Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 91398

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

Third Semester

Electronics and Communication Engineering

EC 2204/EC 35/EC 1202 A/080290015/10144 EC 305 — SIGNALS AND SYSTEMS

(Regulation 2008/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define discrete time unit step and unit impulse functions.

2. Define energy and power signals.

3. What is the relationship between Fourier transform and Laplace transform?

4. State Drichlet's conditions.

5. List the properties of convolution integral.

6. State the significance of impulse response.

7. What is aliasing?

8. Write a note on ROC.

9. Write the n^{th} order difference equation.

10. Write the state variable equations of a DT-LTI system.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find the even and odd components of the signal $x(n) = \{1, 0, -1, 2, 3\}$. (8)

(ii) Find the fundamental period of the signal $x(t) = e^{j\frac{7\pi}{3}n}$. (8)

Or

(b) (i) Check the system $y(n) = \log_{10}|x(n)|$ is linear, time invariant, causal and static. (10)

(ii) Find the summation $\sum_{n=0}^{5} \delta(n+1)2^n$. (6)

12. (a) (i) Find the Fourier transform of $x(t) = \sum_{n=-\infty}^{\infty} x(t - nT)$. (6)

(ii) Prove the time scaling property of Fourier transform and hence find the Fourier transform of $x(t) = e^{-0.5t}u(t)$. (6)

(iii) Derive the relation between trignometric Fourier series and exponential Fourier series. (4)

Or

(b) (i) Find the Laplace transform of $\left[4e^{-2t}\cos 5t - 3e^{-2t}\sin 5t\right]u(t)$. (8)

(ii) Find the inverse Laplace transform of $X(S) = \frac{1 + e^{-2s}}{3s^2 + 2s}$. (8)

13. (a) Find the block diagram representation and state space representation of the system given by

$$\frac{d^3y(t)}{dt^3} + \frac{3d^2y(t)}{dt^2} + \frac{5dy(t)}{dt} + 6y(t) = \frac{d^2x(t)}{dt^2} + \frac{6dx(t)}{dt} + 5x(t). \quad (16)$$

Or

(b) (i) Solve : $\frac{d^2y(t)}{dt^2} + 4\frac{dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt} + x(t)$ with $y(0) = \frac{9}{4}$, $y'(0) = 5$ and $x(t) = e^{-3t}u(t)$. (10)

(ii) The frequency response of continuous LTI system is $H(j\Omega) = \frac{a - j\Omega}{a + j\Omega}$ with $a > 0$. Find the impulse response of the system. (6)

14. (a) (i) State and prove sampling theorem. (8)

(ii) Using Z-transform, find the convolution of two sequences $x_1(n) = \{1, 2, -1, 0, 3\}$ and $x_2(n) = \{1, 2, -1\}$. (4)

(iii) Find the $X(Z)$ if $x(n) = n^2 u(n)$. (4)

Or

(b) (i) Find inverse Z transform of $X(Z) = \dfrac{Z(Z-1)}{(Z+2)^3(Z+1)}$ $Roc|Z| > 2$. (8)

(ii) The Nyquist rate of a signal $x(t)$ is Ω_0. What is the nyquist rate of the following signals? (8)

(1) $x(t) - x(t-1)$

(2) $x(t)\cos\Omega_0 t$.

15. (a) (i) It is given that the state matrices for a discrete time system are $A = \begin{bmatrix} 0 & 1 \\ 2 & 3 \end{bmatrix}$, $B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$, $C = [8 \quad 8]$, $D = [1]$. Find the system transfer function. (12)

(ii) Find DTFT of $x(n) = \left[0, 1, \underset{\uparrow}{2}, 1, 0\right]$. (4)

Or

(b) (i) Given $H(Z) = \dfrac{0.2Z}{(Z+0.4)(Z-0.2)}$ $Roc|Z| > 0.4$. Find the impulse response of the system. (8)

(ii) Find the step response of the system $y(n) + \dfrac{1}{3}y(n-1) = x(n)$. (8)