5E5021

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5E5021

B. Tech. V Sem. (Main / Back) Exam., Dec. 2014

Electronics and Communication Engineering

5EC1A Signal & Systems

(Common for EC, EI)

Time: 3 Hours **Maximum Marks: 80**

Min. Passing Marks: 24

Instructions to Candidates:

*Attempt any **five questions,** selecting **one question** from **each unit.** All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in form No. 205)

1. NIL 2. NIL

UNIT – I

Q. 1 (a) Given $x(t) = t.u(t)$, $y(t) = u(t).t^2$. Plot -

(i) $w(t) = x(t) + y(t)$

(ii) $g(t) = x(t) - y(t)$

(iii) $f(t) = y(t) - x(t)$

(iv) $z(t) = x(t)\, y(t)$ [8]

(b) The output of a system is defined by y [n] = w[n] x [n]. x[n] is the input signal and w[n] is a function of n. Determine the properties of the system. [8]

OR

(a) Given y[n] = cos (5t). x (t). Determine the properties of the system. [8]

(b) Consider the impulse response of a discrete LTI system to be

$$h[n] = \frac{1}{3}; \quad 0 \le n \le 4$$

$$= 0; \quad \text{otherwise}$$

Find an expression that relates an arbitrary input x[n] to the output y [n]. [8]

UNIT-II

Q. 2 (a) Determine the Fourier series coefficients for the signal x (t) given as

$$x(t) = \cos 4t + \sin 8t + 3$$ [8]

(b) Write down the properties of fourier series. [8]

OR

(a) Find the average power of the signal x (t) = 2+2 cos 4t. [8]

(b) Obtain the time domain periodic signal x (n), given x (k) as [8]

$$x[k] = \cos\left(\frac{6\pi}{17}k\right)$$

UNIT- III

Q. 3 (a) Find the Fourier Transform (FT) of the unit step function [8]

$$x(t) = \begin{cases} 1, & t \geq 0 \\ 0, & t < 0 \end{cases}$$

(b) Use partial fraction expansion and linearity to determine the inverse FT of

$$x(jw) = \frac{-jw}{(jw)^2 + 3jw + 2}$$ [8]

OR

(a) Find the FT of the signal $x(t) = e^{-at} \cos w_o t.\ u(t)$, $a > 0$. [8]

(b) Use the modulation property to find the FT of [8]

$$x(t) = \frac{4}{\pi^2 t^2} \sin^2(2t)$$

UNIT-IV

Q. 4 (a) Find the Z- transform and ROC of $x[n] = \alpha^{|n|}$, [8]

(b) Write down the properties of z-transform. [8]

OR

(a) Find z-transform and ROC of the signal -

$x[n] = \{4(3)^n - 3(5)^n\}\, u(n)$. [8]

(b) Find inverse z- transform of [8]

$$x(z) = \frac{z-4}{z^2-5z+6}; \; |z| > 3$$

UNIT-V

Q. 5 Consider the continuous –time signal

$x(t) = \cos(100\pi t)$

(a) Determine the minimum sampling rate required to avoid aliasing.

(b) Suppose that the signal is sampled at the rate fs =200Hz, what is the discrete-time signal obtained after sampling?

(c) Suppose that the signal is sampled at the rate fs=75 Hz, what is the discrete- time signal obtained after sampling?

(d) What is the frequency $0 < f < f_s/2$ of a sinusoid that yields samples identical to those obtained in part (c)? [4×4=16]

OR

(a) Let x (n) = {3, 4, 5, 6}

(i) Find g (n) = x (2n-1) and the step interpolated signal h (n) = x (0.5n-1).

(ii) Find y (n) = x (2n/3) assuming step interpolation where needed. [8]

(b) A signal x (t) = sin (π t)/ πt is sampled by s (t) = $\sum_{n=-\infty}^{\infty} \delta(t - n/2)$. [8]

Determine and sketch the sampled signal and its Fourier transform.
