QP CODE: 24046233

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Reg No : .....

Name : .....

B.Sc DEGREE (CBCS) IMPROVEMENT/REAPPEARANCE/MERCY CHANCE EXAMINATIONS, DECEMBER 2024

First Semester

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

(Common for B.Sc. Chemistry Model – I, B.Sc. Geology Model – I, B.Sc. Physics Model – I, B.Sc. Chemistry Model – II Industrial Chemistry, B.Sc. Physics Model – II Applied Electronics, B.Sc. Physics Model – II Computer Applications, 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. Physics Model – III Electronic Equipment Maintenance)

2017 Admission Onwards

C082A492

Time: 3 Hours Max. Marks : 80

Part A

*Answer any **ten** questions.*

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

1. Evaluate $f(\frac{4}{\sqrt{2}}, \frac{5}{\sqrt{2}}, \frac{6}{\sqrt{2}})$ where $f(x, y, z) = \sqrt{49 - x^2 - y^2 - z^2}$.
2. Find the partial derivative of the function $g(u, v) = v^2 e^{\frac{2u}{v}}$ with respect to each variable.
3. Find $\frac{dw}{dt}$ at $t = 0$ if $w = xy + z,\ x = \cos t,\ y = \sin t,\ z = t$.
4. Write the matrix equation of the system of linear equations
   $2x + 3y + 9z - 8u = 0, 2x + 74 + 1z - 3u = 0, 4x - 7y - 6z + 7u = 0$
5. Define characteristic root of a square matrix. Give examples.
6. If A is a 3×3 matrix with characteristic values 2,3, and 1, then what are the characteristic values of A', where A' is the transpose of A.
7. Express $\sin 3\theta$ in terms of $\sin \theta$.
8. Prove that $\sin(iy) = i \sinh y$.
9. If x is real, show that $\cosh^{-1} x = \log(x + \sqrt{x^2 - 1})$.
10. Separate $\cos(\alpha - i\beta)$ into real and imaginary parts.

11. Use the method of false position to compute the first approximation to a root of the equation $x^3 - x - 1 = 0$, given that the root lies between 1 and 2.

12. Give the generalized Newton's formula to find a root of $f(x) = 0$ with multiplicity p.

(10×2=20)

Part B

*Answer any **six** questions.*

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

13. Find all the second-order partial derivatives of $w = \frac{x-y}{x^2+y}$.

14. Verify whether the function $f(x, y) = \ln \sqrt{x^2 + y^2}$ satisfies the two-dimensional Laplace equation $\frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2} = 0$.

15. Express $\frac{\partial z}{\partial u}$ and $\frac{\partial z}{\partial v}$ as functions of u and v if $z = 4e^x \ln y,\ x = \ln(u \cos v),\ y = u \sin v$.

16. Find the rank of the matrix $\begin{bmatrix} -1 & 1 & 6 & 3 \\ 3 & 1 & -4 & -3 \\ 3 & 5 & 11 & 3 \end{bmatrix}$

17. Obtain the column equivalent canonical matrix A to the following matrix and hence find its rank $A = \begin{bmatrix} 3 & 1 & 2 & 5 \\ -1 & 4 & 1 & -1 \\ 1 & 9 & 4 & 3 \end{bmatrix}$

18. Sum to infinity the series $1 + \frac{1}{2}\cos\theta + \frac{1.3}{2.4}\cos 2\theta + \frac{1.3.5}{2.4.6}\cos 3\theta + \ldots$

19. Sum to infinity the series $\cos(\alpha) + \frac{c\cos(\alpha+\beta)}{1!} + \frac{c^2\cos(\alpha+2\beta)}{2!} + \ldots$

20. Find a positive root of the equation $xe^x = 1$, which lies between 0 and 1 using the bisection method.

21. Use the method of iteration to find a positive root, between 0 and 1, of the equation $xe^x = 1$.

(6×5=30)

Part C

*Answer any **two** questions.*

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

22. Show that the system of equations $x + 2y + z = 2, 3x + y - 2z = 1, 4x - 3y - z = 3, 2x + 4y + 2z = 4$ is consistent and hence solve the same.

23.

1. Verify Cayley-Hamilton theorem for the matrix $B = \begin{pmatrix} 2 & \sqrt{2} \\ \sqrt{2} & 1 \end{pmatrix}$

2. Find characteristic roots and corresponding characteristic vectors of B.

24. (a) Expand $\cos^3\theta \sin^4\theta$ in a series of cosines of multiples of θ.

(b) Sum to infinity the series $c\cos\alpha + \frac{c^2}{2}\cos 2\alpha + \frac{c^3}{3}\cos 3\alpha + \ldots$

25. Find a root of the equation $x\sin x + \cos x = 0$, using the Newton - Raphson method.

(2×15=30)