

Reg. No.:

Name :

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

## Continuous Assessment Test II – May 2023

Programme	: B.Tech.	Semester	: WIN SEM 2022-23
Course Title	: Differential Equations and Transforms	Code	: BMAT102L
Faculty(s)	: Dr. Saroj Kumar Dash; Dr. Srutha Keerthi B; Dr. Somnath Bera; Dr. Ashish Bera; Dr. Kriti Arya	Slot	: C1+TC1+TCC1
		Class Nos.	CH2022232300616; CH2022232300617; CH2022232300673; CH2022232300618; CH2022232300682
Time	: 90 Minutes	Max. Marks	: 50

## Answer ALL the Questions

Q.No.	Question Description	Marks
1.	Find the Laplace transform of the following functions (i) $f(t) = \frac{\sin^2 t}{t}, t > 0$ . (ii) $f(t) = (t^2 - 2t + 1)e^{2-2t}u(t-1)$ , where $u(t)$ denotes the unit step function.	10
2.	Find the inverse Laplace transform of the following function $\frac{s}{s^4+5s^2+9}$ .	10
3.	Using Laplace transform solve the following differential equation. $y'' + 3y' - 16y = 12\delta(t-13)$ , with $y(0) = 2$ , and $y'(0) = -2$ , where $\delta(t)$ denotes the unit impulse function.	10
4.	Solve the following partial differential equation using Laplace transform $\frac{\partial u(x,t)}{\partial x} = 2\frac{\partial u(x,t)}{\partial t} + u(x,t)$ with $0 \leq t < \infty$ , $u(x,0) = 6e^{-3x}$ and $u(x,t)$ is bounded for $x > 0$ and $t > 0$	10
5.	Find the Fourier series expansion of $f(x) = \pi^2 - x^2$ , $x \in (-\pi, \pi)$ and hence obtain the following identities. (i) $\frac{\pi^2}{12} = 1 - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots$ (ii) $\frac{\pi^2}{6} = 1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$	10

