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Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET UNIVERSITY)

M.Sc.(First Semester - Regular) Examinations, January – 2026

24MPCMA1104 - Ordinary Differential Equation

(Mathematics)

Time: 3 hrs | Maximum: 60 Marks

Answer ALL questions
(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions	CO #	Blooms Level
a. Show that the functions are Lipschitz continues on the given region and find the Lipschitz constant. $f(x,y) = 4x^2 + y^2, \|x\| \le a, \ \|y\| \le b$	CO1	K3
b. Find the general solution of $(x^2D^2 - 4xD + 6)y = 0$	CO2	K3
c. Write Bessel's Function	CO3	K2
d. State the Hille -Wintner Theorem.	CO4	K2
e. State the Sturm's Comparison theorem	CO5	K2

PART – B **(10 x 5=50 Marks)**

Answer ***ALL*** the questions

		Marks	CO #	Blooms Level
2. a.	Solve by Picard's method of successive approximation $f(x,y) = e^{-x}y^2 \sin x \ , 0 \le y \le 2 , \quad x < 1$	5	CO	K3
b.	Show that the functions are Lipschitz continues on the given region and find the Lipschitz constant.$f(x,y) = xy^2$ i. $\|x\| \le 1, \ \|y\| \le 1,$ $\|x\| \le 1, \quad \|y\| \le \infty$ (OR)	5	CO1	K3
c.	Find the existence and uniqueness of $f(x,y) = y^{\frac{1}{3}}, y(0) = 0$	5	CO1	K3
d.	Compute the first three approximation for the solution of the equation, $x' = \frac{x}{1+x^2} \ , x(0) = 1$	5	CO1	K3
3.a.	Find the general Solution of$y'' - 9y' + 20y = x + e^{-x}$	5	CO2	K3
b.	Find the general Solution of the system $y_1' = 4y_1 - y_2$ and $y_2' = 2y_1 + y_2$ (OR)	5	CO2	K3
c.	Solve the Differential Equation $y'' + 6y' + 9y = \frac{16\,e^{-3x}}{(x^2+1)}$	5	CO2	K3
d.	Find the general solutions of $x''' + x'' + x' + x = 1$, given that $\cos t$, $\sin t$ *and* e^{-t} *are three Linear Independent solution of* the corresponding homogeneous equation. Also find the solution when x (0) = 0, $x'(0) = 1, x''(0) = 0$.	5	CO2	K3
4.a.	Solve $y'' - y' + xy = 0$ by using power series method	5	CO3	K3
b.	Prove that I. $J_n'(x) = \frac{1}{2}\{J_{n-1}(x) - J_{n+1}(x)\}$ II. $J_{n-1}(x) + J_{n+1}(x) = \frac{2n}{x}J_n(x)$ (OR)	5	CO3	K3

c.	Explain Bessel ‘s Equatio and Bessel’s function.	10	CO3	K3
5.a.	Prove that $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}}\, cosx$	10	CO4	K3
	(OR)			
b.	State and prove of Hille -Wintner Theorem	10	CO4	K3
6.a.	Find the non trivial solution of the sturm –Liouville problem $\frac{d^2y}{dx^2} + \lambda y = 0$ at $y(0) = 0\,, y'(1) = 0$	5	CO5	K3
b.	Find the eigenvalues and eigenfunction of the sturm –Liouville problem $-4y'' - 4y' + (1+\lambda)y = 0$ at $y(0) = 0\,, y'(1) = 0$	5	CO5	K3
	(OR)			
c.	Solve the boundary value problem of $u_{tt} = c^2 u_{xx,}$ BCs: $u(0,t) = u(l,t) = 0, \quad 0 \le x \le l, \ for\ all\ t \ge 0$ $u(x,0) = f(x), \quad u_t(x.0) = g(x), \quad 0 \le x \le l.$	10	CO5	K3

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