K 1026

./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2004.

Third Semester

Electronics and Communication Engineering

EC 232 — SIGNALS AND SYSTEMS

(Common to Bio–Medical Engineering)

: Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

Classify the following signal as

(a) periodic or non periodic and

(b) energy or power signal.

(i) $e^{\alpha t}$, $\alpha > 1$

(ii) $e^{-j2\pi ft}$.

Is diode a linear device? Give your reason.

A signal $x(t) = \cos 2\pi ft$ is passed through a device whose input–output is related by $y(t) = x^2(t)$. What are the frequency components in the output?

4. What are the differences between Fourier series and Fourier transform?

5. Draw the waveform $x(-t)$ and $x(2-t)$ of the signal $x(t) = \begin{cases} t & 0 \le t \le 3 \\ 0 & t > 3 \end{cases}$.

6. What is the Laplace transform of (a) $e^{-at} \sin wt\, u(t)$ (b) $a^n u(n)$.

7. What is the difference between the spectrum of the continuous signal and the spectrum of the corresponding sampled signal?

8. What is the transfer function of a system whose poles are at $-0.3 \pm j0.4$ and a zero at –0.2?

9. What is the linear convolution of the two signals $\{2, 3, 4\}$ and $\{1, -2, 1\}$?
$\uparrow$ $\uparrow$

10. Write the difference equation and the transfer function of the system in figure Q. No. 10.

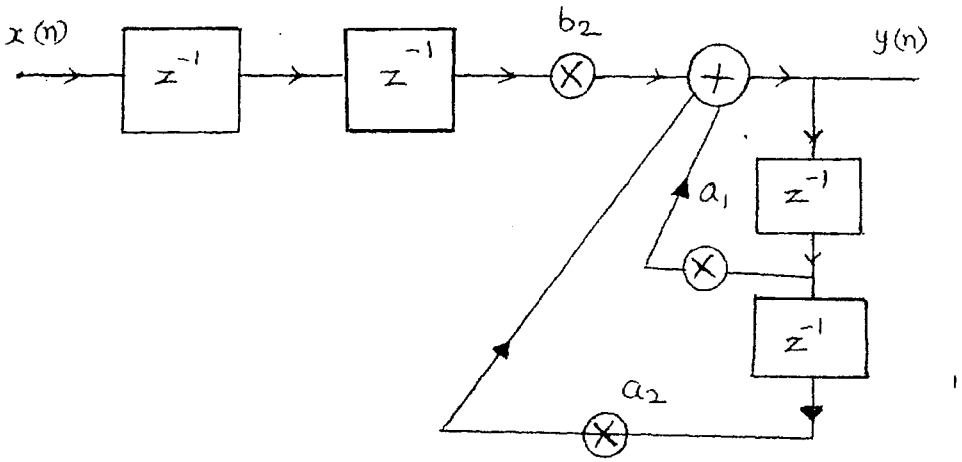


figure Q. No. 10

PART B — ($5 \times 16 = 80$ marks)

11. (i) Prove that the convolution of two signals is equivalent to multiplication of their respective spectrum in the frequency domain. (8)

(ii) Find and plot the magnitude spectrum of the transfer function $H(jw) = \dfrac{e^{jw} + a}{e^{jw} + 1/a}$. (8)

12. (a) (i) Define Linear time invariant system. (4)

(ii) Verify the linearity causality and time invariance of the system $y(n+2) = ax(n+1) + bx(n+3)$. (9)

(iii) What is the periodicity of the signal $x(t) = \sin 100\pi t + \cos 150\pi t$? (3)

Or

(b) (i) Derive convolution integral of a system. (7)

(ii) What are basic continuous time signals? Draw any four waveforms and write their equations. (9)

(a) Find the Fourier series of the signal $x(t) = \int_0^{2\pi} \sin 2\pi f_0 mt \cos 2\pi f_0 nt$ where f_0 is the fundamental frequency and m and n are any positive integer.

Or

(b) (i) Find the Laplace transform of $t\,x(t)$ and $x(t-t_0)$ where t_0 is a constant in terms of $X(s)$ if $x(t) \longleftrightarrow X(s)$. (8)

(ii) Find the response of the system shown in figure Q. No. 13 (b) (ii) for the input $x(t) = \delta(t) - \delta(t-1.5)$ $h(t)$ = impulse response of the system. (8)

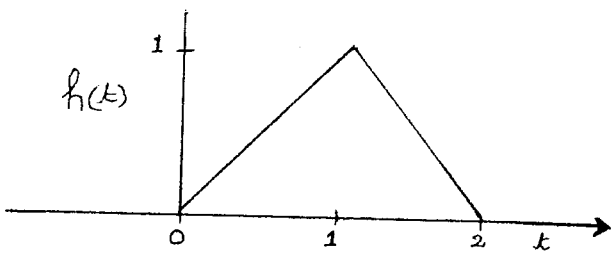


figure Q. No. 13 (b) (ii)

(a) (i) Define one–sided and two–sided Z–transform. (2)

(ii) Find the Z–transform of the sequence

$$x(n) = \left(\frac{1}{2}\right)^n u(n) - \left(\frac{1}{4}\right) u(n-1)$$

(8)

(iii) Find the DFT coefficients $X(0)$ & $\int_{-\pi}^{\pi} |X(w)|^2\, dw$ for the sequence $x(n) = \{-1, 2, -3, 2, -1\}$. (6)

Or

(b) (i) What are the three possible sequences whose Z–transform is given by $X(Z) = \dfrac{\frac{8}{6}Z^2 - \frac{67}{12}Z}{Z^2 - \frac{17}{12}Z + \frac{1}{2}}$. (13)

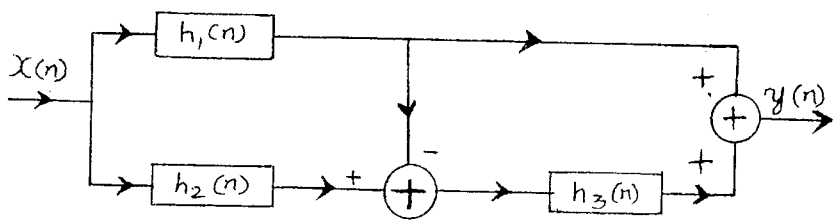
(ii) What is the impulse response $x(n)$ of the system if the poles and zeros are radially moved K times their original location? (3)

15. (a) Find the output sequence $y(n)$ of the system described by the equation $y(n) = 0.7y(n-1) - 0.1y(n-2) + 2x(n) - x(n-2)$ for the input sequence $x(n) = u(n)$.

Or

(b) (i) What is state–space technique? (4)

(ii) Find the overall impulse response of the causal system shown in figure Q. No. 15 (b) (ii). (12)



Where $h_1(n) = \left(\frac{1}{3}\right)^n u(n)$ $\quad h_2(n) = \left(\frac{1}{2}\right)^n u(n)$

$h_3(n) = \left(\frac{1}{5}\right)^n u(n)$.

figure Q. No. 15 (b) (ii)