Siliguri Institute of Technology
Department of Engineering Sciences and Humanities
1st Internal Examination – 2022 (Odd Semester)
Section-E

Paper Name: Mathematics IB — Paper Code: BS-M 102
Full Marks: 25 — Time: 01Hour

Group –A

Q1. (Answer any *five* Questions) **1×5=5**

(i) The series $\sum_{n=1}^{\infty} 4$ is [BS-M101.3]
(a) Divergent (b) Convergent (c) Oscillatory (d) None of these

(ii) Let $x \geq 1$ and $x_n = \{\left(2x^{\frac{1}{n}} - 1\right)^n\}_{n\in\mathbb{N}}$. Then the sequence $\{x_n\}_{n\in\mathbb{N}}$ converges to
(a) 0 (b) x (c) x^2 (d) $2x$ [BS-M101.3]

(iii) The sequence $\{3^{-n}\}$ is [BS-M101.3]
(a) convergent (b) divergent (c) oscillatory (d) none of these

(iv) Which one of the following is not a lower bound of the sequence $\{3 + sinn\}$
(a) -2 (b) 2 (c) 1 (d) 3 [BS-M101.3]

(v) The value of the determinant $\begin{vmatrix} 100 & 101 & 102 \\ 105 & 106 & 107 \\ 110 & 111 & 112 \end{vmatrix}$ is [BS-M101.5]
(a) 2 (b) 0 (c) 405 (d) -1

(vi) For any orthogonal matrix A, det A is equal to [BS-M101.5]
(a) 0 (b) 1 (c) ±1 (d) -1

(vii) The system of equations x + 2y – z = 2; 4x + 8y - 4z = 8 has [BS-M101.5]
(a) infinitely many solution (b) no solution (c) a unique solution (d) none of these

Group –B **4×5=20**
(Answer any *four* Questions)

2. Test the convergence of the series $x - \frac{x^2}{\sqrt{2}} + \frac{x^3}{\sqrt{3}} - \frac{x^4}{\sqrt{4}} + \ ...$ [BS-M101.3]

3. Test the convergence of the series $\sum_{n=1}^{\infty} \left(\frac{n}{n+1}\right)^{n^2}$. [BS-M101.3]

4. Examine the nature of the series $(\frac{2^2}{1^2} - \frac{2}{1})^{-1} + (\frac{3^3}{2^3} - \frac{3}{2})^{-2} + (\frac{4^4}{3^4} - \frac{4}{3})^{-3} + \ ....$ [BS-M101.3]

5. Find the rank of the matrix $\begin{bmatrix} 1 & 3 & 4 & 3 \\ 3 & 9 & 12 & 3 \\ 1 & 3 & 4 & 1 \end{bmatrix}$ [BS-M101.5]

6. For what value of λ and μ the following system of equations [BS-M101.5]

x + y + z = 6
x + 2y + 3z = 10
x + 2y + λ z = μ

has (i) no solution (ii) a unique solution (iii) an infinite number of solution

7. If A = $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ find all eigen values of A and obtain all the eigen vectors corresponding to the eigen values. [BS-M101.5]