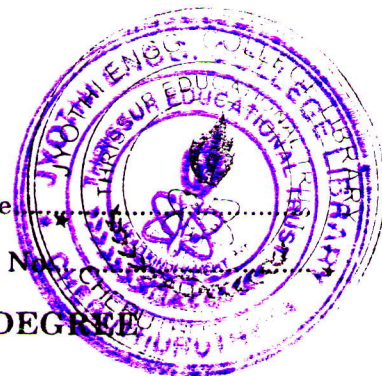


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(Pages 2)

Name: \_\_\_\_\_

Reg. No.: \_\_\_\_\_



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

**EC/AI/IC 2K 403—SIGNALS AND SYSTEMS**

Time : Three Hours

Maximum : 100 Marks

*Answer all questions.*

I. (a) Determine whether the following signals are energy or power or neither :—

1  $x(t) = 10 \exp[j(50\pi t + 10)]$

2  $x(t) = 5 \sin\left(2\pi t + \frac{\pi}{3}\right)$

- (b) Explain about (1) causality and (2) invertability of a system.
- (c) State and prove integration property of Fourier transform.
- (d) State sampling theorem for low-pass band limited signal and explain.
- (e) Derive the necessary and sufficient condition for BIBO stability of an LTI system.
- (f) Find the discrete Fourier series representation of  $x(n) = \{1, 0, 1, 0\}$  with period  $N = 4$ .
- (g) Explain the properties of region of convergence of Z-transform.
- (h) A system is described by the difference equation :

$$y(n) = 0.5y(n-1) + x(n)$$

Find its system function and plot pole-zero diagram.

(8 × 5 = 40 marks)

II. (a) Show that convolution operation obeys (i) commutative property and (ii) associative property.

(7 + 8 = 15 marks)

*Or*

(b) For the systems represented by following functions, determine whether every system is,  
(i) linear ; (ii) time-invariant ; and (iii) causal.

(i)  $y(t) = 10x(t) + 5$ .

(ii)  $\frac{dy(t)}{dt} + ty(t) = x(t)$

(iii)  $y(t) = \exp\{x(t)\}$ .

(3 × 5 = 15 marks)

**Turn over**

- III. (a) (i) State and prove Parseval's theorem for deterministic energy signal. (8 marks)  
 (ii) State and prove any two Properties of Hilbert transform. (7 marks)

Or

- (b) A system has the impulse response  $h(t) = t\pi \exp(-4\pi t) u(t)$ , where  $u(t)$  is unit step signal, and input to the system is  $x(t) = 4 \cos(4\pi t) + 4 \cos(12\pi t)$ . Find and plot the amplitude and phase spectra for the input and output signals of the system.

- IV. (a) (i) Determine the discrete-time Fourier transform of the following signals :—

1  $x(n) = 2^n u(-n)$ .

2  $x(n) = 2 - \frac{1}{2}n, \quad |n| \leq 4$   
 $= 0, \quad |n| > 4.$

(8 marks)

- (ii) Determine the inverse DTFT of  $X(u) = \cos^2(u) \sin^2(3u)$ . (7 marks)

Or

- (b) Determine the transfer function of the system described by the differential equation :

$$\frac{d^2 y(t)}{dt^2} + 6 \frac{dy(t)}{dt} + 9y(t) = \frac{d^2 x(t)}{dt^2} + 3 \frac{dx(t)}{dt} + 2x(t)$$

and hence find the output of the system for  $x(t) = u(t)$  by assuming zero initial conditions.

- V. (a) (i) State and prove convolution property of Z-transform. (8 marks)

- (ii) Determine Z-transform of  $x(n) = \left(\frac{1}{2}\right)^n \cos(\omega_0 n) u(n)$ . (7 marks)

Or

- (b) Determine the impulse response of the system having difference equation :

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

[4 × 15 = 60 marks]