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BIEL-007

B.Tech. IN ELECTRONICS AND COMMUNICATION ENGINEERING (BTECVI)

00491

Term-End Examination

December, 2012

BIEL-007 : SIGNALS AND SYSTEMS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt **any seven** questions.*
*All questions carry **equal** marks. Use of Scientific calculator is allowed.*
All the questions are to be answered in English Language only.

1. Determine whether or not the signals below are periodic and for each signal that is periodic, determine the fundamental period : **10**

(a) $x(t) = 2\sin\left(\frac{2}{3}\right)t + 3\cos\left(\frac{2\pi}{5}\right)t$

(b) $x(t) = \cos t + \sin(\sqrt{2})t$

(c) $x(n) = 2\sin(0.8\pi n)$

(d) $x(n) = 1 + e^{(j4\pi n)/7} + e^{(j2\pi n)/5}$

(e) $x(t) = 2\cos(10t+1) - \sin(4t-1)$

2. (a) Compare Energy and Power signals ? Determine the condition of periodicity for continuous time signals. 5

(b) A continuous time signal $x(t)$ is shown in Fig.1. Sketch and label each of the following signals. 5

(i) $x(t-2)$ (ii) $x(2t)$

(iii) $x\left(\frac{t}{2}\right)$ (iv) $x(-t)$

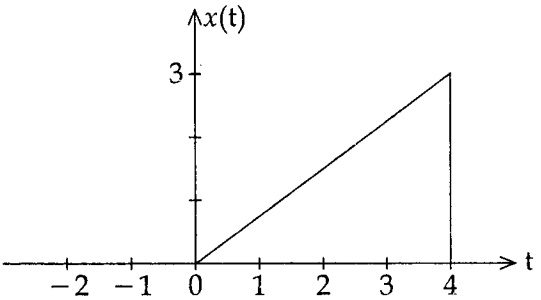

Fig. 1

3. (a) Consider a LTI system with input and output related through the following equation 5

$$y(t) = \int_{-\infty}^{t} e^{-(t-\tau)}\, x(\tau - 2)\, d\tau$$

What is the impulse response h(t) for this system.

(b) Show that the convolution of two odd functions is an even function. 5

4. Determine whether the following systems are static or dynamic, Linear or non-linear. Shift variant or invariant, non-causal or causal, stable or unstable. 10

(a) $y(t) = x(t+10) + x^2(t)$

(b) $y(n) = x(n)u(n)$

(c) $y(n) = \text{sgn}[x(n)]$

(d) $y(n) = \text{Trunc}[x(n)]$

(e) $y(n) = \sum_{K=-\infty}^{n+1} x(K)$

5. (a) Consider a causal LTI system with frequency response $H(\omega) = \frac{1}{3 + j\omega}$. 5

For a particular input $x(t)$, this system is observed to produce the output

$y(t) = e^{-3t}u(t) - e^{-4t}u(t)$

Determine $x(t)$.

(b) Find the Fourier transform of the following : 5

$$x(t) = \begin{cases} \frac{t}{b-a} + \frac{b}{b-a}, \text{ for } -b < t < -a \\ 1, \text{ for } -a < t < a \\ \frac{b}{b-a} + \frac{t}{b-a}, \text{ for } a < t < b \end{cases}$$

6. Determine the system Transfer function H(z) and the frequency response of the system whose impulse response is given as **10**

$$h(n) = \left(\frac{1}{2}\right)\left[\left(\frac{1}{2}\right)^n + \left(-\frac{1}{4}\right)^n\right]u(n)$$

Also locate zeros and poles in Z-plane.

7. Determine the inverse Z-Transform of the function **10**

$$X(Z) = \frac{Z-1}{Z^2 - 4Z + 4}.$$

8. Find the Z-transform of the following discrete-time signal. Also determine the ROC for each of the following cases : **10**

(a) $S(n) = 2^n u(n) + 3\left(\frac{1}{2}\right)^n u(n)$

(b) $S(n) = 3\left(\frac{-1}{2}\right)^n u(n) - 2(3)^n u(-n-1)$

9. For the DT system described by the following difference equation. **10**

$y(n) = 0.6y(n-1) - 0.08y(n-2) + x(n)$

Determine :

(a) The unit-sample response sequence, h(n)

(b) The step-response sequence g(n)

(c) Whether it is BIBO stable

10. Write short notes on ***any two*** : **5x2=10**

(a) Classification of signals.

(b) Linear time Invariant (LTI) system.

(c) Region of Convergence (ROC).