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CS 131601

Library, G.I.M.T.

Roll No. of candidate

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2018

B.Tech. 6th Semester End-Term Examination

SIGNALS AND SYSTEMS

Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer question No.1 and any Six from the rest.

1. All questions are compulsory : (10 × 1 = 10)
- (a) What is aliasing?
 - (b) Sketch the continuous signal $X(t) = u(-t - 1)$; for all t .
 - (c) What is the condition for existence of DTFT?
 - (d) Find even and odd parts of the signal $X(t) = 2 \sin(100\pi t)$.
 - (e) Define convolution sum and convolution integral.
 - (f) Define Nyquist rate of sampling.
 - (g) What is meant by region of convergence in Z-transform?

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- (h) What is a deterministic signal?
- (i) What is causal and non causal system?
- (j) What is the condition for stability of LTI system?

2. Answer the following questions :

- (a) Describe the causality and stability properties of LTI system. (10)
- (b) Test the causality of the following systems:(2+3)
 - (i) $y(t) = x(2t)$
 - (ii) $y(t) = x(t) + \int_0^t x(p) dp$

3. Answer the following questions :

- (a) Check whether the following systems are time invariant or time variant. (2+3)
 - (i) $y(t) = \cos x(t)$
 - (ii) $y(t) = t x(t)$
- (b) Check whether the following systems are linear or non linear. (2+3)
 - (i) $y(t) = x^2(t)$.
 - (ii) $y(t) = t x(t)$.
- (c) Obtain the convolution of two continuous time function. (5)

$$x(t) = e^{-3t}u(t); h(t) = u(t-2)$$

4. Answer the following questions :

(a) State sampling theorem. Show that the sampling frequency must be at least twice the maximum frequency of the signal for the proper reconstruction of the signal. (3+7)

(b) Find the nyquist rate and nyquist interval for the signal. (5)

$$X(t) = \frac{1}{2\pi} \cos(400\pi t) \cos(100\pi t).$$

5. Answer the following questions :

(a) Define discrete time Fourier transforms. Describe at least four properties of discrete time Fourier transforms. (2+8)

(b) Find the Laplace transform of the signal $x(t) = e^{-at}u(t)$ and its region. (5)

6. Answer the following questions :

(a) Find the Z transform and ROC of the following

$$x(n) = \alpha^{|n|}, |\alpha| < 1. \quad (5)$$

(b) Find all the possible inverse z transform of

$$X(z) = (z^2 - 5z) / (z-1)(z-2)^2. \quad (10)$$

7. Answer the following questions :

(a) State and prove the Parseval's power theorem of a periodic signal. (5)

(b) A continuous time periodic signal with period $T = 8$ is given by (5)

$$x(t) = 1; 0 \leq t < 4$$

$$x(t) = -1; 4 \leq t < 8$$

Find the Fourier series coefficient α_k .

- (c) Derive the relationship between Laplace transform and Fourier transform of a continuous time signal. (5)

8. Answer the following questions :

- (a) Determine whether the following signals are periodic or not. If periodic find the time period. (3+4)

(i) $x(t) = 3 \cos 4t + 2 \sin \Pi t$.

(ii) $x(t) = 5 \cos 3\Pi t + 8 \sin 7 \Pi t$

- (b) Determine whether the following signals are power or energy signals: (4+4)

(i) $x(t) = t u(t)$

(ii) $x(t) = e^{-2t} u(t)$.

9. Write short note on the following (any three) (3 × 5 = 15)

- (a) Wavelet Transforms.
(b) Short — Time Fourier Transform.
(c) The uncertainty principle.
(d) Properties of convolution.
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