

5E3109-P

Roll No. : _____

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B. Tech. (Sem. V) (Main/Back) Examination, December - 2011

Electronics And Communication

5EC1 Signals And Systems

(Common for 5E11 & 5BM1)

Time : 3 Hours]

[Total 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

1 (a) Define the term system ? List down the properties of a system.

8

(b) Prove mathematically that the signals given are periodic. For each signal, find the fundamental period and fundamental frequency.

(i) $x(t) = 7 \sin 3t$

(ii) $x(t) = \sin(8t + 30^\circ)$

(iii) $x(t) = e^{j(st + \pi)}$

(iv) $x(t) = \cos t + \sin 2t$

8

OR

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1

[Contd...

- (a) Consider an LTI system with input $x[n]$ and unit impulse response $h[n]$ specified as follows -

$$x[n] = 2nu[-n]$$

$$h[n] = u[n]$$

Calculate the convolutions of these two signals.

8

- (b) Explain the following terms for LTI system :

- (i) Memory
- (ii) Invertibility
- (iii) Causality
- (iv) Stability

8

UNIT - II

- 2 (a) Give the Parseval's relation for continuous time periodic signals. If the signal is periodic with period N , find the fourier series coefficients.

$$x[n] = 1 = \sin\left(\frac{2\pi}{N}n\right) + 3\cos\left(\frac{2\pi}{N}n\right) + \cos\left(\frac{4\pi}{N}n + \frac{\pi}{2}\right)$$

3+5

- (b) A continuous time period signal $x(t)$ is real valued and has a fundamental period $T=8$. The non zero fourier series coefficients for $x(t)$ are

$$X_1 = X_{-1} = 2$$

$$X_3 = X_{-3}^* = 4j$$

Express $x(t)$ in the form

$$x(t) = \sum_{k=0}^{\infty} A_K \cos(w_k t + \phi_k)$$

8

OR

- 2 (a) Give all the properties of discrete time fourier series.

6



- (b) Use the fourier series analysis euqation to calculate the coefficients X_n for the continuous time periodic signal

$$x(t) = \begin{cases} 1.5, & 0 \leq t \leq 1 \\ -1.5, & 1 \leq t \leq 2 \end{cases}$$

with fundamental frequency $w_0 = \pi$

10

UNIT - III

- 3 (a) Explain the time scaling and time shifting property of continous time fourier transform.

6

- (b) Consider the fourier transform pair :

$$e^{-|t|} \xleftrightarrow{F} \frac{2}{1+w^2}$$

Using the duality property to find the fourier transform $G(jw)$ of the signal

$$\left[g(t) = \frac{2}{1+t^2} \right]$$

10

OR

- 3 (a) Determine the fourier transform of -

(i) $x[n] = (0.5)^{n-3} u[n-3]$

(ii) $x[n] = e^{jn\Omega_0} a^n u[n]$

10

- (b) Briefly define following terms for DTFT

(i) Frequency shifting

(ii) Multiplication

6



UNIT - IV

- 4 Find the inverse z transform of the following function by using partial fraction expansion ;

$$\left[X(Z) = \frac{1 - (1/2)z^{-1}}{1 + \frac{3}{4}z^{-1} + \frac{1}{8}z^{-2}} \right]$$

for the following ROC :

- (a) $|Z| > 1/2$
- (b) $|Z| < 1/4$
- (c) $\frac{1}{4} < |Z| < \frac{1}{2}$

16

OR

- 4 (a) List down the properties of ROC for the laplace transform. 6
- (b) State and prove the initial value and final value theorem for laplace transform. 10

UNIT - V

- 5 (a) The signal $x_c(t) = \sin(2\pi(100)t)$ was sampled with sampling frequency f (period $T = 1/400$ sec) to obtain a discrete time signal $x[n]$. What is the resulting signal $x[n]$? 6

- (b) Define the term Aliasing. Give the condition by which No-Aliasing condition can be achieved. 10

OR

- 5 (a) Explain interpolation with zero-order hold circuit. 8
- (b) Determine the Nyquist rate for the following signals :

(i) $x(t) = 1 + \cos(2000\pi t) + \sin(4000\pi t)$

(ii) $x(t) = \frac{\sin 4000\pi t}{\pi t}$ 8

