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

CLASS: BTECH/IMSC **SEMESTER : I/ADD**
BRANCH: ALL/PHYSICS **SESSION : MO/2024**

SUBJECT: MA24101 / MA103 MATHEMATICS - I

TIME: 02 Hours **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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	Question	Marks	CO	BL
Q.1(a)	Determine whether the sequence $\{a_n\}$ is monotonic, bounded and convergent: when $a_n = \left(\frac{1}{3}\right)^n + \left(\frac{1}{\sqrt{2}}\right)^n$	[2]	1	2
Q.1(b)	Check the following series for absolutely or conditionally convergence: $$\sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt{n}}$$	[3]	1	2
Q.2	Check the following positive term series for convergence and divergence: $$\sum_{n=1}^{\infty} \frac{4.7.10.\ldots\ldots\ldots..(3n+1)}{n\,!} x^n, \quad x > 0.$$	[5]	1	2
Q.3(a)	Find the value of λ, for which the system of equations: $x + 2y - 3z = -2;\ 3x - y + 4z = 3;\ 6x + 5y + \lambda z = -3,$ will have an infinite number of solutions.	[2]	2	2
Q.3(b)	Check whether the set of vectors is linearly dependent or independent. $\{(1, -1, 0), (0, 1, -1), (1, 0, 3)\}$	[3]	2	2
Q.4	Find the eigenvalues and eigenvectors of the matrix: $$A = \begin{bmatrix} 1 & 2 & 2 \\ 0 & 2 & 1 \\ 0 & 0 & 2 \end{bmatrix}$$	[5]	2	2
Q.5(a)	Find the first order partial derivatives f_x, f_y, f_z of the following function at specified point: $f(x, y, z) = (xy)^z$ at $(3, 5, 0)$.	[2]	3	2
Q.5(b)	If $f(x,y)$ is a homogeneous function of degree m, then using Euler's theorem, prove that : $x\frac{\partial^2 f}{\partial x^2} + y\frac{\partial^2 f}{\partial x \partial y} = (m-1)\frac{\partial f}{\partial x}$.	[3]	3	2

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