give the condition for trivial solution and non trivial solution.
6. Find the solution of the Lagrange's equation $2p + 3q = 1$.
7. Eliminate the constants from the equation $y = e^x(Acosx + Bsinx)$ and obtain the differential equation.
8. Solve the differential equation (x+y)dy=(x-y)dx
9. Find one of the solution of $x(y-z)p + y(z-x)q = z(x-y)$.
10. Find the differential equations of all straight lines in a plane.
11. Find characteristic equation of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 3 & 8 & -1 \\ -1 & -2 & 6 \end{bmatrix}$
12. Show that $u = e^{x+y}$ is a solution of the PDE $\frac{\partial^2 u}{\partial x^2} - \frac{\partial^2 u}{\partial y^2} = 0$.

(2 x 10 = 20)

PART B

Answer any 5 (5 marks each)

13. Solve the system of equations
$x + y + z = 8$
$x - y + 2z = 6$
$3x + 5y - 7z = 14$
14. Separate into real and imaginary parts the quantity $\sin^{-1}(\cos x + i \sin x)$, where x is real.
15. Form a partial differential equation by eliminating the function *f* from the relation $z = y^2 + 2f(\frac{1}{x} + \log y)$.
16. Determine the particular solution of the PDE $\frac{\partial^2 u}{\partial y \partial z} = 4x \sin(3xy)$.
17. Determine the solution of the initial value problem $x\frac{dy}{dx} - 2y = \frac{3y^4}{x}, y(1) = 1/2$.

18. Find the eigen values and eigen vectors corresponding to the largest eigen value of the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$

19. Prove that $\tan h^{-1} x = \frac{1}{2} \log\left(\frac{1+x}{1-x}\right)$.

20. Find the solution of the differential equation $y'+(y/x)=y^2$

(5 x 5 = 25)

PART C

Answer any 3 (10 marks each)

21. Solve $y'-2y\tan x=y^2\tan^2 x$

22. Sum the series $1 + c\cos\alpha + c^2\cos 2\alpha + c^3\cos 3\alpha + \cdots$, where c is less than unity and sum the series $c\sin\alpha + c^2\sin 2\alpha + c^3\sin 3\alpha + \cdots$, where c is less than unity.

23. Verify cayley Hamilton theorem for the matrix A and find A^{-1}, Where A = $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$.

24. (a)Solve $\partial^2 z/\partial x^2=a^2 z$ given that when $x=0$, $\partial z/\partial x=a\sin y$ and $\partial z/\partial y=0$

(b)Form a PDE by eliminating the arbitrary constants from $(x-a)^2+(y-b)^2+z^2=1$.

(10 x 3 = 30)