

Reg. No.:

Name :

VIT<sup>®</sup>Vellore Institute of Technology  
(Deemed to be University under Section 3 of HEC Act, 1956)

## Continuous Assessment Test II – May 2023

Programme	: B.Tech.	Semester	: Winter 2022-2023
Course Title	: Differential Equations and Transforms	Code	: BMAT 102L
Faculty	: Dr. Saroj Kumar Dash, Dr. Lakshmanan Shanmugham, Dr. Abhishek Kumar Singh, Dr. Harshavarthini Shanmugam, Dr. P.T. Sowndarajan, Dr. Soumendu Roy, Dr. Manimaran J.	Slot	: A2+TA2+TAA2
		Class No.	: CH2022232300442, CH2022232300445, CH2022232300446, CH2022232300447, CH2022232300448, CH2022232300449, CH2022232300450
Time	: 90 Minutes	Max. Marks	: 50

Answer ALL the Questions (5x10 = 50)

Q.No.	Sub. Sec.	Question Description	Marks
1.	a)	Find the Laplace transform of $ \sin 5t $ .	5
	b)	Find the inverse Laplace transform of $\frac{1}{\sqrt[3]{8s-27}}$ .	5
2.	a)	Find the Laplace transform of $\int_0^t u e^{-u} \sin 4u \, du$ .	5
	b)	Find the inverse Laplace transform of $\frac{(1+e^{-2s})^2}{2s+1}$ .	5
3.		Solve the following system of Initial Value Problems: $3x' + y' + 2x = H(t-1)$ , $x' + 4y' + 3y = 0$ such that $x(0) = 0 = y(0)$ . <b>Note:</b> $H(t-a)$ is the Heaviside function, which is also known as unit step function at the point $a$ .	10
4.		Solve the following initial and boundary value problem (by using Laplace Transform): $u_t(x, t) + u_x(x, t) = x$ , such that $u(0, t) = e^{3t}$ , for all $t \geq 0$ and $u(x, 0) = 0$ , for all $x \geq 0$ .	10
5.		Consider the $2\pi$ -periodic function $f(x) = \begin{cases} (x-\pi)^2, & 0 \leq x < \pi \\ \pi^2, & \pi \leq x < 2\pi \end{cases}$ Find the Fourier series expansion of $f(x)$ and hence deduce the value of $\sum_{n=1}^{\infty} \frac{1}{n^2}$ by using the Fourier series of the given $f(x)$ .	10

