Exam.Code:0927
Sub. Code: 6898

1128

B.E. (Electronics and Communication Engineering)
Third Semester
EC-302: Signals and Systems

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Part. Use of scientific calculators is allowed.

x-x-x

(1)

I. (a) Differentiate between analog and digital signals. (1)
(b) What are elementary signals? (1)
(c) What is interpolation function? (1)
(d) What is a filter? (1)
(e) Explain the concept of negative frequency. (1)
(f) What is aliasing? (1)
(g) What are advantages of using Laplace transform over Fourier transform? (2)
(h) With the help of suitable transform, prove that compression of a signal in time domain is equivalent to its expression in frequency domain and vice-versa. (2)

Part A

II. (a) List in how many ways signals can be classified. For the signal $x(t)$ shown in Fig 1, sketch the following signals.

(1) $x(t-3)$
(2) $x(2t)$
(3) $x\left(t/2\right)$
(4) $x(-t)$ (4)

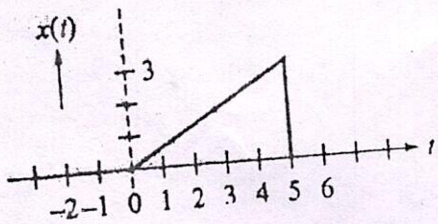

Fig. 1

(b) Describe convolution integral and its important properties. (4)
(c) What are the limitations of using Fourier series for analyzing linear systems? How to resolve these limitations? (2)

III. (a) Define causal and non-causal systems. For the systems described by the equations below, with the input $f(t)$ and output $y(t)$, determine which of the systems are causal and which are non-causal.

(1) $y(t)=f(t-2)$
(2) $y(t)=f(-t)$
(3) $y(t)=f(at)$ $a>1$
(4) $y(t)=f(at)$ $a<1$ (4)

(b) Explain how a continuous-time non-periodic signal can be represented in frequency domain using Fourier transformation. (3)
(c) For an LTI system with unit impulse response $h(t)=6e^{-t}u(t)$, find the system response to the input $2u(t)$. (3)

IV. (a) Describe Dirac Delta function along with its properties. (3)
(b) Determine and explain the Fourier transform of unit impulse function. (2)
(c) Find discrete-time Fourier series for $f[k]=\sin 0.1\pi k$. Sketch the amplitude and phase spectra. (5)

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Part- B

V. (a) Establish and explain the relationship between discrete-time Fourier transform and continuous-time Fourier transform. (5)

(b) Find the response $y[k]$ of a linear time-invariant discrete-time system described by the following difference equation:

$$y[k+2]+y[k+1]+0.16y[k]=f[k+1]+0.32f[k]$$

Given that the input $f[k]=(-2)^{-k}u(k)$. All initial conditions are zero. (5)

VI. (a) State and explain sampling theorem. What is its significance? Determine the Nyquist rate and Nyquist interval for the following signal:

$$f(t)=\frac{1}{2\pi}\cos(4000\pi t)\cos(1000\pi t)$$ (4)

(b) Find the loop current in the circuit shown in Fig 2 using Laplace transformation method. Assume all initial conditions to be zero. (3)

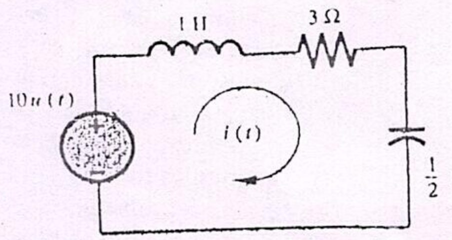

Fig. 2

(c) Find the inverse Laplace transform of

$$F(s)=\frac{8s+10}{(s+1)(s+2)^3}.$$ (3)

VII. (a) For the signal $f(t)=e^{-at}u(t)$, find the Laplace transform and the region of convergence. (4)

Further explain the significance of region of convergence. (3)

(b) Explain merits of state-space analysis for describing systems. (3)

(c) Define z-transform. Give condition/s for its existence.

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