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QP CODE: 18103620

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Reg No : ....

Name : ....

B.Sc.DEGREE(CBCS)EXAMINATION, DECEMBER 2018

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)

2018 Admission only

145E90EB

Maximum Marks: 80 **Time: 3 Hours**

Part A

Answer any **ten** questions.

Each question carries **2** marks.

1. Sketch the domain for the function $f(x,y) = \ln(x^2 + y^2 - 4)$.

2. Find $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{\partial y}$ if $f(x,y) = \tan^{-1}\frac{y}{x}$ at the point $(1,-1)$.

3. If $f(x,y) = x\,e^{y^2/2}$, evaluate $\frac{\partial^5 f}{\partial x^2 y^3}$.

4. Show that the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 0 & 1 & 2 \end{bmatrix}$ is singular.

5. Write the matrix equation of the system of linear equations $6x + 5y + 9z = 0, 2x + 7y + 1z = 0, 6x - 4y + 6z = 0$

6. Prove or disprove: A characteristic vector of a matrix can correspond to two different characteristics roots of that matrix.

7. Express $\cos 3\theta$ in terms of $\cos\theta$.

8. Prove that $\sinh 2\theta = \frac{2\tanh\theta}{1-\tanh^2\theta}$.

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

10. Write the binomial expansions of $(1+x)^n$ and $(1-x)^{-n}$ when n is a rational number.

11. Define a transcendental equation. Give an example.

12. Obtain the next approximation to a real root of the equation $4(x - \sin x) = 1$, by using the Newton - Raphson method, if $x_0 = 1$ is the initial approximation.

(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. Use chain rule to evaluate $\frac{dw}{dt}$ at $t = 3$ if $w = \ln(x^2 + y^2 + z^2)$, $x = \cos t$, $y = \sin t$, $z = 4\sqrt{t}$.

15. Find $\frac{\partial z}{\partial u}$ when $u = 0, v = 1$ if $z = \sin(xy) + x \sin y$, $x = u^2 + v^2, y = uv$.

16. Show that the characteristic roots of an idempotent matrix are either zero or unity.

17. Verify the Cayley-Hamilton theorem for the matrix $\begin{pmatrix} 7 & 4 & -4 \\ 4 & -8 & -1 \\ -4 & -1 & -8 \end{pmatrix}$.

18. If $A + iB = c\tan(x + iy)$, prove that

$$\tan(2x) = \frac{2Ac}{c^2 - A^2 - B^2}.$$

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

20. Given that the equation $x^{2.2} = 69$ has a root between 5 and 8. Use the method of regula-falsi to determine it.

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.

a. Reduce to the $B = \begin{bmatrix} 2 & 0 & 4 & 6 \\ 2 & 1 & 0 & 1 \\ 8 & 2 & 8 & 14 \end{bmatrix}$ normal form.

b. Obtain the row equivalent canonical matrix of $A = \begin{bmatrix} 2 & 2 & 2 & 4 \\ 2 & 1 & -3 & -6 \\ 3 & -3 & 1 & 2 \end{bmatrix}$

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23. 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.

24. (a) Expand $\sin^3\theta\cos^5\theta$ in a series of sines of multiples of θ.
(b) Sum to infinity the series $c\sin\alpha + \frac{c^2}{2}\sin 2\alpha + \frac{c^3}{3}\sin 3\alpha + \ldots$

25. State and prove the theorem, which gives a sufficient condition for convergence of the iteration process in the iteration method for finding the roots of a given equation.

(2×15=30)