UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Kedua
Sidang Akademik 2002/2003

Februari/Mac 2003

JEE 327 – ISYARAT DAN SISTEM

Masa : 3 jam

ARAHAN KEPADA CALON:

Sila pastikan bahawa kertas peperiksaan ini mengandungi **LAPAN (8)** muka surat bercetak dan **ENAM (6)** soalan sebelum anda memulakan peperiksaan ini.

Jawab **LIMA (5)** soalan.

Agihan markah bagi soalan diberikan disut sebelah kanan soalan berkenaan.

Jawab semua soalan di dalam Bahasa Malaysia.

1. (a) Cari Siri Fourier bagi isyarat-isyarat berikut. Lakarkan spektrum magnitud dan phasa setiap isyarat.

Compute the Fourier Series for the following signals. Sketch the magnitude and phase spectrums.

(i) $x(t) = 4 + 8\cos(50t + \pi) + 6\cos(100t - \pi/2)$

(ii) $x(t) = 2\cos(4\pi(1000)t)\cos(2\pi(500)t)$

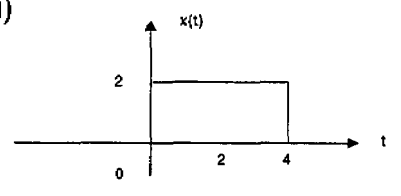
(10%)

(b) Cari Transformasi Fourier untuk isyarat-isyarat berikut dan lakarkan $|X(j\omega)|$.

Find the Fourier Transform for each of the following signals and then sketch $|X(j\omega)|$.

(i) $x(t) = \cos(100t)P_2(t)$

(ii)



(iii) $x(t) = e^{-2t}\cos(2t)u(t)$

(10%)

2. (a) Cari komponen genap dan ganjil bagi isyarat-isyarat berikut.

Find the even and odd components of each of the following signals.

(i) $x(t) = \cos(t) + \sin(t) + \sin(t)\cos(t)$

(ii) $x(t) = (1 + t^3)\cos^3(10t)$

(6%)

(b) Tentukan sama ada isyarat-isyarat berikut adalah berkala. Jika ya, cari kala asasnya.

Determine whether the following signals are periodic. If so, find the fundamental period.

(i) $x(t) = \cos^2(\pi t)$

(ii) $x[n] = (-1)^n$

(iii) $x(t) = \cos(\pi t)$

(6%)

(c) Kategorikan isyarat-isyarat berikut kepada isyarat tenaga atau kuasa. Cari tenaga atau kuasanya.

Categorise each of the following signals as an energy or power signals. Find the energy and power of the signals.

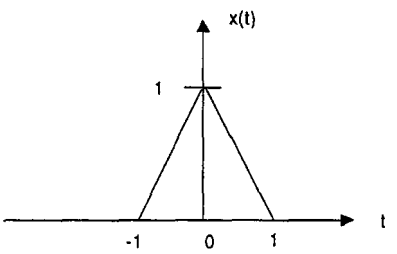
(i)
$$x(t) \begin{cases} 2t, & 0 \le t < 1 \\ 2-2t, & 1 \le t < 2 \\ 0, & \text{otherwise} \end{cases}$$

(4%)

(ii)
$$x(t) \begin{cases} 2\cos(\pi t), & -1 \le t \le 1 \\ 0, & \text{otherwise} \end{cases}$$

(4%)

3. (a) Satu isyarat dedenyut segitiga, x(t), ditunjukkan di dalam gambarajah di bawah :
A triangular pulse signal, x(t), is depicted as below :



Lakarkan isyarat-isyarat berikut yang dihasilkan berdasarkan x(t).
Sketch each of the following signals derived from x(t).

(i) x(2t)
(ii) x(2t + 2)
(iii) x(2t) + x(2t + 2)

(10%)

(b) Sistem-sistem di bawah mempunyai masukan x(t) atau x[n] dan keluaran y(t) atau y[n] masing-masing. Tentukan sama ada setiap satu adalah kausal, mempunyai ingatan, lelurus dan/atau tak-berubah-masa.

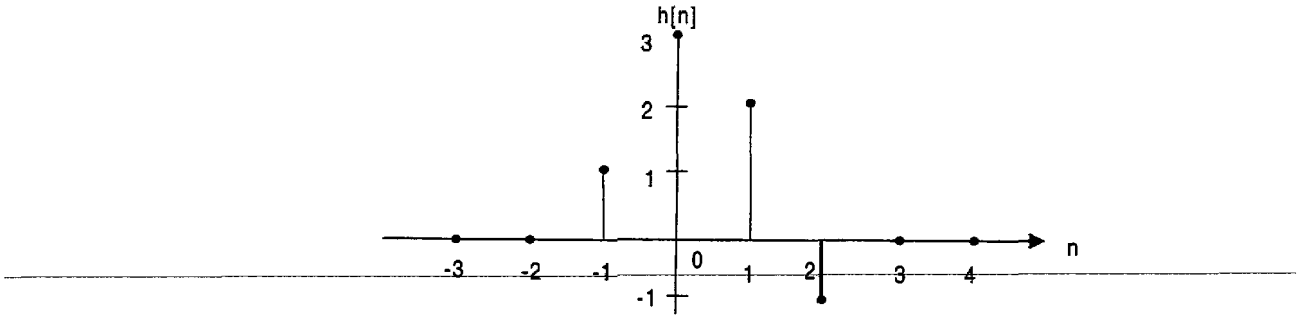
The systems below have an input x(t) or x[n] and an output y(t) or y[n], respectively. Determine whether each of them are causal, memoryless, linear and/or time-invariant.

