

E 8341

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Reg. No.....

Name.....

B.Sc. DEGREE (CBCS) EXAMINATION, JANUARY/FEBRUARY 2018

First Semester

**Complementary—Mathematics : PARTIAL DIFFERENTIATION, MATRICES,
TRIGONOMETRY AND NUMERICAL METHODS**

[Common to (B.Sc. Food Science and Quality Control Geology Model I and III, Physics Model I, Physics Model II Applied Electronics, B.Sc. Physics (Computer Applications) B.Sc. Chemistry Model III Petro-Chemicals, Physics Model III Electronic Equipment Maintenance)]

(2017 Admissions)

Time : Three Hours

Maximum Marks : 80

Part A

Answer any ten questions. Each question carries 2 marks.

1. Find f_{xx} for the function $x + y + xy$.
2. State the mixed Derivative theorem.
3. Write the chain rule for functions of two independent variables.
4. Find the characteristic polynomial of $\begin{bmatrix} 1 & 2 \\ 0 & 3 \end{bmatrix}$.
5. Define singular and non-singular matrices with example.
6. If $A = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix}$. Find rank of A^2 .
7. Write binomial theorem for real quantities.
8. Using Euler's exponential values prove that $\sin(x + y) = \sin x \cos y + \cos x \sin y$.
9. Separate $\tan(x + iy)$ into real and imaginary parts.
10. Prove that $\cos h^2 x - \sin h^2 x = 1$.
11. If the roots lies between a and b write the equation to find x using bisection method.
12. State Iteration method to find the root.

(10 × 2 = 20)

Part B

Answer any six questions. Each question carries 5 marks.

13. Find all second order partial derivatives of $f(x, y) = x^2y + \cos y + y \sin x$.

Turn over

14. Is $f(x, y)$ continuous at (x_0, y_0) if f is differentiable at (x_0, y_0) ? Prove. Is the converse true.
15. Find $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{\partial y}$ if $f(x, y) = e^{xy} \ln y$.
16. Verify Cayley Hamilton Theorem for the matrix $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$.
17. Solve the system $x + y - z + t = 0$, $x - y + 2z - t = 0$, $3x + y + t = 0$.
18. Expand $\frac{\sin 7\theta}{\sin \theta}$.
19. If x is real prove that $\cosh^{-1} x = \log \left(x + \sqrt{x^2 - 1} \right)$.
20. Solve $x^3 - 9x + 1$ for the root between, $x = 2$ and $x = 4$ by the bisection method.
21. Using Regula-Falsi method, find the real root of the following equation correct to three decimal places $x \log_{10} x = 1.2$.

(6 × 5 = 30 marks)

Part C

Answer any two questions. Each question carries 15 marks.

22. (a) Solve the system $5x + 3y + 7z - 4 = 0$, $3x + 2y - 2z - 9 = 0$, $7x - 2y - 10z - 5 = 0$.

(b) If $a + b + c = 0$. Find characteristic roots of :

$$A = \begin{bmatrix} a & c & b \\ c & b & a \\ b & a & c \end{bmatrix}$$

23. For what values of k , the system :

$$2x + 3ky + (3k + 4)z = 0$$

$$x + (k + 4)y + (4k + 2)z = 0$$

$x + (2k + 1)y + (3k + 4)z = 0$ has (a) Unique Solution ; (b) Infinite Solution ; and (c) No Solution.

24. (a) If $u = \log \tan \left(\frac{\pi}{4} + \frac{\theta}{2} \right)$. Prove that $\tanh \frac{u}{2} = \tan \frac{\theta}{2}$.

(b) Separate into real and imaginary part of the expression $\tan^{-1}(x + iy)$.

25. (a) Describe Newton-Raphson method and its Geometrical interpretation.

(b) Find a real root of the equation $x^3 - x - 1 = 0$ using Newton-Raphson method, correct to four decimal places.

