Roll No. | | | | | | | | | | |

B.E / B.Tech (Full-Time) DEGREE END SEMESTER EXAMINATIONS, APR / MAY 2014

COMMON TO ELECTRONICS AND COMMUNICATION ENGINEERING AND BIOMEDICAL ENGINEERING
III Semester

EC 274/ EC 9203 SIGNALS AND SYSTEMS

(Regulation – 2004/2008)

Time: 3 Hours | Answer ALL Questions | Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. Express discrete time unit step signal interms of unit impulse signal.
2. Determine the fundamental period for the signal x[n] given by $x[n]=e^{j5\pi n}$.
3. Let a_k be the Fourier series coefficient of a periodic signal x(t). Write the expression for the Fourier series coefficient for the signal $x(t-t_o)$.
4. Express the Laplace transform for the signal $x(t)=e^{-at}u(t)$.
5. Consider an LTI system with input x(t) and with response y(t) defined by the expression y(t)= x(t)-x(t-1). Determine the impulse response h(t) of the LTI system.
6. State Sampling theorem.
7. Consider an LTI system defined by the transfer function $H(s)=\frac{1}{s^2+3s+2}$; Determine the poles and zeros.
8. Express the z-transform for the signal y[n]= δ[n] - δ[n-1].
9. Consider the impulse response of an LTI system as h[n]= δ[n] - δ[n-1]. Determine the response y[n] if the input x[n] to the LTI system is u[n].
10. Consider the LTI system described by the transfer function $H(z)=\frac{z^3+1}{z^2+z+1}$. State whether the system is causal or not with justification.

PART-B (5 x 16 = 80 Marks)

11. i. Consider a system whose input x(t) and output y(t) are related by the following expression. y(t)= x(t-1) – x(2-t). Determine whether the system satisfies the following properties with justification
(a) Memoryless
(b)Time invariant
(c) Linear
(d) Causal. **(8)**
ii. Consider the signal $x(t)=e^{-2t}u(t)$.
(a) Plot the signal x(t) and x(-t)
(b) Determine P_∞ and E_∞ **(8)**

12. a. i. Calculate the Fourier series coefficient for the continuous time periodic signal x(t)= $\begin{cases} 1, & 0 < t < 1 \\ -1 & 1 < t < 4 \end{cases}$, with fundamental frequency ω=π/2. **(8)**

ii. Determine the Laplace transform for the signal x(t)= $2e^{-2t}u(t) - 4e^{-t}u(-t)$ and plot the region of convergence. **(8)**

(OR)

12. b. i. Consider a rectangular pulse signal x(t) = $\begin{cases} 1, & |t| < T_1 \\ 0, & |t| > T_1 \end{cases}$. Determine its Fourier transform and plot its spectrum. **(8)**

ii. Compute the Fourier transform for the signal x(t)= $e^{-a|t|}$ u(t) with a>0. Plot its spectrum. **(8)**

13 a. i. Let x(t)= u(t-2) – u(t-4) and h(t)= e^{-4t} u(t). Compute the convolution of x(t) and h(t). **(8)**

ii. Consider an LTI system with system function H(s)= $\frac{s-1}{(s+1)(s-4)}$, determine the impulse response h(t), if the system is causal. **(8)**

(OR)

13. b. i. Consider an LTI system with input x(t)= $e^{-2t}u(t)$ and output y(t)= $[e^{-t}-e^{-4t}]u(t)$. Determine the transfer function H(s). Using H(s), state whether the system is causal and/or stable with justification. **(8)**

ii. Let x(t)= e^{-2t} u(t) and h(t)=u(t). Compute the convolution of x(t) and h(t) **(8)**

14 a. i. Compute the Fourier transform for the signal x[n]=u[n-2] – u[n-6] **(8)**

ii. Consider the signal x[n]= $\begin{cases} \left(\frac{1}{3}\right)^n \cos\left(\frac{\pi}{4}n\right), & n \le 0 \\ 0, & n > 0 \end{cases}$, evaluate the z-transform and plot the region of convergence. **(8)**

(OR)

14 b. i. Compute the Fourier transform for the signal x[n]= $\begin{cases} n, & -3 \le n \le 3 \\ 0, & otherwise \end{cases}$ **(8)**

ii. Consider the signal x[n]= $\left(\frac{1}{5}\right)^n u[n-3]$, evaluate the z-transform and plot the region of convergence. **(8)**

15 a. i.Compute the convolution of x[n] and h[n] where x[n] and h[n] are defined by

x[n]= $\begin{cases} 1, & 3 \le n \le 8 \\ 0, & otherwise \end{cases}$

h[n]= $\begin{cases} 1, & 4 \le n \le 15 \\ 0, & otherwise \end{cases}$ **(12)**

ii. Consider the difference equation y[n] – 1/4y[n-1]=x[n] relating the input x[n] and output y[n] of a causal LTI system. Determine the transfer function H(z) of the system. **(4)**

(OR)

15 b.Consider a causal LTI system described by the transfer function

$$H(z)=\frac{\left(1+\frac{1}{4}z^{-1}\right)\left(1-2z^{-1}\right)}{\left(1-\frac{1}{4}z^{-1}\right)\left(1+\frac{1}{2}z^{-1}\right)},$$

i. Mark the poles and zeros in the z-plane and show the region of convergence and determine the impulse response h[n]. **(8)**

ii. Represent the block diagram for H(z) using direct form II realization. **(8)**