

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 $\frac{1}{31}$ by Newton's iteration method.
21. Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using Simpson's $\frac{1}{3}$ 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)

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 $\sin x = \frac{1}{x}$ 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 $\frac{dy}{dx} = x + y$ and $y = 1$ when $x = 0$.

(6 × 4 = 24 Marks)

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)