(i) y(t) = cos(2x(t))
(ii) y(t) = x(2 - t)
(iii) y(t) = d/dt (x(t))

(10%)

4. (a) Satu sistem LTI masa-diskret mempunyai sambutan dedenyut seperti rajah di bawah :

A discrete-time LTI system has an impulse response as below :

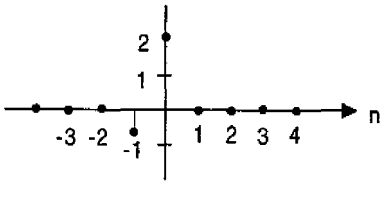


Gunakan hukum lelurus dan tak-berubah-masa untuk menentukan keluaran, y[n], apabila masukan, x[n], diberi oleh :

Use linearity and time-invariance properties to determine the system output, y[n], if the input, x[n], is given by :

(i) $x[n] = 2\delta[n] - \delta[n-1]$

(ii)



(10%)

(b) Lakarkan isyarat-isyarat berikut dan seterusnya cari hasil pelingkarannya $y(t) = x_1(t) * x_2(t)$.

Sketch the signals below and then find their convolution $y(t) = x_1(t) * x_2(t)$.

(i) $x_1(t) = e^{-2t}\, u(t)$
$x_2(t) = u(\, t+2\,)$

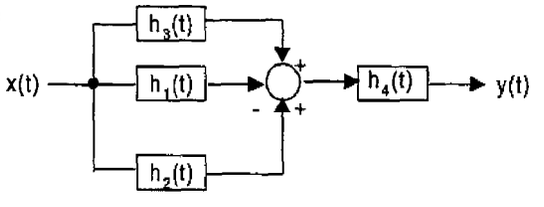
(ii) $x_1(t) = \cos(\, \pi t\,)(\, u(t+1) - u(t-3)\,)$
$x_2(t) = u(t)$

(10%)

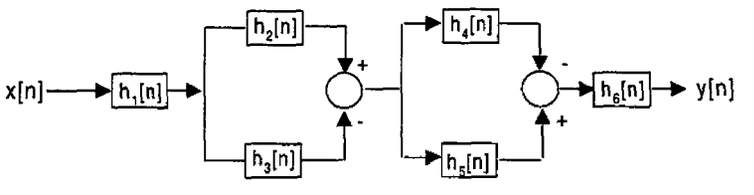
5. (a) Cari expresi untuk sambutan dedenyut menghubungkan masukan, x(t) atau x[n], kepada keluaran, y(t) atau y[n], dalam terma sambutan dedenyut sub-sistem setiap sistem LTI di bawah :

Find the expressions for the impulse response relating the input, x(t) or x[n], to the output, y(t) or y[n], in terms of the impulse response of each of the sub-system for the LTI systems below :

(i)



(ii)

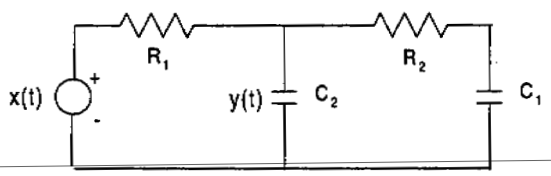


(4%)

(b) Tuliskan persamaan kebezaan yang menghubungkan keluaran, y(t) dengan masukan, x(t), bagi litar di bawah.

Write the differential equation relating the output, (y(t) to the input, x(t), of the circuit below.

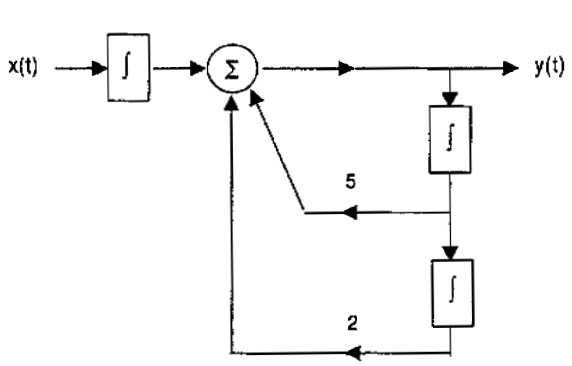
(8%)



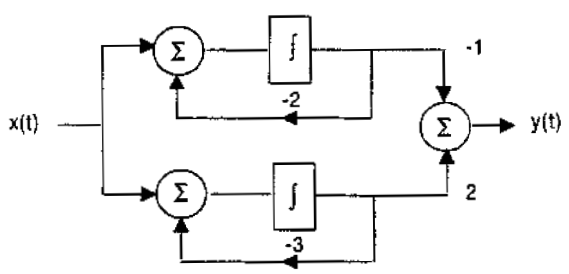
(c) Cari persamaan kebezaan untuk sistem-sistem di bawah:

Find the differential equation descriptions for the systems below:

(i)



(ii)



(8%)

6. (a) Tentukan sambutan semulajadi bagi sistem-sistem yang dihuraikan oleh persamaan-persamaan kebezaan berikut:

Determine the natural response of the systems described by the following differential equations:

(i) $5\frac{dy(t)}{dt} + 10\,y(t) = 2\,x(t), \quad y(0) = 3$

(ii) $\frac{d^2}{dt^2}y(t) + 3\frac{d}{dt}y(t) + 2\,y(t) = x(t) + \frac{d}{dt}x(t)$

$y(0) = 0; \quad \frac{d}{dt}y(t)\Big|_{t=0} = 1$

(10%)

(b) Tentukan transformasi-z dan ROC bagi isyarat-isyarat berikut. Lakarkan ROC, sifar dan kutub di dalam plana-z.

Determine the z-transform and ROC for the following time signals. Sketch the ROC, poles and zeros in the z-plane.

(i) $x[n] = (1/2)^n(u[n] - u[n-10])$

(ii) $x[n] = (1/2)^n u[-n]$

(10%)

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