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QP CODE: 19103020

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Reg No : .....

Name : .....

B.Sc. DEGREE (CBCS) EXAMINATION, NOVEMBER 2019

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

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Time: 3 Hours Maximum Marks :80

Part A

*Answer any **ten** questions.*

Each question carries 2 marks.

1. Find an equation for the level surface of the function $f(x, y, z) = \sqrt{x - y} - \ln z$ through the point $(3, -1, 1)$.
2. Find $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{\partial y}$ if $f(x, y) = e^{xy} \ln y$.
3. Find the derivative of $w = xy$ with respect to t at $t = \frac{\pi}{2}$ along the path $x = \cos t,\ y = \sin t$.
4. Show that the matrix $\begin{bmatrix} 1 & 3 \\ 2 & 5 \end{bmatrix}$ is non singular.
5. Write the matrix equation of the system of linear equations
   $2x + 3y + 9z - 8u = 0, 2x + 74 + 1z - 3u = 0, 4x - 7y - 6z + 7u = 0$
6. Define characteristic space of a square matrix.
7. Express $\sin 3\theta$ in terms of $\sin \theta$.
8. Find the series representations of $\sinh x$ and $\cosh x$.
9. If x is real, show that $\sinh^{-1} x = \log(x + \sqrt{x^2 + 1})$.
10. If $x = \cos\theta + i \sin\theta$, find the imaginary part of $\frac{1}{x}$.
11. Define a transcendental equation. Give an example.
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 $w = y\,e^{x^2-y}$.

14. Verify whether the function $f(x,y,z) = e^{3x+4y}\cos 5z$ satisfies the three-dimensional Laplace equation $\frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2} + \frac{\partial^2 f}{\partial z^2} = 0$.

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

16. Show that the system of equations $2x - y + 2z = 8, 3x + 2y - 2z = -1, 5x + 3y - 3z = 3$ are consistent.

17. Find the characteristic roots and corresponding characteristic vectors of the matrix
$$\begin{pmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{pmatrix}.$$

18. Sum to infinity the series $1 + c\cos\alpha + c^2\cos 2\alpha + \ldots$ where $|c| < 1$.

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

20. Given that the equation $x^3 + x^2 + x + 7 = 0$ has a root in between -3 and -2. Use the method false position to obtain it, correct to three decimal places.

21. Use the method of iteration to find a root of the equation $2x = \cos x + 3$ correct to three decimal places.

(6×5=

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 $A = \begin{bmatrix} 2 & 2 & 2 & 4 \\ 2 & 1 & -3 & -6 \\ 3 & -3 & 1 & 2 \end{bmatrix}$

23. 1. State Cayley-Hamilton theorem.

2. Show that the matrix $A = \begin{pmatrix} 0 & c & -b \\ -c & 0 & a \\ b & -a & 0 \end{pmatrix}$ satisfies Cayley-Hamilton theorem.

24. (a) Expand $\sin^3\theta\cos^4\theta$ 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. By using Newton- Raphson method, establish the formula $x_{n+1} = \frac{1}{2}(x_n + \frac{N}{x_n})$ for computing the square root of a given positive number N. using the same, find the square root of 2 exact to six decimal places. 15

(2×15=30)