Registration No. : | | | | | | | | | | |

Total number of printed pages – 3

B. Tech

PCBM 4302

Fifth Semester Regular Examination – 2014

SIGNALS AND SYSTEMS

BRANCH(S) : AEIE, BIOMED, CSE, EC, ETC, IEE, IT

QUESTION CODE : H 179

Full Marks – 70

Time : 3 Hours

Answer Question No. ***1*** *which is compulsory and any* ***five*** *from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

   (a) Define discrete time signal.

   (b) Define a system.

   (c) Determine whether unit ramp signal is an energy signal or power signal.

   (d) Differentiate between even and odd signals.

   (e) Determine the z-transform for the signal $x(n) = \underset{\uparrow}{\{2,\ -1,\ 0,\ 1\}}$

   (f) If the N point DFT of x(n) is X(k), then show that the N-point DFT of x(N – n) is X(N – k).

   (g) Describe the homogeneity property of a continuous time system.

   (h) State and prove the frequency shifting property of Fourier transform.

P.T.O.

(i) Show that $R_{xy}(l) = x(l) * y(-l)$, where $R_{xy}(l)$ denotes the cross-correlation between x(n) and y(n), and '*' represents the convolution.

(j) Find the continuous time Fourier transform of $e^{j\omega_0 t}$.

2. (a) Show that a relaxed LTI system is causal if and only if h(n) = 0 for n < 0, where h(n) represents the impulse response of the system. 5

(b) Show that the necessary and sufficient condition for a relaxed LTI system to be BIBO sable is $\sum_{n=-\infty}^{\infty} |h(n)| \le M_h < \infty$, for some constant M_n. 5

3. (a) Determine the direct form I and II realization of the LTI system given as $2y(n) + y(n-1) - 3y(n-2) = x(n) + 4x(n-4)$. 5

(b) Determine the impulse response and unit step response of the system $y(n) = 0.6y(n-1) - 0.08y(n-2) + x(n)$. 5

4. Determine the response, y(n), $n \ge 0$, of the system described by the second-order difference equation $y(n) - 3y(n-1) - 4y(n-2) = x(n) + 2x(n-1)$ when the input sequence is $x(n) = 4^n u(n)$, and $y(-1) = y(-2) = 0$. 10

5. (a) Determine the z-transform of the signal $x(n) = (\cos \omega_0 n)\, u(n)$. 5

(b) Determine the inverse z-transform of $X(z) = \dfrac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$ if ROC : $|z| > 1$. 5

6. (a) Perform the circular convolution between the two sequences given as $x_1(n) = \left\{ \underset{\uparrow}{1} \quad 2 \quad 3 \quad 1 \right\}$, and $x_2(n) = \left\{ \underset{\uparrow}{4} \quad 3 \quad 2 \quad 2 \right\}$ using the time domain formula. 5

(b) If x(n) is real and odd prove that its DFT X(k) is purely imaginary and odd. 5

7. (a) Determine the one sided z-transform of the signal $x(n-2)$, where $x(n) = a^n$. 5

(b) Find the Fourier Transform of $x(t) = t \cdot (\sin \Omega_0 t) \cdot u(t)$. 5

8. Write short notes on any two : 5×2

(a) Correlation of discrete time signals

(b) Stability of linear time-invariant system

(c) Relation between Z-transform and DFT

(d) Time shifting property of Fourier transform.