C 48105 (Pages 3) Name.....

Reg. No.....

FOURTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2008

IT 2K 403—SIGNALS AND COMMUNICATION SYSTEMS

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

I. (a) Define energy signal and find the energy of $x(t) = e^{-|t|}$ for all t.

(b) Derive the relationship between input and output of an LTI system.

(c) State and prove any two properties of autocorrelation of deterministic signal.

(d) Find the DTFT of :

$$x(n) = \left(\tfrac{1}{3}\right)^n, \quad n \geq 0$$
$$= 2^n, \quad n < 0.$$

(e) Explain the method of determining frequency response from poles and zeros.

(f) State and prove convolution property of Z transform.

(g) Derive the power relations for single-tone AM wave.

(h) Explain the method of generating FM wave by using PM.

(8 × 5 = 40 marks)

Part B

II. (a) (i) Consider the signal :

$$x(t) = t, \quad 0 \leq t \leq 1$$
$$= 1, \quad 1 \leq t \leq 2$$
$$= 2, \quad 2 \leq t \leq 4$$
$$= 0, \quad \text{otherwise.}$$

Plot $x(t)$, $x(3t)$, $x(4t - 2)$ and $x\left(t - \tfrac{3}{2}\right)$.

(7 marks)

Turn over

(a) (ii) Explain (1) linearity ; (2) Time-invariant ; and (3) causality. (8 marks)

Or

(b) (i) State and prove convolution theorem of Fourier transform. (7 marks)

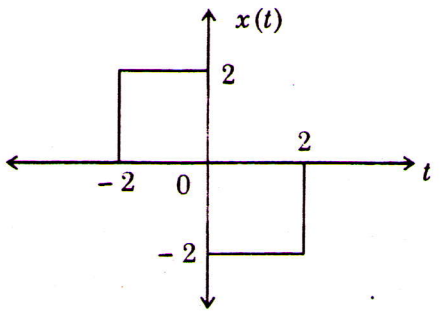
(ii) Find the Fourier transform of :

$$x(t) = 1, \quad |t| \leq 1$$
$$= 0, \quad |t| > 1$$

by using differentiation property.

(8 marks)

III. (a) Determine and plot the energy spectrum of the signal shown below :



Or

(b) (i) State and prove any two properties of Hilbert transform. (8 marks)

(ii) Find the discrete Fourier series representation of the periodic sequence $x(n) = \{1, 2, 3.$ with period N = 4.

(7 marks)

IV. (a) (i) Find the transfer function of the system described by the differential equation :

$$y''(t) + 6y'(t) + 5y(t) = 4x(t).$$

(5 marks)

(ii) State and prove any two properties of Z-transform. (10 marks)

Or

(b) Find the impulse response of an LTI system described by the difference equation.

$$y(n) - \frac{3}{4}\, y(n-1) + \frac{1}{8}\, y(n-2) = 2x(n).$$

(15 marks)

V. (a) (i) Explain the method of generation of AM signal. (9 marks)

(ii) Explain the spectrum of AM wave with diagram. (6 marks)

Or

(b) (i) Derive the expression for single-tone FM signal. (8 marks)

(ii) Explain the difference between narrow band FM and wideband FM. (7 marks)

[4 × 15 = 60 marks]