QP CODE: 21102420

Reg No : .....

Name : .....

B.Sc DEGREE (CBCS) EXAMINATIONS, OCTOBER 2021

First Semester

Complementary Course - MM1CMT01 - MATHEMATICS - PARTIAL DIFFERENTIATION, MATRICES, TRIGONOMETRY AND NUMERICAL METHODS

(Common to B.Sc Chemistry Model I, B.Sc Chemistry Model II Industrial Chemistry, B.Sc Chemistry Model III Petrochemicals, B.Sc Electronics and Computer Maintenance Model III, B.Sc Food Science & Quality Control Model III , B.Sc Geology and Water Management Model III, B.Sc Geology Model I, B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications & B.Sc Physics Model III Electronic Equipment Maintenance)

2017 Admission Onwards

71746F8A

Time: 3 Hours Max. Marks : 80

Part A

*Answer any **ten** questions.*

*Each question carries **2** marks.*

1. Find an equation for the level curve of the function $f(x, y) = \sqrt{x^2 - 1}$ that passes through the point $(1, 0)$.
2. The plane $x = 1$ intersects the paraboloid $z = x^2 + y^2$ in a parabola. Find the slope of the tangent to the parabola at $(1, 2, 5)$.
3. Write a chain rule formula for the derivative $\frac{dz}{dt}$ if $z = f(x, y),\ x = g(t),\ y = h(t)$.
4. Reduce the matrix $A = \begin{bmatrix} 3 & 6 \\ 4 & 3 \end{bmatrix}$ into its normal form.
5. Write the matrix equation of the system of linear equations
   $2x + 3y + 4z = 0, 4x + 3y + 4z = 0, 5x - 2y + 4z = 0$
6. Define characteristic root of a square matrix. Give examples.
7. Express $\cos 3\theta$ in terms of $\cos \theta$.
8. Expand $\sin^4 \theta$ in a series of cosines of multiples of θ.
9. Prove that $\cosh(x - y) = \cosh x \cosh y - \sinh x \sinh y$.
10. Write the binomial expansions of $(1 + x)^n$ and $(1 - x)^{-n}$ when n is a rational number.
11. Find a real root of the equation $x = (5 - x)^{1/3}$ using the iteration method, by taking the first approximation as $x_0 = 1.5$.
12. Give the first and second approximations to the root of an equation $f(x) = 0$, using the Newton - Raphson method.

(10×2=20)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. Find and sketch the domain of the function $f(x,y)=\sqrt{y-x}$. Determine whether the domain is open or closed, bounded or unbounded?

14. Verify whether $w_{xy}=w_{yx}$ if $w=e^x+x\ln y+y\ln x$.

15. Express $\frac{\partial w}{\partial r}$ and $\frac{\partial w}{\partial s}$ in terms of r and s if $w=x^2+y^2,\ x=r-s,\ y=r+s$.

16. Show that the characteristic roots of a triangular matrix are just the diagonal elements of the matrix.

17. Verify the Cayley-Hamilton theorem for the matrix $\begin{pmatrix}1&2&3\\2&-1&4\\3&1&1\end{pmatrix}$.

18. If x is real, show that $\cosh^{-1}(x)=\log(x+\sqrt{x^2-1})$.

19. Sum to infinity the series $\sin(\alpha)+\frac{1}{2}\sin(2\alpha)+\frac{1}{2^2}\sin(3\alpha)+\ldots$

20. Find a real root of the equation $f(x)=x^3-x-1=0$ using the bisection method.

21. Use the generalized Newton's method to find a double root of the equation $f(x)=x^3-x^2-x+1=0$ near 1.

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **15** marks.*

22. Find the rank of the following matrices $a)$. $\begin{bmatrix}1&1&1&1\\2&6&-4&2\\4&0&-6&4\\3&3&-3&3\end{bmatrix}$ $b)$. $\begin{bmatrix}4&6&-2&-2\\1&-1&-2&-4\\3&1&3&2\\12&6&0&14\end{bmatrix}$

23. Solve the system of equations
$x+y+z+w=0, x+y+z-w=4, x+y-z+w=-4, x-y+z+w=2$

24. (a) If $\sin(A+iB)=x+iy$ show that $\frac{x^2}{\cosh^2 B}+\frac{y^2}{\sinh^2 B}=1$ and $\frac{x^2}{\sin^2 A}-\frac{y^2}{\cos^2 A}=1$

(b) Sum to infinity the series $\frac{c\sin\theta}{1!}+\frac{c^2\sin 2\theta}{2!}+\frac{c^3\sin 3\theta}{3!}+\ldots$

25. Use the method of false position to obtain a root, correct to four decimal places, of the equation $x^3-x-1=0$.

(2×15=30)