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S – 3436

Reg. No. : ....

Name : ....

Third Semester B.Sc. Degree Examination, February 2024

First Degree Programme under CBCSS

Mathematics

Complementary Course for Chemistry and Polymer Chemistry

MM 1331.2 : MATHEMATICS III – (LINEAR ALGEBRA, PROBABILITY THEORY AND NUMERICAL SOLUTIONS)

(2021 Admission Onwards)

Time : 3 Hours

Max. Marks : 80

SECTION – A

All the first **ten** questions are compulsory. They carry **1** mark each.

1. Find the determinant $\begin{vmatrix} 1 & 4 \\ 0 & 5 \end{vmatrix}$.

2. Define rank of a matrix.

3. Define an orthogonal matrix.

4. Give a set of linearly independent vectors.

5. Define mutually exclusive events.

6. What is a random experiment?

7. The number of permutations of five different things taken three at a time is _____

P.T.O.

8. Write the iterative formula to find $\sqrt{N}$.

9. Evaluate Δe^x.

10. Write Newton's forward interpolation formula.

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. These questions carry **2** marks each.

11. Determine the rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$.

12. Solve the equations $x + 2y + 3z = 0$, $3x + 4y + 4z = 0$, $7x + 10y + 12z = 0$.

13. Show that if A is orthogonal then $|A| = \pm 1$.

14. Find the inverse of the linear transformation
$y_1 = 2x_1 + x_2 + x_3$, $y_2 = x_1 + x_2 + 2x_3$, $y_3 = x_1 - 2x_3$.

15. Show that eigen values of an idempotent matrix are either zero or unity.

16. Find the probability that a non-leap year should have 53 Saturdays.

17. An ordinary six faced die is thrown four times. What are the probabilities of obtaining 4, 3, 2, 1 and 0 faces?

18. The mean number of bacteria per millilitre of a liquid is known to be six. Find the probability that in 1 ml of the liquid, there will be less than four bacteria.

19. Using bisection method, find the negative root of the equation $x^2 - 4x + 9 = 0$.

20. Evaluate $\dfrac{1}{31}$ by Newton's iteration method.

21. Evaluate $\displaystyle\int_0^6 \dfrac{dx}{1 + x^2}$ by using Simpson's $\dfrac{1}{3}$ rule.

22. Find the polynomial $f(x)$ using Lagrange's formula:

x	0	1	2	5
$f(x)$	2	3	12	147

(8 × 2 = 16 Marks)

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SECTION – C

Answer any **six** questions: These questions carry **4** marks each.

23. Using Gauss-Jordan method, find the inverse of the matrix $\begin{bmatrix} 5 & 7 & 9 \\ 4 & 3 & 8 \\ 7 & 5 & 6 \end{bmatrix}$.

24. Solve the equations $3x + y + 2z = 3,\ 2x - 3y - z = -3,\ x + 2y + z = 4$ by determinants.

25. Prove that $A^3 - 4A^2 - 3A + 11I = 0$, where $A = \begin{bmatrix} 1 & 3 & 2 \\ 2 & 0 & -1 \\ 1 & 2 & 3 \end{bmatrix}$.

26. A five figure number is formed by the digits 0,1, 2, 3, 4 without repetition. Find the probability that the number formed is divisible by 4.

27. Three urns contain 6 red, 4 black; 4 red, 6 black, and 5 red, 5 black balls respectively. One of the urns is selected at random and a ball is drawn from it. If the ball drawn is red, find the probability that it is drawn from the first urn.

28. The probability density function of a variate X is

X	0	1	2	3	4	5	6
p(X)	k	3k	5k	7k	9k	11k	13k

Find $P(X < 4),\ P(X \geq 5)$ and $P(3 < X \leq 6)$.

29. Using bisection method, find the approximate root of the equation $\sin x = \dfrac{1}{x}$ that lies between $x = 1$ and $x = 1.5$ (in radians).

30. Find the missing values in the following data:

x	45	50	55	60	65
y	3	....	2	.....	-2.4

31. Using Euler's method, find an approximate value of y corresponding to $x = 1$ given that $\dfrac{dy}{dx} = x + y$ and $y = 1$ when $x = 0$.

(6 × 4 = 24 Marks)

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SECTION – D

Answer any **two** questions. These questions carry **15** marks each.

32. For the matrix $A = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 3 \\ 0 & -1 & -1 \end{bmatrix}$, find non singular matrices P and Q such that PAQ is in normal form. Hence find the rank of A.

33. Reduce the matrix $A = \begin{bmatrix} -1 & 2 & -2 \\ 1 & 2 & 1 \\ -1 & -1 & 0 \end{bmatrix}$ to the diagonal form.

34. The following data are the number of seeds germinating out of 10 on a damp filter paper for 80 sets of seeds. Fit a binomial distribution to these data:

x	0	1	2	3	4	5	6	7	8	9	10
f	6	20	28	12	8	6	0	0	0	0	0

35. Apply Gauss-elimination method to solve the equations $x + 4y - z = -5$, $x + y - 6z = -12$, $3x - y - z = 4$.

(2 × 15 = 30 Marks)

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