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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 $x(t)=\frac{\cos 2\pi t}{3}$ 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 $H(s)=\frac{s}{s^2+2s+1}$. 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 $x[n]=\{2, -1, \underset{\uparrow}{3}, 0, 2\}$.

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 $y(t) = \frac{1}{2}\int_{-\infty}^{t} x(z)\, dz$.

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 $\frac{d^2}{dt^2} y(t) + 6\frac{d}{dt} y(t) + 8y(t) = \frac{d}{dt} x(t) + x(t)$. 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)

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

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

Or

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