A 235

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2005.

Third Semester

Electronics and Communication Engineering

EC 232 — SIGNALS AND SYSTEMS

(Common to : Bio–Medical Engineering)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What are the advantages of linear time invariant system?

2. What is the condition that the signal $e^{at}u(t)$ to be energy signal?

3. Do Fourier transform and Laplace transform exist? What is the condition for its existence?

4. What is the Fourier transform of sin wt? When this signal is multiplied by $e^{j\Omega t}$ what is the Fourier transform?

5. What is the output of a system whose impulse response $h(t) = e^{-at}$ for a delta input?

6. What is the overall impulse response of $h_1(t)$ and $h_2(t)$ when they are in (a) series (b) parallel?

7. Is the IDFT of DFT periodic or not? Give your comment.

8. Define Z–transform.

9. What is the condition for stability of a discrete time system?

10. What are the four steps to obtain the convolution?

PART B — (5 × 16 = 80 marks)

11. (i) Let the Fourier transform of a signal $x(t)$ as shown in Figure 11 (i).

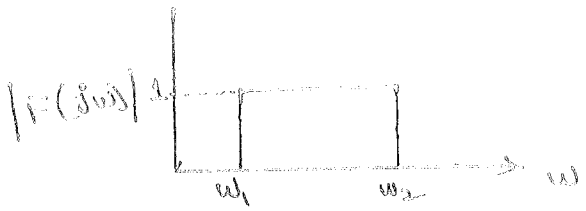


Figure 11 (i)

Determine the Fourier transform of $\frac{dx(t)}{dt}$ $tx(t)$ and $\int_0^t x(t)\,dt$ using property. (6)

(ii) Find the inverse Z-transform of $H(z) = 1/(1 - 2z^{-1})(1 - z^{-1})^2$ which is causal. (10)

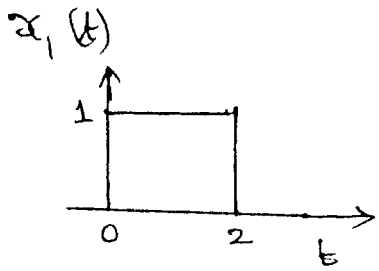
12. (a) (i) Prove that the convolution of the two signals corresponds to multiplication of their respective Fourier transform. (8)

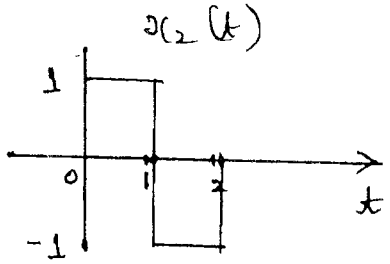
(ii) Find the Laplace transform of $x(t) = e^{-at} \cos wt\, u(t)$. (8)

Or

(b) (i) Find the inverse Laplace transform of $(3s^2 + 8s + 23)/(s + 3)(s^2 + 2s + 10)$. (6)

(ii) Find the convolution of the two signals. (10)





13. (a) (i) Find the magnitude spectrum of Fourier transform and plot it where $H(jw) = (1 + 2e^{-jw})/(1 + 1/2\, e^{-jw})$. (8)

(ii) Determine the impulse response $h(t)$ of the system whose input–output is related by the differential equation $x(t)$ is input $y(t)$ is output $\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = x(t)$ with all initial conditions to be zeros. (8)

Or

(b) (i) Determine the output response of the system whose impulse response $h(t) = e^{-at}\, u(t)$ for the step input. (8)

(ii) Explain state space equations. (8)

14. (a) (i) What is the condition for Z–transform to exist? (2)

(ii) What are the properties of region of convergence? (6)

(iii) Find the DFT of the sequence $x(n) = \{1, 1, 0, 0\}$. (8)

Or

(b) (i) Prove that the spectrum of a discrete–time signal is periodic. (8)

(ii) How do you get Fourier transform from Z–transform? Explain in detail. (8)

15. (a) Find the overall impulse response of the system shown in Figure 15 (a) if $h_1(n) = \left(\frac{1}{3}\right)^n u(n)$ $h_2(n) = \left(\frac{1}{2}\right)^n u(n)$ and $h_3(n) = \left(\frac{1}{5}\right)^n u(n)$.

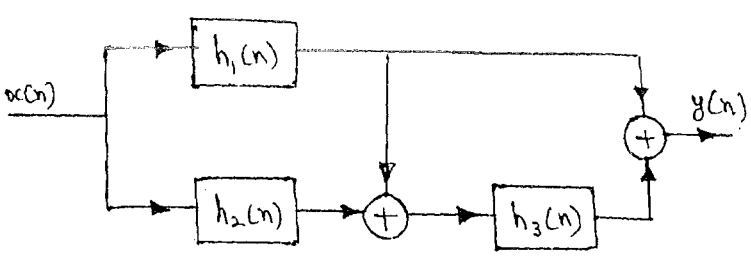


Figure 15 (a)

Or

(b) (i) Define FFT. (2)

(ii) Find the convolution of $x(n) = a^n\, u(n)$ with $h(n) = \begin{cases} 1 & 0 \le n \ 9 \\ 0 & n \ge 10 \end{cases}$. (14)