Code No. 6075 / M

FACULTY OF INFORMATICS

B.E. 2/4 (IT) II – Semester (Main) Examination, June 2014

Subject : Signals and Systems

Time : 3 hours **Max. Marks : 75**

Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.

PART – A (25 Marks)

1 Given x(t) = 6 cos4t + 3 sin 2t + 4 cost sin t. Find the even and odd components of the signal. 2

2 How orthogonal property is central to determine the Fourier series coefficients? 3

3 Find the inverse FT of X(jw) = $2\pi\delta(w)$. 3

4 Write initial value and final value theorems of LT. 2

5 State sampling theorem. 2

6 How z-transform is used to determine the causality of LTI system? 2

7 Evaluate the convolution of x[n] with $\delta[n]$. 3

8 Given x(n) = [4, -2, 2, 0, 4] and y[x] = [3, 0, -3, 6] determine their cross-correlation sequence. 3

9 How are the impulse response and step response of an LTI system related? 2

10 An LTI system has system function $H(z) = \frac{z}{z-a}$. What is the range of values of a for which system is stable. 3

PART – B (50 Marks)

11 a) Determine the complex – exponential Fourier series expansion of the periodic signal shown in figure 11(a). 6

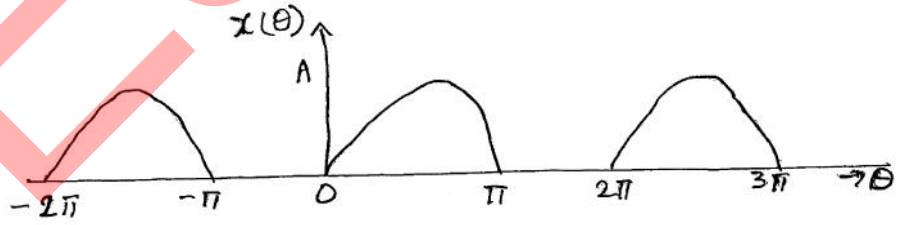

figure 11(a)

b) State and prove Parseval's theorem. 4

12 a) Find the Fourier transform of 5

$$x(t) = \cos \pi t \quad ; \quad -\frac{1}{2} \le t \le \frac{1}{2}$$

$$0 \qquad \text{otherwise}$$

b) Determine the energy contained in the signal x(t) = 20 sinc 10t. 5

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13 a) Find the bilateral Laplace transform of $x(t) = 3\,e^{-7t}\,u(t) - 12\,e^{4t}\,u(-t)$. 4

b) Solve the following differential equation using the unilateral Laplace transform. 6

$$\frac{d^2x(t)}{dt^2} + 3\frac{dx(t)}{dt} + 2x(t) = 2\,u(t) \text{ and } x(0^-) = 1, \quad x^1(0^-) = 0$$

14 a) What is aliasing? What causes it and how it can be eliminated?

b) Find and sketch the wave form $z(t) = x(t) * y(t)$, if x(t) and y(t) an shown in figure 14(b).

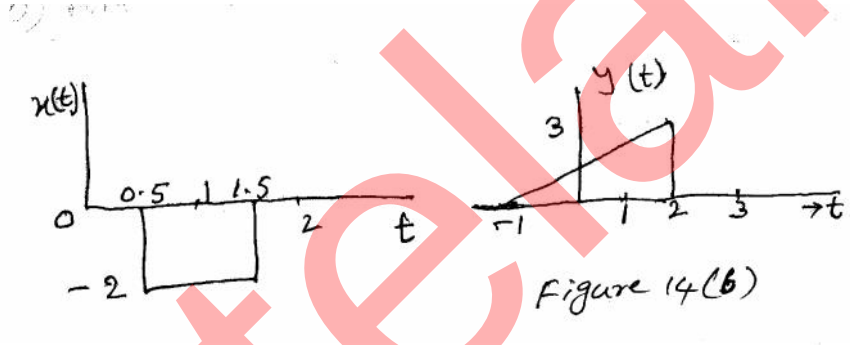

Figure 14(b)

15 a) Find the auto-correlation function and the energy spectral density of the signal $x(t) = e^{-t}\,u(t)$. 5

b) Find the unilateral z-transform of $x(n) = \left[a^n \cos w_0 n\right] u(n)$ 5

16 a) An LTI system has an impulse response of $e^{-t}\cos(100\,\pi\,t)\,u(t)$. Determine the output of the system for an input of $x(t) = \cos(100\,\pi\,t)\,u(t)$. 6

b) Determine whether the following system is static, linear time invariance and causal. 4

$$2\frac{dy(t)}{dt} + t \quad y(t) = 4x(t)$$

17 a) Write a MATLAB program to compute and plot 20 samples of the unit sample response sequence h(n) of the causal LTI system described by the first order difference equation. 6

$y(n) = x(n) - 0.9\,y(n-1)$

b) Write a MATLAB program to determine the circular convolution of the sequences $x(n) = [2, -1, 3, 5, 1]$ and $y(n) = [1, -2, 3, 1, 4]$. 4

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