5E3109-P

Roll No. : _____ Total Printed Pages : 4

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B. Tech. (Sem. V) (Main/Back) Examination, December - 2011
Electronics And Communication
5EC1 Signals And Systems
(Common for 5EI1 & 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) $x(t) = \sin\left(8t + 30^{\circ}\right)$

(iii) $x(t) = ej(st + \pi)$

(iv) $x(t) = \text{cost} + \sin 2t$ 8

OR

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

$x[n]=2n\,u[-n]$

$h[n]=u[n]$

Calculate the convolutions of theses 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.

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

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

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

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

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

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 :

$$e^{-|t|}=\overset{F}{\leftrightarrow}\frac{2}{1+w^2}$$

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) $x[n]=e\,j^{n\Omega 0}\,a^n u[n]$

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
