B.Tech
1st Semester

AUTUMN MID-SEMESTER EXAMINATION-2023

Subject: Differential Equations & Linear Algebra

Code: MA 11001

Full Marks: 40 **Time: 90 min**

Answer any FOUR QUESTIONS including question No. 1 which is compulsory. The figures in the margin indicate full marks. Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered in one place only

Q.1	Answer the following questions	Marks	CO
a)	Solve $y' = e^{3x+2y}$.	2	CO1
b)	For what value of k, $(x^3 + 3xy^2)\,dx + (kx^2y + y^3)dy = 0$ be an exact differential equation?	2	CO1
c)	Formulate the differential equation for $y = ax^3 + bx^2$.	2	CO1
d)	Find the Wronskian of $tanx$ and $cotx$.	2	CO3
e)	Apply the operator $D(D + 2I)$ on the function $f(x) = e^{-x} + e^{2x}$.	2	CO3

Q.2		Marks	CO
a)	If $y(x)$ satisfy the differential equation $\sin x\frac{dy}{dx} + ycosx = 1, y\left(\frac{\pi}{2}\right) = \frac{\pi}{2}$, then find the value of $y\left(\frac{\pi}{6}\right)$.	5	CO1
b)	Determine a basis of solutions for $x^2y'' - 5xy' + 9y = 0$, by using reduction of order method if $y_1 = x^3$. Hence write the general solution.	5	CO3

Q.3		Marks	CO
a)	A metal bar whose temperature is 40^0C is placed in a boiling water. How long does it take to reach the temperature as 99^0C if the temperature of the bar after 1 minute increased to 60^0C.	5	CO2
b)	Find a particular solution of the initial value problem $x^2y'' + 5xy' + 4y = 0,\ y(1) = 1,\ y'(1) = -3.$	5	CO3

Q.4		Marks	CO
a)	Find a general solution of $x^2y\,dx - (x^3 + y^3)dy = 0$.	5	CO1
b)	Solve $(D^2 - 2D)y = 6e^{2x} - 4e^{-2x}$.	5	CO2

Q.5		Marks	CO
a)	Find the current $I(t)$ in the RLC circuit for the given data $R = 2\Omega, L = 1H, C = \frac{1}{20}F, E = cos\,4t\ Volt.$	5	CO3
b)	Reduce to linear form and then solve the ODE $\frac{dx}{dy} - yx = y^3x^2$	5	CO1

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