(2 × 15 = 30)



QP CODE: 19101021

Reg No _____

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

First Semester

Complementary Course - MM10MAT01 - 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 II, 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 IV, Electronic Equipment Maintenance)

2017 Admission (Reappearance)

EEEB9B9C

Maximum Marks: 80

Time: 3 Hours

Part A

Answer any ten questions

Each question carries 2 marks

1. Find an equation for the level surface of the function $f(x, y, z) = \ln(x^2 + y + z^2)$ that passes through the point $(-1, 2, 1)$
2. If $f(x, y) = x^2 + 5xy + \sin x + 7e^x$, evaluate $\frac{\partial^2 f}{\partial x^2 \partial y^2}$
3. Find $\frac{dw}{dt}$ at $t = 0$ if $w = xy + z$, $x = \cos t$, $y = \sin t$, $z = t$.
4. Find the rank of the matrix $\begin{bmatrix} 3 & 3 & 3 \\ 3 & 3 & 3 \\ 3 & 3 & 3 \end{bmatrix}$
5. Define characteristic root of a square matrix. Give examples.
6. If A is a non-singular matrix with characteristic values 1, 3 and 4 then what are the characteristic values of A^{-1} .
7. Prove that $\cos 4\theta = \cos^4 \theta - 6 \cos^2 \theta \sin^2 \theta + \sin^4 \theta$.
8. Prove that $\tanh(2\theta) = \frac{2 \tanh \theta}{1 + \tanh^2 \theta}$.
9. If x is real, show that $\sinh^{-1} x = \log(x + \sqrt{x^2 + 1})$.
10. Write the binomial expansion of $(1 + x)^n$, when n is a positive integer and when n is a rational number.
11. Find the next two approximations to a real root of the equation $\cos x = 3x - 1$ using the iteration method, if the first approximation is $x_0 = 0.5000$.

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

(13+2=20)

Part B

Answer any six questions

Each question carries 5 marks

13. Resistors of R_1, R_2 and R_3 ohms are connected in parallel to make an R -ohm resistor. Find the value of $\frac{\partial R}{\partial R_1}$ when $R_1 = 30, R_2 = 45$ and $R_3 = 90$ ohms

14. Find all the second-order partial derivatives of $s(x, y) = x^2 \tan(xy)$

15. Find the values of $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ at $(2, 3, 6)$ if $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} - 1 = 0$.

16. Obtain the row equivalent matrix of $\begin{bmatrix} 2 & 2 & 2 & 2 \\ 1 & 2 & 3 & 4 \\ 4 & 3 & 2 & 1 \end{bmatrix}$

17. Show that the equations $x - 4y + 7z = 14, 3x + 8y - 2z = 13, 7x - 8y + 26z = 5$ are inconsistent.

18. Expand $\sin^6 \theta$ in a series of cosines of multiples of θ .

19. Sum to infinity the series $x \sin x - x^2 \sin 2x + x^3 \sin 3x - \dots$ where $|x| < 1$.

20. Find a real root of the equation $x^3 - 2x - 5 = 0$ using the bisection method.

21. Use Newton-Raphson method to obtain a root correct to four decimal places of the equation $x^3 + 3x^2 - 3 = 0$, by taking the initial approximation to the root as $x_0 = 1$.

(8+5=30)

Part C

Answer any two questions

Each question carries 15 marks

22. Solve the system of equations $4x + 2y + z + 3u = 0, 4x + 2y + 4z + 7u = 0, 2x + y + u = 0$

23.

1. Determine the characteristic equation of the matrix $A = \begin{pmatrix} 0 & 1 & 2 \\ 0 & -3 & 0 \\ 1 & 1 & -1 \end{pmatrix}$. Also verify whether this equation is satisfied by A or not. Hence find A^{-1} .

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 $\frac{e^{i\theta} \theta}{1!} + \frac{e^{i\theta} \theta^2}{2!} + \frac{e^{i\theta} \theta^3}{3!} + \dots$

25. Using regula-falsi method, find a real root of the equation $f(x) = x^3 + x - 1 = 0$, near $x = 1$.

(2+15=30)