BITS, PILANI – DUBAI CAMPUS

Knowledge Village, Dubai

Year II – Semester II 2003 – 2004

Test II (Closed Book)

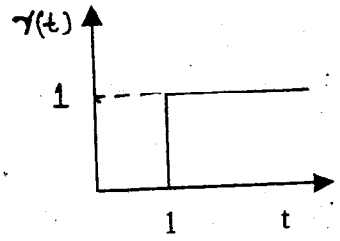
Course No.: EEE UC 272 / INSTR UC 272 Course: Circuits & Signals

16 - 05 - 04 Time: 50 Minutes M.M. = 30 Weightage = 15 %

1. A system is described by the following differential equation

   $\frac{d^2 y(t)}{dt^2} + 3\frac{d y(t)}{dt} + 2\, y(t) = r(t); \quad y(0) = 0 ; \dot{y}(0) = 1$

   The input r(t) is sketched in figure below.



   Find the response of the system y(t) using laplace transform.

2. State and prove the initial and final value theorems of Z- transform.

3. With neat sketches, explain the effect of pole locations of the characteristics equation of a discrete time system in the z-plane, on the system response.

4. Find the unit impulse response h(n) of the system described by the following difference equation

   $y(n) - 2\, y(n-1) + y(n-2) = r(n) + r(n-2)$

5. Deduce the linear convolution of the sequences $f_1(k) = \{2,1,0,1\}$ and $f_2(k) = \{1,2,2\}$ employing cyclic convolution technique.

****

BITS, PILANI – DUBAI CAMPUS

Knowledge Village, Dubai

Year II – Semester II 2003 – 2004

Comprehensive Exam (Closed Book)

Course No.: EEE UC 272 / INSTR UC 272 Course: Circuits & Signals

06 - 06 - 04 Time: 3 Hrs. M.M. = 60 Weightage = 40 %

(Part A : Each Question Carries 1 mark)

A1. Differentiate between Static and Dynamic systems.

A2. Plot the function $f(t) = e^{at} \sin(\omega t + \Pi/4)$

A3. How do you classify the response of a second order system based on the damping facor?

A4. If $x_1(t) * x_2(t) = y(t)$; then $x_1(t) * x_2(t-T) = ?$ (* represents convolution)

A5. Define Fourier transform of a function f(t).

A6. If $\mathcal{L}[f(t)] = F(s)$; then $\mathcal{L}[f'(t)] = ?$

A7. What is an IIR filter?

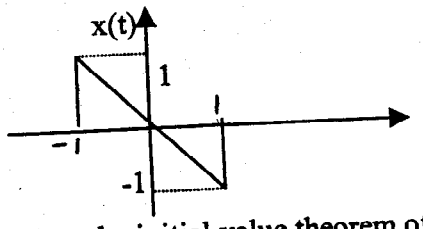
A8. The number of complex multiplications to be performed to compute N point DFT is _____

A9. While using Decimation-in-time algorithm to compute N point FFT, the number of complex multiplications to be performed are _____

A10. Write the inverse Z transform of $[z^3/(z+2)^3]$

(Part B : Each Question carries 2 marks)

B1. Draw the even and odd components of the signal shown below.



B2. State the initial value theorem of Laplace transform. Find the final state response of a system whose Laplace transform is given by $(s + 2) / [s (s+5) (s+4)]$.

B3. What do you understand by Image impedance and characteristic impedance of an attenuator?

B4. The poles of a discrete time system are given by i) $z = -1$ ii) $z = 0.5 \pm j\,0.7$

Sketch the respective response of the system in the discrete time domain.

B5. Two sequences are given as $x_1(n) = \{ 1, 1, 0 \}$ and $x_2(n) = \{ 0, 1, 2, 0 \}$.

