REG.NO.: 23BEC0852

VIT

Vellore Institute of Technology

SCHOOL OF ELECTRONICS ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
FALL SEMESTER 2024-2025

SLOT: B2+TB2

Programme Name & Branch	: B.Tech. and ECE
Course Code and Course Name	: BECE202L, Signals and Systems
Faculty Name(s)	: VALARMATHI I, RAMACHANDRA REDDY, RAJESH N, KARTHIKEYAN M
Class Number(s)	: VL2024250104070/4074/4116/4069
Date of Examination	: 14-10-2024
Exam Duration	: 90 minutes

Maximum Marks: 50

General instruction(s): Answer All Questions.

Q. No	Question	M
1.	a) Let $x(t) = \sum_{n=-\infty}^{+\infty} \delta[t-n]$. Determine the Fourier series coefficients of $y(t) = \frac{d^2x(t)}{dt^2}$.	5+5
	b) Let $x(t) = e^{\left(\frac{-t}{2}\right)}, 0 \le t \le \pi$ is a periodic signal. Determine the Fourier series coefficients of $x\left(t - \frac{T_o}{2}\right)$, where T_o is the fundamental period of $x(t)$.	
2.	a) Use the basic signal transforms and properties to find the Fourier transform of the signal: $x[n] = \left[\frac{\sin\left(\frac{\pi}{2}n\right)}{\pi n}\right]^2 * \left[\frac{\sin\left(\frac{\pi}{2}n\right)}{\pi n}\right]$, where * denotes convolution.	5+5
	b) Determine the difference equation for the LTI system with the frequency response given by: $H(e^{j\omega}) = 1 + \frac{e^{-j\omega}}{\left(1-\frac{e^{-j\omega}}{2}\right)\left(1+\frac{e^{-j\omega}}{4}\right)}$	
3.	The differential equation relating the output and input of a causal LTI system is given by: $$\frac{d^2y(t)}{dt^2} + 6\frac{dy(t)}{dt} + 8y(t) = 2x(t)$$ a) Find the impulse response of the system. b) Find the output response if $x(t) = e^{-2t}u(t)$.	5+5
4.	We want to design a discrete LTI system that has the property that if the input is $x[n] = \left(\frac{1}{2}\right)^n u[n] - \left(\frac{1}{4}\right)\left(\frac{1}{2}\right)^{n-1} u[n-1]$, then the output is $y[n] = \left(\frac{1}{3}\right)^n u[n]$. a) Find the impulse and frequency responses of the system. b) Find the difference equation relating $x[n]$ with $y[n]$ of the system.	5+3+2
5.	A signal $x(t) = 3\cos(150\pi t) + 2\cos(320\pi t)$ is ideally sampled using the periodic impulse train method with sampling frequency = 500 Hz. If the sampled signal is passed through an ideal low pass filter, with a cut-off frequency of 350 Hz and gain equal to the sampling period, to obtain the output $y(t)$. (a) Sketch the input spectrum $X(j\omega)$. (b) Sketch the output spectrum $Y(j\omega)$ and compute $y(t)$.	3+3+4