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

CLASS: IMSc **SEMESTER : II**
BRANCH: MATHEMATICS **SESSION : SP/2025**

SUBJECT: MA106R1 ORDINARY DIFFERENTIAL EQUATIONS

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**

			CO	BL
Q.1(a)	Check whether $sin(x), sin(2x), sin(3x)$ are linearly independent in the interval $[0,2\pi]$. Give reason.	[3]	3	2
Q.1(b)	For certain values of the constant n, the function g defined by $g(x) = x^n$ is the solution of the differential equation $x^3y''' + 2x^2y'' - 10xy' - 8y = 0$. Determine all such values of n.	[2]	3	2
Q.2	Solve $y'' + y = tan(x)$.	[5]	3	4
Q.3(a)	Solve $y'' - 6y' + 8y = (e^{2x} - 1)^2 + sin(3x)$.	[3]	3	4
Q.3(b)	Solve $x^4y''' + 2x^3y'' - x^2y' + xy = 0$.	[2]	3	2
Q.4(a)	Suppose $m \neq n$, then find the value of $\int_{-1}^{1} P_m(x)P_n(x)\ dx$, where $P_n(x)$ denotes the Legendre polynomial of degree n.	[2]	2	1
Q.4(b)	Find the polynomial $P_3(x)$. Prove that $P_{2m}(0) = (-1)^m \frac{2m!}{(m!)^2 2^{2m}}$.	[3]	4	1
Q.5	Use Frobenious method to find the solution of the given differential equation $2x^2y'' + xy' + (x^2 - 3)y = 0$ in some interval $0 < x < R$.	[5]	2	3

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