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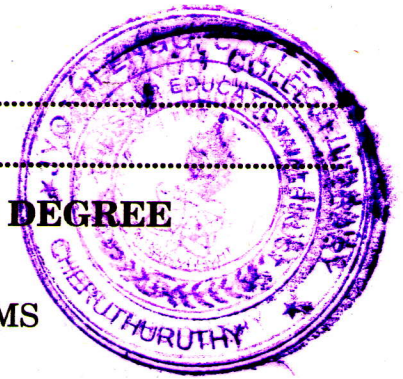
Name.....

Reg. No.....

**FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE
EXAMINATION, DECEMBER 2006**

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

(2004 admissions)



Time : Three Hours

Maximum : 100 Marks

Answer all questions.

Part A

I. (a) Define and plot the following signals :—

- (i) Unit impulse.
- (ii) Unit step.
- (iii) Unit ramp.
- (iv) Exponential.

(b) Check whether the following input-output relations are LTI or not :—

(i) $y(t) = 2x(t) + 7.$

(ii) $y(t) = \int_{-\infty}^t x(\tau) d\tau.$

(c) Find the Fourier transform of $x(t) = t, 0 \leq t \leq 2$
 $= 0, \text{ otherwise.}$

(d) State and prove any one property of Hilbert transform.

(e) Find the discrete time Fourier transform of $x(n) = \left(\frac{1}{2}\right)^n, n \geq 0$
 $= 3^n, n < 0.$

(f) Explain what is meant by causality?

(g) State and prove initial value theorem of Z-transform.

(h) Find the impulse response of the inverse system for the system having impulse response

$$h(n) = \left(\frac{1}{2}\right)^n u(n).$$

(8 × 5 = 40 marks)

Part B

II. (a) (i) Check whether the following signals are periodic or not :—

(1) $x_1(t) = \cos\left(\frac{2\pi t}{3}\right) + 7 \sin\left(\frac{10\pi t}{7} + \frac{\pi}{3}\right).$

(2) $x_2(t) = 2 + \sin\left(\frac{4\pi t}{3}\right) + 10 \cos(3t).$

(7 marks)

Turn over

(ii) Define and explain the following terms :—

(1) Stability. (2) Causality.

(8 marks)

Or

(b) Find the response of an LTI system with impulse response $h(t) = e^{-3t} u(t)$ for the input

$$x(t) = 1, -1 \leq t \leq 1$$

$$= 0, \text{ otherwise}$$

III. (a) (i) State and prove Parseval's theorem for Fourier transform.

(8 marks)

(ii) Find the inverse Fourier transform of $X(w) = \frac{2}{jw}$.

(7 marks)

Or

(b) State and prove Sampling theorem for low-pass band limited signals.

IV. (a) Find the impulse response of the system described by the differential equations :

$$y''(t) - 5y'(t) + 6y(t) = x(t)$$

using Laplace transform.

Or

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

(8 marks)

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

(7 marks)

V. (a) (i) Find the Z-transform of $x(n) = \left(\frac{1}{2}\right)^n, n \geq 1$
 $= 5^n, n < 1$

and find its ROC.

(7 marks)

(ii) Explain the properties of ROC of Z-transform.

(8 marks)

Or

(b) Find the solution of the difference equation $y(n) - y(n-1) - y(n-2) = \left(\frac{1}{2}\right)^n, n \geq 0$,
 with $y(-1) = 1, y(-2) = 0$.

[4 × 15 = 60 marks]