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Question Paper Code : 10290

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2012.

Third Semester

Electronics and Communication Engineering

EC 2204/147303/EC 35/EC 1202 A/10144 EC 305/080290015 — SIGNALS AND SYSTEMS

(Regulation 2008)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Verify whether the system described by the equation is linear and time invariant $v(t) = x(t^2)$.

2. Find the fundamental period of the given signal $x[n] = \sin\left((6\pi n/7 + 1)\right)$.

3. Define Nyquist rate.

4. Determine the Fourier series coefficients for the signal $\cos \pi t$.

5. Determine the Laplace transform of the signal $\delta(t-5)$ and $u(t-5)$.

6. Determine the convolution of the signals $x[n] = \{2, -1, 3, 2\}$ and $h[n] = \{1, -1, 1, 1\}$.

7. Prove the time shifting property of discrete time Fourier transform.

8. State the final value theorem.

9. List the advantages of the state variable representation of a system.

10. Find the system function for the given difference equation $y(n) = 0.5\ y(n-1) + x(n)$.

PART B — (5 × 16 = 80 marks)

11. (a) Determine whether the systems described by the following input-output equations are linear, dynamic, casual and time variant

(i) $y_1(t) = x(t-3) + (3-t)$

(ii) $y_2(t) = dx(t)/dt$

(iii) $y_1[n] = n\, x[n] + bx^2[n]$

(iv) Even $\{x[n-1]\}$.

Or

(b) A Discrete time system is given as $y(n) = y^2(n-1) = x(n)$. A bounded input of $x(n) = 2\delta(n)$ is applied to the system. Assume that the system is initially relaxed. Check whether system is stable or unstable.

12. (a) (i) Prove the scaling and time shifting properties of Laplace transform.

(ii) Determine the Laplace transform of $x(t) = e^{-at} \cos \omega t\; u(t)$.

Or

(b) (i) State and prove the Fourier transform of the following signal in terms of $X(j\omega)$; $x(t-t_0)$, $x(t)e^{j\omega t}$.

(ii) Find the complex exponential Fourier series coefficient of the signal $x(t) = \sin 3\pi t + 2\cos 4\pi t$.

13. (a) Compute and plot the convolution $y(t)$ of the given signals

(i) $x(t) = u(t-3) - u(t-5)$, $h(t) = e^{-3t} u(t)$

(ii) $x(t) = u(t)$, $h(t) = e^{-t} u(t)$.

Or

(b) The LTI system is characterized by impulse response function given by $H(s) = 1/(s+10)$ ROC : Re >-10

Determine the output of a system when it is excited by the input

$x(t) = -2e^{-2t} u(-t) - 3e^{-3t} u(t)$.

14. (a) Determine the Z-transform and sketch the pole zero plot with the ROC for each of the following signals

(i) $x[n] = (0.5)^n u[n] - (1/3)^n u[n]$

(ii) $x[n] = (1/2)^n u[n] + (1/3)^n u[n-1]$.

Or

(b) (i) Find the inverse Z-transform of the $1/(Z^2 - 1.2Z + 0.2)$

(ii) Express the Fourier transforms of the following signals in terms of $X(e^{j\omega})$

(1) $X_1[n] = X[1-n]$

(2) $X_2[n] = (n-1)^2 x[n]$.

15. (a) (i) Find the impulse response of the difference equation

$y(n) - 2y(n-2) + y(n-1) + 3y(n-3) = x(n) + 2x(n-1)$.

(ii) Find the state variable matrices A, B, C and D for the input-output relation given by

$y(n) = 6y(n-1) + 4y(n-2) + x(n) + 10(n-1) + 12(n-2)$.

Or

(b) (i) Draw the direct form II block diagram representation for the system function

$H(Z) = 1 + 2Z^{-1} - 20Z^{-2} - 20Z^{-2} - 5Z^{-4} + 6Z^{-6} / 1 + 0.5Z^{-1} - 0.25Z^{-2}$.

(ii) Find the input $x(n)$ which produces output $y(n) = \{3, 8, 14, 8, 3\}$ when passesd through the system having $h(n) = \{1, 2, 3\}$.
