Seat No.: ________ Enrolment No. 102CTB[redacted]

NATIONAL FORENSIC SCIENCES UNIVERSITY

B.TECH-M.TECH(Integrated) - Semester - III – Nov -2022

Subject Code: CTBTCSE SIII P1 **Date:** 07/11/2022

Subject Name: Engineering Mathematics-III

Time: 11:30 – 1:00 pm **Total Marks: 50**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			Marks
Q.1	**(a)**	Expand $f(x) = \sin x, 0 < x < \pi$, in a Fourier cosine series.	**04**
		or	
	(b)	Find (a) $\mathcal{L}[e^{2t}t^2]$ (b) $\mathcal{L}[e^{3t}\cos 2t]$	04.
	(c)	Prove the second shifting theorem of the Laplace Transform.	**05**
	(d)	Expand $f(x) = x, 0 < x < 2$, in a half range (*a*) sine series, (*b*) cosine series.	**07**
		Attempt any three	
Q.2	**(a)**	Expand f(x)=cos x, 0<x<Pi, in a Fourier series	**06**
	(b)	Write any six properties of the Laplace Transform with examples.	**06**
	(c)	What is the condition for the existence of the Laplace Transform? Also Find $\mathcal{L}^{-1}\left[\frac{3s+6}{s^2+3s}\right]$	**06**
	(d)	Expand $f(x) = x^2, 0 < x < 2\pi$ in a Fourier series if ~~(*a*)~~ the period is 2π, ~~(*b*)~~ th specified.	**06**
		Attempt any two.	
Q.3	**(a)**	What is the condition for the existence of the Fourier Series? Classify each of the following functions according as they are even, odd, or neither even nor odd. (*a*) $f(x) = \begin{cases} 2 & 0 < x < 3 \\ -2 & -3 < x < 0 \end{cases}$ Period = 6 (*b*) $f(x) = \begin{cases} \cos x & 0 < x < \pi \\ 0 & \pi < x < 2\pi \end{cases}$ Period = 2π	**08**
	(b)	Find the Laplace transform, if it exists, of each of the following functions (*a*) $f(t) = e^{at}$ (*b*) $f(t) = 1$ (*c*) $f(t) = t$ (*d*) $f(t) = e^{t^2}$	**08**
	(c)	Expand $f(x) = x, 0 < x < 2$, in a half range (*a*) odd ~~sine~~ series. (*b*) even ~~cosine~~ series.	**08**

-END OF PAPER-

Seat No.: [redacted]

Enrolment No. 102CT BMCS2[redacted]

NATIONAL FORENSIC SCIENCES UNIVERSITY

B.Tech + M.Tech. Cyber Security Semester - III JAN-2023

Subject Code: CTBTCSE SIII P1 **Date: 04/01/2023**

Subject Name: Engineering Mathematics III

Time: 11:00 Am to 2:00 PM **Total Marks: 100**

Instructions:

1. **Write down each question on separate page.**
2. **Attempt all questions.**
3. **Make suitable assumptions wherever necessary.**
4. **Figures to the right indicate full marks.**

			Marks
Q.1	(a)	Solve $(D^2-1)y = 4xe^x$	05
	(b)	Find the general solution of $\frac{d^2y}{dx^2} + y = cosecx$ by method of variation of parameters.	05
	(c)	Obtain Half Range Fourier Cosine and Sine Series for $f(x)=x, 0<x<\pi$	07
		OR	
	(c)	Find the real root of the equation $x^3 - x - 1 = 0$, correct up to 3 decimal places, using N-R method.	07
Q.2	(a)	Find the Inverse Laplace Transform of $\frac{1}{(s+\sqrt{2})(s+\sqrt{3})}$	05
	(b)	Form the Partial Differential equation from $z = (x-a)^2 + (y-b)^2$	05
	(c)	Find the Fourier series of $f(x) = 2x, -1 < x < 1,\ 2p = 2L = 2$	07
		OR	
	(c)	Solve the IVP $y'' + 3y' + 2y = e^t, y(0) = 1, y'(0) = 0$ using Laplace transform.	07
Q.3	(a)	Find a root of the equation $x^3 - 4x - 9 = 0$ using bisection method correct up to three decimal places.	08
	(b)	Solve: $\frac{d^3y}{dx^3} - 6\frac{d^2y}{dx^2} + 11\frac{dy}{dx} - 6y = e^{4x}$	08
		OR	
	(b)	Find the Fourier series for the Periodic function $f(x) = -\pi\ ;\ -\pi < x < 0$ $= x\ ;\ 0 < x < \pi$ Hence deduce that $\frac{\pi^2}{8} = \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}$	08
Q.4	(a)	State second shifting theorem and also find $L[cost.u(t-\pi)]$.	05
	(b)	Using the Method of Separation of Variables Solve $\frac{\partial u}{\partial x} = 4\frac{\partial u}{\partial y}$; given that $u(0,y) = 8e^{-3y}$	05
	(c)	If $f(x) = x^2,\ 0 \le x \le 2\pi$, find a Fourier series for $f(x)$.	07
		OR	

