Continuous Assessment Test – I

VIT
Vellore Institute of Technology

Programme Name & Branch: B.Tech ECE (IoT)

Course Name & Code: Signal Analysis and Processing & ECE1018

Class Number: VL2019201Q01099/06827.
Exam Duration: 90 Minutes

Slot: A1
Maximum Marks: 50

Answer ALL Questions.

1. A. Consider the following DTSs whose output $y(n)$ is related to the input $x(n)$ by
$y(n) = x^2(n)$

Determine whether the above system is (a) linear, (b) time-invariant, (c) stable, and (d) causal. [2]

B. Determine whether the following signals are periodic and, for each signal that is periodic, determine the fundamental period. [3]

i. $y(n) = \sin(\pi + 0.2n)$

ii. $y(n) = e^{jn\pi/16}\cos(n\pi/17)$

C. The power in a real-valued signal $x(n)$ is defined as $P = \sum_{n=-\infty}^{\infty} x^2(n)$. Suppose that a sequence $x(n)$ has an even part $x_e(n)$ equal to $x_e(n) = \left(\frac{1}{2}\right)^n$. If the power in $x(n)$ is $P = 5$ W, find the power in the odd part, $x_o(n)$, of $x(n)$. [5]

2. A. Given a continuous time periodic signal $x(t) = 5\cos 200\pi t + 10\sin 150\pi t$,

i. Find the minimum sampling rate required to avoid aliasing. [1]

ii. Determine the discrete-time signal obtained after sampling with sampling frequency $F_s = 400$ Hz. [2]

iii. Determine the discrete-time signal $x(n)$ or $x(nT_s)$ obtained after sampling with sampling frequency $F_s = 150$ Hz and comment on your results. [3]

B. Represent the signal $x(n)$ shown in Fig. 1 with unit impulse function and unit step function. [4]

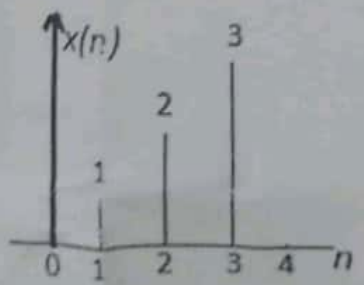

Fig. 1

SEARCH VIT QUESTION PAPERS ON TELEGRAM TO JOIN

3. A. Find the convolution sum of the following two sequences graphically:
$x(n) = [2, -3, 1, 0, 5]$, $h(n) = [-1, 2, \mathbf{0}, 4]$ [5]

B. Find the convolution of $x(n)$ and $h(n)$ where [5]

$$x(n) = \left(\frac{1}{6}\right)^{n-6} u(n)$$

$$h(n) = \left(\frac{1}{3}\right)^{n} u(n-3)$$

4. A. Find the convolution of $x(t)$ and $h(t)$ where [5]

$$x(t) = u(t) - u(t-3)$$
$$h(t) = u(t) - u(t-2)$$

B. Find the overall impulse response of the system where two systems with $h_1(t) = e^{-2t}u(t)$ and $h_2(t) = 2e^{-t}u(t)$ are cascaded. [5]

5. Find the trigonometric and the exponential Fourier series coefficients of the signal shown in Fig. 2 and comment on your results for both cases. [10]

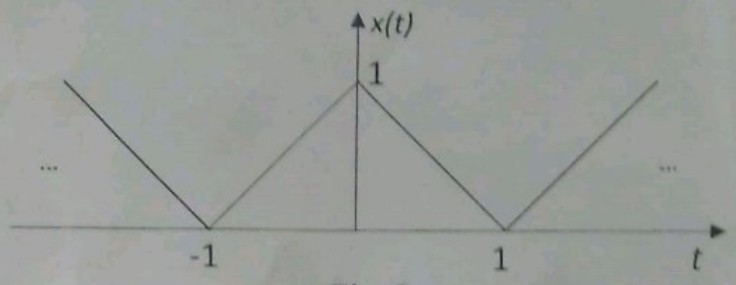

Fig .2