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4455

Reg. No. : ....

Name : ....

Fourth Semester B.Tech. Degree Examination, July 2015
(2008 Scheme)
08.403 : SIGNALS AND SYSTEMS (TA)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions :

1. Define even signal and odd signal. Show that any signal x(t) can be expressed as $x(t) = x_e(t) + x_0(t)$ where $x_e(t)$ is an even signal and $x_0(t)$ is an odd signal.

2. Sketch the following signals.

   a) $x(t) = u(t+5) - u(t-5)$ b) $t.[u(t) - u(t-4)]$

3. Check whether the following system is linear time invariant $y(t) = x(2t)$.

4. Show that a discrete system with unit sample response h[n] is stable if $\sum_{-\infty}^{\infty}|h[n]| \le k_2 < \infty$.

5. Show that, for a symmetric periodic signal x(t), the exponential Fourier series is real.

6. State and prove convolution property of Fourier transform (discrete signal).

7. Prove the shifting property of Discrete Time Fourier Transform (DTFT).

8. Determine the Laplace transform and region of convergence of the signal $x(t) = te^{-2t}u(t)$.

9. Consider a discrete signal x(n) having z transform $x(z) = \frac{z}{z-a}$. Determine all possible choices of x[n]. Which among the possible choices have DTFT ?

10. Compute the z-transform of x(n) = coswnu(n). **(10×4=40 Marks)**

P.T.O.

PART – B

Answer **any two** questions from **each** Module.

Module – I

11. Let $x_1(t) = u(t) - u(t-5)$ and $x_2(t) \leq u(t+5) - u(t)$. Compute (a) $x_1(2t)$ (b) $x_2(t/2)$ (c) $x_1(t) * x_2(t)$. 10

12. a) Show that convolution is linear and commutative. 4

    b) Unit step response of an LTI system is given by $\frac{1-a^{n+1}}{1-a}u[n]$, $|a|<|$. Determine the unit sample response of the system. 4

    c) Define a) Causal system b) Static system. 2

13. a) Determine whether the following discrete signals are periodic or non-periodic. If the signal is periodic, find its fundamental period.

    a) $\sin\left(\pi n/3\right)\sin\left(\pi n/8\right)$ b) $e^{j\pi n} + e^{j2n}$. 5

    b) $x_1[n] = n,\ 0 \leq n \leq 5$ $x_2[n] = \{-1, 0, 2, 5, -2, 1\}$.

    $= 0$ otherwise.

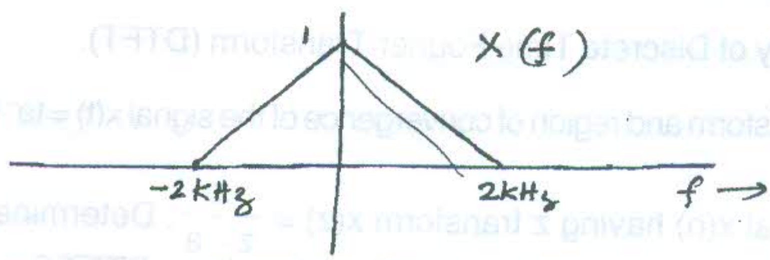
    Sketch $x_1[n]$, $x_2[n]$ and compute $x_1[n] * x_2[n]$. 5

Module – II

14. a) Fourier series coefficients of a discrete periodic signal is given by

    $C_k = \cos\frac{k\pi}{4} + \sin\frac{3k\pi}{4}$. Period of $x[n]$ is $N = 8$. Determine the sequence $x[n]$. 5

    b) Determine and sketch the magnitude and phase spectra of the following periodic signal $x[n] = \cos\frac{2\pi}{3}n + \sin\frac{2\pi}{5}n$. 5

15. 

Consider the continous time band-limited signal x(t) with a spectrum x(f) as shown in figure above. Sketch the spectrum of the discrete signals $x_1[n]$ and $x_2[n]$ obtained from x(t) by sampling at 5 KHz and 3 KHz respectively. 10

16. a) A signal x[n] has the following Fourier transform $x(w) = \frac{1}{1-ae^{-jw}}$. Determine the Fourier transform of a) x[2n + 1] b) x[n] * x[–n]. **6**

b) Consider LTI system with impulse response $h[n] = \left(\frac{1}{3}\right)^n u[n]$. Sketch the magnitude and phase response |H(w)| and < H(w) respectively. **4**

Module – III

17. Find the inverse Laplace transforms of the following functions and sketch the time functions.

a) $F(s) = \frac{e^{-2s}}{s(s+1)}$ b) $F(s) = \frac{1-e^{-5s}}{s(s+5)}$. **10**

18. a) Determine the inverse z-transform of the following functions. Assume that the signals are causal.

a) $X(z) = \frac{0.5z}{(z-1)(z-0.5)}$ b) $X(z) = \frac{z}{z^2-z+1}$. **6**

b) State and prove convolution property of z-transform. **4**

19. a) Explain the terms stationary and ergodic random process. **6**

b) Obtain relation between DTFT and z transform. **4**
