BITS, PILANI – DUBAI CAMPUS
Knowledge Village, Dubai
Year II – Semester II 2004 – 2005
Comprehensive Examination (Closed Book)
CIRCUITS & SIGNALS
EEE UC 272 / INSTR UC 272

Date: 22 – 05 - 05 **Time: 3 hrs** **Max Marks= 60** **Weightage = 40 %**

Answer ALL Questions
All Questions Carry Equal marks
(Answer all part of the same question together)

1 (a). Sketch the even and odd components of the function

$$g(t) = 8 + 7t^2$$

(b). Find the derivative of the function f (t) shown in figure 1 and draw the waveform

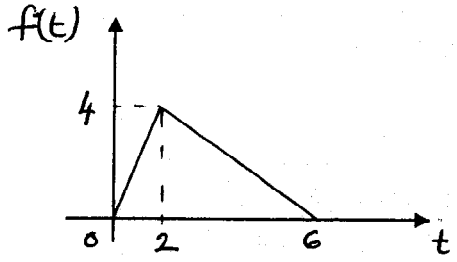

Figure 1

(c) Represent the given function f(t) in the graphical form

$$f(t) = 5\,u(t) - 3\,u(t-3) - 2\,u(t-5)$$

(3+4+3)

2 (a) State and prove the frequency shifting property of Fourier transform.

(b) Derive the Laplace transform of the periodic signal shown in figure 2

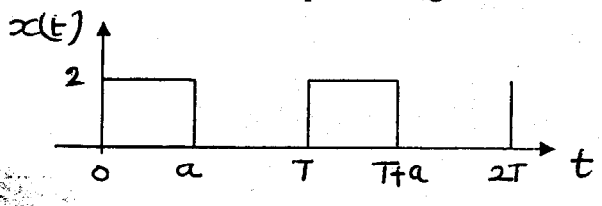

Figure 2

(c). Find the Z-transform of $f(n) = \sin(\omega_o n)\,u(n)$ (3+4+3)

3 (a) Consider the circuit shown in figure 3. The switch has been in position '1' for long time. It is thrown to position '2' at t = 0. Solve for the current i(t) using Laplace transform.

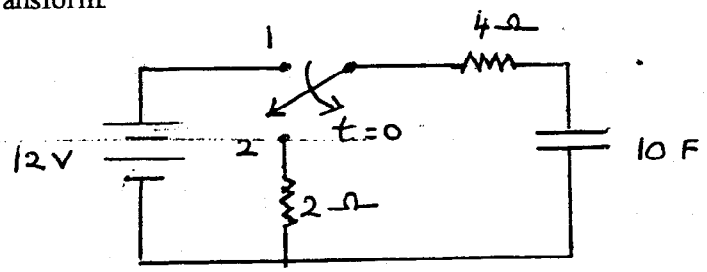

Figure 3

(b) Find the inverse Z-transform of

$$\frac{z + z^{-1}}{z(1 + \frac{1}{8}z^{-1})}$$

(6+4)

4. (a) The transfer function of a system is given as

$$H(s) = \frac{s}{s^2 + 2s + 5}$$

If the input to the system $x(t) = 100\,u(t)$, find the output $y(t)$ using convolution Integral.

(b) Consider a causal LTI system whose input x[n] and output y[n] is related by the difference equation $y[n] = \frac{1}{4}\,y[n-1] + x[n]$

Determine y[n] if $x[n] = \delta[n-1]$ (5+5)

5 (a) Perform the circular convolution of the following sequences

$f_1(n) = \{1\ 2\ 3\ 4\}$; $f_2(n) = \{2\ 2\ 2\ 2\}$

(b) Calculate the DFT of the time sequence given by $f(k) = \{0, 2, 1, 0\}$ (5+5)

6 (a) Differentiate between FIR and IIR filter

(b) Design a Low Pass Butterworth filter whose maximum amplitude is unity at $\omega = 0$ rad/s and at 100 rad/s the amplitude becomes 0.5 times the maximum amplitude. The cut-off frequency $\omega_c = 62.8$ rad/s where the amplitude is 0.707 times that of maximum amplitude. (3+7)

BITS – PILANI DUBAI CAMPUS

Knowledge Village, Dubai

II semester II Year

Circuits & Signals EEE / INSTR UC 272

Test II / 08 – 05 – 05 **(Closed Book)** **Time : 50 min.** Max. Marks : 30

1. Consider the system characterized by the differential equation

$$\frac{d^3y}{dt^3}+6\frac{d^2y}{dt^2}+11\frac{dy}{dt}+6y=x(t)$$

   a. Determine the zero state response of the system for the input $x(t) = e^{-4t}u(t)$ (6)

   b. Determine zero input response of the system for $t > 0$ given that $y(0) = 1$; $\dot{y}(0) = -1$; $\ddot{y}(0) = 1$ (6)

   b. Determine the output when the input is $x(t) = e^{-4t}u(t)$ and the initial conditions are the same as those specified in 1(b) (3)

2. The i/p - o/p relation ship of a LTIDT system is described by the difference equation given below with the initial conditions

$$y(n+2) - 3/2\, y(n+1) + \tfrac{1}{2}\, y(n) = x(n) \qquad \text{for } n >= 0$$

   a. Determine the zero state response of the system for $x(n) = (1/4)^n$ (6)

   b. Determine the zero input response of the system for $t > 0$ given that $y(0) = 10$; $y(1) = 4$; (6)

   c. Determine the output when the input is $x(n) = (1/4)^n$ and the initial conditions are the same as those specified in 2(b) (3)

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BITS, PILANI – DUBAI CAMPUS

Knowledge Village, Dubai

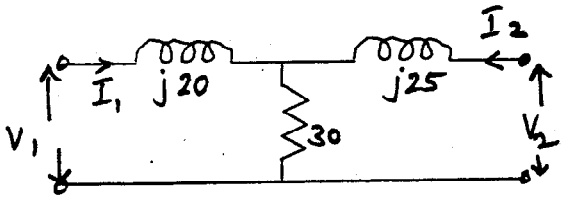
Year II – Semester II 2004 – 2005

Test I (Closed Book)

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

20 – 03 - 05 Time: 50 Minutes M.M. = 30 Weightage = 15 %

1(a). For the network shown in figure, determine the Z parameters.



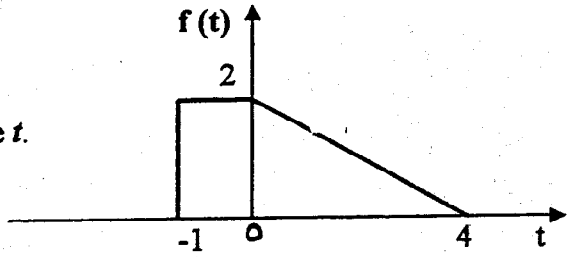
(1.5 x 4)

2. (a) Define i) a Linear system ii) An Impulse signal (2 + 2)

(b) Evaluate $\int_{-\infty}^{\infty} e^{(x-1)} \cos [\pi/2 (x-5)] \delta (x-3)\, dx$ (2)

3. The unit Impulse response of a LTIC system is given by $h(t) = \cos 3t\, u(t)$. Find the system's zero-state response y(t) if the input $f(t) = e^{-t} u(t)$. (6)

4. For the signal shown .



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

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

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

(2+2+2)

5. Find the exponential Fourier series for the continuous time periodic signal given by

f(t) = 1.5 $0 \le t < 1$

= -1.5 $1 \le t < 2$ with a fundamental frequency $\omega_o = \Pi$

(1.5 x 4)

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