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Question Paper Code : 80334

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Third Semester

Electronics and Communication Engineering

EC 6303 – SIGNALS AND SYSTEMS

(Common to Biomedical Engineering and Medical Electronics Engineering)

(Regulations 2013)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1.   Give the mathematical and graphical representation of a continuous time and discrete time unit impulse functions.

2.   State the difference between causal and non causal system.

3.   Find the Fourier series representation of the signal $x(t) = \dfrac{\cos 2\pi t}{3}$ and determine the Fourier series coefficients.

4.   Find the Laplace transform of $x(t) = e^{-at}u(t)$.

5.   Convolve the following signals $u(t-1)$ and $\delta(t-1)$.

6.   Given $H(s) = \dfrac{s}{s^2 + 2s + 1}$. Find the differential equation representation of the system.

7.   Find the Nyquist rate of the signal $x(t) = \sin 200\pi t - \cos 100\pi t$

8.   Find the Z–transform of the signal and its associated ROC $x[n] = \{2, -1, 3, 0, 2\}$.

9. Convolve the following sequences

$x[n] = \{1, 2, 3\}$

$h[n] = \{1, 1, 2\}$.

10. Given the system function $H(z) = 2 + 3z^{-1} + 4z^{-3} - 5z^{-4}$. Determine the impulse response $h[n]$.

PART B — (5 × 13 = 65 marks)

11. (a) Determine whether the system is Linear, Time Invariant, Causal and memoryless $y(t) = \dfrac{1}{2} \int_{-\infty}^{t} x(z)\, dz$.

Or

(b) Sketch the following signals

(i) $u(-t + 2)$

(ii) $r(-t + 3)$

(iii) $2\delta[n + 2] + \delta[n] - 2\delta[n - 1] + 3\delta[n - 3]$

(iv) $u[n + 2]\, u[-n + 3]$

where $u(t)$, $r(t)$, $\delta[n]$, $u[n]$ represent continuous time unit step, continuous time ramp, discrete time impulse and discrete time step functions respectively.

12. (a) Find the Fourier transform of the signal $x(t) = \cos \Omega_0 t\ u(t)$.

Or

(b) State and prove the multiplication and convolution propert of Fourier transform.

13. (a) Convolve the following signals

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

$h(t) = u(t + 3)$.

Or

(b) A system is described by the differential equation $\dfrac{d^2}{dt^2} y(t) + 6 \dfrac{d}{dt} y(t) + 8y(t) = \dfrac{d}{dt} x(t) + x(t)$. Find the transfer function and the output signal $y(t)$ for $x(t) = \delta(t)$.

14. (a) (i) Discuss the effects of undersampling a signal using necessary diagrams. (5)

(ii) Find the Z–transform of $x[n] = a^n u[n] - b^n u[-n - 1]$ and specify its ROC. (8)

Or

(b) (i) Give the relation between Discrete Time Fourier Transform (DTFT) and Z-transform. (5)

(ii) State and prove the time shifting property and time reversal property of Z-transform. (8)

15. (a) Convolve the following signals

$x[n] = u[n] - u[n - 3]$

$h[n] = (0.5)^n u[n]$.

Or

(b) Determine whether the given system is stable by finding $H(z)$ and plotting the pole-zero diagram

$y[n] = 2y[n - 1] - 0.8y[n - 2] + x[n] + 0.8x[n - 1]$.

PART C — (1 × 15 = 15 marks)

16. (a) A causal system has input $x[n]$ and output $y[n]$. Find the

(i) System function $H(z)$. (4)

(ii) Impulse Response $h[n]$. (6)

(iii) Frequency response $H(e^{jw})$. (5)

$x[n] = \delta[n] + \dfrac{1}{6}\delta[n - 1] - \dfrac{1}{6}\delta[n - 2]$

$h[n] = \delta[n]^6 - \dfrac{2}{3}\delta[n - 1]$.

Or

(b) Find the response $y(t)$ of a continuous time system using Laplace transform with transfer function $H(s) = \dfrac{1}{(s + 2)(s + 3)}$ for an input $x(t) = e^{-t} u(t)$.

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