

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2025)

CLASS: BSC
BRANCH: CHEMISTRY

SEMESTER : III
SESSION : SP/2025

SUBJECT: MA108R1 MATHEMATICS-III

TIME: 02 Hrs

FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

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|--|-----|-----|----|
| Q.1(a) Determine the nature of the sequence whose nth term is:
$a_n = \ln(2n^3 + 2) - \ln(5n^3 + 2n^2 + 4)$. | [2] | CO1 | 2 |
| Q.1(b) Test the convergence of the series : $\frac{1}{1.2.3} + \frac{2}{2.3.4} + \frac{3}{3.4.5} + \dots$ | [3] | CO1 | 2 |
| Q.2(a) Apply Integral test and determine the convergence of the series:
$\sum_{n=1}^{\infty} \frac{(-1)^n}{n(\log n)^3}$ | [2] | CO1 | 2 |
| Q.2(b) Investigate the behaviour of this series : $\frac{1}{2}x + \frac{1.3}{2.4}x^2 + \frac{1.3.5}{2.4.6}x^3 + \dots$ | [3] | CO1 | 2 |
| Q.3(a) Find the rank of $A = \begin{bmatrix} 1 & 4 & 5 \\ 2 & 6 & 8 \\ 3 & 7 & 22 \end{bmatrix}$. | [2] | CO2 | 2 |
| Q.3(b) Compute Adj A and A^{-1} of $A = \begin{bmatrix} 3 & 2 & 2 \\ 1 & 3 & 1 \\ 5 & 3 & 4 \end{bmatrix}$. | [3] | CO2 | 2 |
| Q.4(a) Verify Cayley Hamilton theorem and compute A^{-1} .
$A = \begin{bmatrix} 3 & 6 \\ 1 & 2 \end{bmatrix}$. | [2] | CO2 | 2 |
| Q.4(b) Solve the system $\begin{cases} y + z = 4 \\ 3x + 6y + 3z = 3 \\ -2x - 3y + 7z = 10 \end{cases}$ | [3] | CO2 | 2 |
| Q.5 If $z = f(x, y) = x^3y^4 + 8x^2y + y^3 + 5xy + 2$.
Then find $\frac{\partial z}{\partial x}, \frac{\partial z}{\partial y}, \frac{\partial^2 z}{\partial x^2}, \frac{\partial^2 z}{\partial y^2}$ and $\frac{\partial^2 z}{\partial x \partial y}$. | [5] | CO3 | 2 |