

B. Tech. V Semester (Main/Back) Examination, Dec., 2014

ELECTRONICS & COMMUNICATION ENGINEERING

SIGNALS AND SYSTEMS

(Common for
5E11 & 5E21)

Time : 3 Hours Min. Passing Marks : 20 Max. Marks : 80

Instruction 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.)

Unit-I

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 $y[n] = w[n] \times [n]$. $x[n]$ is the input signal and $w[n]$ is a function of n . Determine the properties of the system.

[8]

OR

1. (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

$$h[n] = \begin{cases} \frac{1}{3}; & 0 \leq n \leq 4 \\ 0; & \text{otherwise} \end{cases}$$

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

[8]

Unit-II

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

2. (a) Find the average power of signal $x(t) = 2 + 2 \cos 4t$.

[8]

- (b) Obtain the time domain periodic signal $x(n)$, given $x(k)$ as

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

[8]

Unit-III

3. (a) Find the Fourier Transform (FT) of the unit step function

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

[8]

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

$$x(j\omega) = \frac{-j\omega}{(j\omega)^2 + 3j\omega + 2}$$

[8]

OR

3. (a) Find the FT of the signal $x(t) = e^{-at} \cos \omega_0 t . u(t)$, $a > 0$

[8]

- (b) Use the modulation property to find the FT of

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

[8]

Unit-IV

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

[8]

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

[8]

OR

4. (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

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

[8]

Unit-V

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 $f_s = 200$ Hz, what is the discrete-time signal obtained after sampling?

- (c) Suppose that the signal is sampled at the rate $f_s = 75$ 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

5. (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 $x(t) = \sin(\pi t)/\pi t$ is sampled by $s(t) =$

$$\sum_n^\infty -\infty \delta(t - n/2)$$

[8]