Find the circular convolution sample $x(2)$, where $x(n) = x_1(n) \circledast x_2(n)$

(Part C All questions carry 10 marks each)

I(a). Sketch the following periodic signal with a period 4 and is represented by

$$x(t) = \sin \Pi t; \quad 0 \le t \le 2$$
$$= 0 \quad ; \quad 2 \le t \le 4$$ (2)

(b). Find the trigonometric Fourier series representation of a half wave rectified sine wave of frequency 2 rad/sec. (8)

II. Consider the LTI system characterized by the differential equation

$y'''(t) + 6\,y''(t) + 11\,y'(t) + 6\,y(t) = x(t)$; Using Laplace transform ,

a) Determine the zero-state response of the system for an input $x(t) = e^{-4t}\,u(t)$ (4)

b) Determine the zero-input response of the system for $t > 0^-$, given that

$y(0^-) = 1, \quad y'(0^-) = -1, \quad y''(0^-) = 1$ (4)

c) Determine the output of the system when the input is $x(t) = e^{-4t}\,u(t)$ and the initial conditions are the same as those specified above. (2)

III a). Prove the discrete convolution property of Z - transforms (5)

b) Find the impulse response for the discrete time system described by the difference equation $y(n) = 3\,y(n-1) + r(n-1)$ (5)

IV. a) plot the complex numbers W_8^0, W_8^2, W_8^4 and W_8^5 (4)

b) Calculate the DFT of the time sequence given by $f(n) = \{ 0, 1, 2, 0 \}$ (6)

Va) Deduce the transfer function of a second order Chebyshev LP filter with cut-off frequency of 100 Hz, pass-band ripple of 0.5 dB and amplitude of unity at zero Hz. (5)

b) The behaviour of a causal LTI system is represented by the following difference equation. $x(n) - 2\,x(n-1) + x(n-2) = y(n) + 2\,y(n-1) + y(n-2)$. Determine the transfer function of the system and realize the function in canonical form (5)

BITS, PILANI – DUBAI CAMPUS

Knowledge Village, Dubai

Year II – Semester II 2003 – 2004

Test I (Closed Book)

Course No.: EEE UC 272 / INSTR UC 272 Course: Circuits & Signals

28 - 03 - 04 Time: 50 Minutes M.M. = 30 Weightage = 15 %

1(a). Derive the Hybrid parameters of a linear two port network.

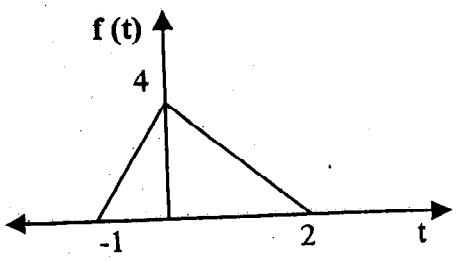
(b). Write the conditions for a hybrid network to be symmetrical. (4+1)

2. (a) Define energy and Power signals.

(b) Show that $\int_{-\infty}^{\infty} \delta'(t)\,\phi(t)\,dt = -\phi'(0)$ (2+3)

3. The unit Impulse response of a LTIC system is $\mathbf{h(t) = 4\,e^{-2t}\ Cos\ 3t\ u(t)}$. Find the system's zero-state response **y(t)** for an input $\mathbf{f(t) = e^{-t}\,u(t)}$. (5)

4. For the signal shown below,



(a) write a single expression $f(t)$ valid for all time t.

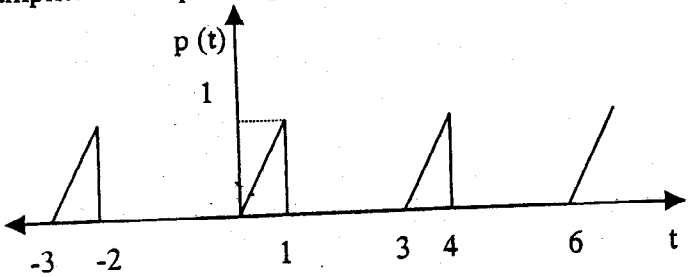
(b) Sketch $f(-t)$

(c) Sketch $f(t-2)$ & $f(t+2)$

(d) Sketch $f(3t)$ & $f(t/2)$

(3+1+2+2)

5. For the periodic signal shown below, find the compact trigonometric Fourier series and sketch the amplitude and phase spectra. (4 +1.5+1.5)



****