D 42158   (Pages 2)
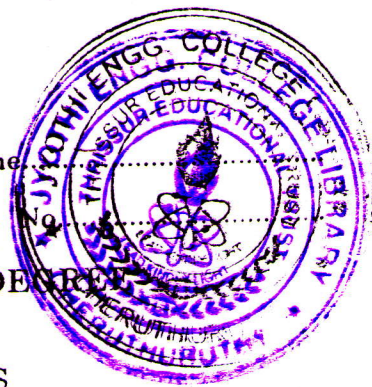
FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2007

EC/AI/IC/BM 04 501—SIGNALS AND SYSTEMS

(2004 admissions)

Time : Three Hours   Maximum : 100 Marks

Answer **all** *questions.*

Part A

I. (a) Explain what is meant by power and energy signals ? Give an example for each.

(b) Explain what is LTI system.

(c) State and prove time-delay property of Fourier transform.

(d) Find the Hilbert transform of :

$$x(t) = 1, \ |t| \le \frac{1}{2}$$

$$= 0, \ |t| > \frac{1}{2}.$$

(e) Find the discrete Fourier series of $x(n) = \{1, 1, 0, 0\}$.

(f) What is inverse system ? Explain.

(g) State and explain the properties of ROC of z transform.

(h) Derive the necessary and sufficient condition for BIBO stability of a discrete-time LTI system.

(8 × 5 = 40 marks)

Part B

II. (a) (i) Explain the following :—

1 Periodic signal.   2 Causality.

3 Memoryless.

(6 marks)

(ii) Find the convolution integral of $x(t) = e^{-t} u(t)$ with $h(t) = u(t)$.
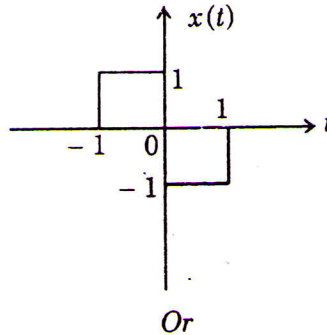
(9 marks)

Or

Turn over

(b) (i) Let $x(t)$ be any arbitrary signal. Show that $x(t) = \int_{-\infty}^{\infty} x(\tau) \, \delta(t - \tau) \, d\tau$ where $s(t)$ is unit impulse.

(9 marks)

    (ii) Show that $x(t) * \delta(t - a) = x(t - a)$.

(6 marks)

III. (a) Find the magnitude and phase spectrum of the signal shown below :

Or

(b) (i) State and explain sampling theorem.

(8 marks)

    (ii) State and prove convolution property of Fourier transform.

(7 marks)

IV. (a) Find the trigonometric Fourier series representation of full wave rectified sine wave signal.

Or

(b) Find the impulse response of the system described by the differential equation :

$$y''(t) + 3y'(t) + 2y(t) = x(t)$$

using Laplace transform.

(15 marks)

V. (a) (i) Find the z-transform and its ROC of :

$$x(n) = \left(\frac{1}{2}\right)^n ; \quad n \geq 0$$
$$= 3^n \quad ; \quad n < 0$$

(8 marks)

    (ii) State and prove final value theorem of z-transform.

(7 marks)

Or

(b) Find the inverse z-transform of $X(z) = \dfrac{1 + z^{-1}}{1 - \frac{7}{2} z^{-1} + \frac{3}{2} z^{-2}}$ for all possible ROCs.

(15 marks)

[4 × 15 = 60 marks]