	(c)	Elimination of the function from the relation $f(xy+z^2, x+y+z)=0$	07
Q.5	(a)	Find inverse Laplace transform of $\log\left(\frac{s+a}{s+b}\right)$	05
	(b)	Find the general solution of $3x^2\frac{d^2y}{dx^2}-x\frac{dy}{dx}+y=0$, $x>0$ where one of the solutions is $y_1=x$.	05
	(c)	Find $L^{-1}\left(\frac{1}{s(s^2+1)(s^2+4)}\right)$	07
		OR	
	(c)	Solve $x^3\frac{d^3y}{dx^3}+x^2\frac{d^2y}{dx^2}=x^2$, using Cauchy's-Euler Differential equation.	07
Q.6	(a)	Solve $(1+x)^2\frac{d^2y}{dx^2}+(1+x)\frac{dy}{dx}+y=4\cos(\log(1+x))$ using the Legendre's homogeneous differential equation.	08
	(b)	State Convolution theorem and evaluate $L^{-1}\left(\frac{1}{s(s^2+4)}\right)$	08
		OR	
	(b)	Use the Regula Falsi method to find a real root of the equation $x=e^{-x}$, correct up to three decimal places.	08

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Enrolment No. 102C7BMC[redacted]

NATIONAL FORENSIC SCIENCES UNIVERSITY

B.Tech + M.Tech. Cyber Security Semester – III-ATKT-JUNE-2023

Subject Code: CTBTCSE SIII P1 **Date: 13/06/2023**

Subject Name: Engineering Mathematics-3

Time: 11:00 a.m to 2:00 p.m **Total Marks: 100**

Instructions:

1. **Write down each question on a separate page.**
2. **Attempt all questions.**
3. **Make suitable assumptions wherever necessary.**
4. **Figures to the right indicate full marks.**

			Marks
Q.1	(a)	Find the Inverse Laplace Transform of $\dfrac{3s^2+2}{(s+1)(s+2)(s+3)}$	05
	(b)	Form the Partial Differential equation from $z^2 = ax^2 + by^2$	05
	(c)	Obtain Half Range Fourier Cosine and Sine Series for $f(x) = x, 0 < x < \pi$	07
		OR	
	(c)	Solve the IVP $y'' + y' - 2y = 0, y(0) = 4, y'(0) = -5$ *using* Laplace transform.	07
Q.2	(a)	Solve $(D^2 - 2D + 1)y = 10e^x$	05
	(b)	Find the general solution of $\frac{d^2y}{dx^2} + 9y = sec3x$ by method of variation of parameters.	05
	(c)	Find the Fourier series of $f(x) = 2x, -1 < x < 1,\ 2p = 2L = 2$	07
		OR	
	(c)	Find the real root of the equation $x^3 - x - 1 = 0$, correct up to 3 decimal places, using N-R method.	07
Q.3	(a)	State Convolution theorem and evaluate $L^{-1}\left(\frac{s}{(s^2+a^2)^2}\right)$	08
	(b)	Solve $(1+x)^2\frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = 4\cos(\log(1+x))$ using the Legendre's homogeneous differential equation.	08
		OR	
	(b)	Use the Regula Falsi method to find a real root of the equation $x = e^{-x}$, correct up to three decimal places.	08
Q.4	(a)	Find the general solution of $3x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = 0$, $x > 0$ *where one of the solutions is* $y_1 = x$.	05
	(b)	Find inverse Laplace transform of $\log\left(\frac{s+a}{s+b}\right)$	05
	(c)	Solve $x^3\frac{d^3y}{dx^3} + x^2\frac{d^2y}{dx^2} = x^2$, using Cauchy's-Euler Differential equation.	07
		OR	
	(c)	Find $L^{-1}\left(\frac{1}{s(s^2+1)(s^2+4)}\right)$	07
Q.5	(a)	Using the Method of Separation of Variables Solve	05

		$\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$; given that $u(x,0) = 6e^{-3x}$	
	(b)	State second shifting theorem and also find $L[cost.u(t-\pi)]$.	05
	(c)	If $f(x) = x^2,\ 0 \le x \le 2\pi$,find a Fourier series for $f(x)$.	07
		OR	
	(c)	Elimination of the function from the relation $f(x+y+z, x^2+y^2+z^2) = 0$	07
Q.6	(a)	Find a root of the equation $x^3 - 4x - 9 = 0$ using bisection method correct up to three decimal places.	08
	(b)	Solve: $\frac{d^3y}{dx^3} - 6\frac{d^2y}{dx^2} + 11\frac{dy}{dx} - 6y = e^{4x}$	08
		OR	
	(b)	Find the Fourier series for the Periodic function $f(x) = -\pi\ ;\ -\pi < x < 0$ $= x;\quad 0 < x < \pi$ Hence deduce that $\frac{\pi^2}{8} = \sum_{n=1}^{\infty}\frac{1}{(2n-1)^2}$	08