

C 31885

(Pages 2)

Name:

Reg. No.

**FOURTH SEMESTER B.TECH. (ENGINEERING) DEGREE
EXAMINATION, JUNE 2007**

EC/AI/IC 2K 403—SIGNALS AND SYSTEMS

Time : Three Hours

Maximum 100 Marks

Answer all questions.

- I. (a) Define power and energy signal. And find the energy of the signal $x(t) = e^{-3t}$, $t \geq 0$
 $= 0$, $t < 0$.
- (b) Determine whether the systems given below are linear or non-linear, time-invariant or time-variant (i) $y(t) = 10x(t) + 5$; (ii) $y(t) = x(t^2)$.
- (c) What are Dirichlet conditions? What is the significance of these conditions?
- (d) What is meant by distortionless transmission? Explain.
- (e) Find the discrete-time Fourier transform of $x(n) = \left(\frac{1}{2}\right)^n$, $n \geq 0$
 $= 0$, $n < 0$
and plot its magnitude.
- (f) The system is modelled by the following differential equation :

$$\frac{d^2y(t)}{dt^2} + \frac{5dy(t)}{dt} + 6y(t) = -\frac{dx(t)}{dt}$$

Find the Pole-zero plot.

- (g) State and prove time-reversal property of Z-transform.
- (h) Explain how causality and stability is determined in terms of Z-transform?

(8 × 5 = 40 marks)

- II. (a) (i) Determine whether the continuous-time signals $x(t)$ and $y(t)$ are periodic. Compute period for any that are periodic $x(t) = x_1(t) + x_2(t) + x_3(t)$ where $x_1(t)$, $x_2(t)$ and $x_3(t)$, have periods of $\frac{8}{3}$, 1.26 and $\sqrt{2}$ seconds respectively. $y(t) = y_1(t) + y_2(t) + y_3(t)$ where $y_1(t)$, $y_2(t)$ and $y_3(t)$, have periods of 1.08, 3.6, and 2.025 seconds respectively.

(7 marks)

- (ii) List various property of system and explain.

(8 marks)

Or

- (b) Find the response of an LTI system with impulse response $h(t) = 1 - |t|$, $|t| \leq 1$
for the input $x(t) = 1$, $|t| \leq 2$
 $= 0$, $|t| > 1$
 $= 0$, $|t| > 2$.

(15 marks)

Turn over

III. (a) (i) Show that Fourier transform of real valued signal is Hermitian symmetry.

(7 marks)

(ii) Find the Fourier transform $x(t) = e^{-|t|}$.

(8 marks)

Or

(b) (i) Explain about distortionless transmission of rectangular pulse through an ideal LPF system with frequency response.

(7 marks)

(ii) State and prove any two properties of Hilbert transform.

(8 marks)

IV. (a) (i) Find the impulse response of the system described by the differential equation

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

using Laplace transform.

(8 marks)

(ii) State and prove any two properties of DFS.

(7 marks)

Or

(b) (i) Explain about inverse system.

(7 marks)

(ii) Explain how the frequency response of the system can be determined from pole-zero plot.

(8 marks)

V. (a) (i) Find the Z-transform and its ROC of $x(n) = \left(\frac{1}{2}\right)^n u(n) + 3^n u(-n-1)$.

(8 marks)

(ii) Explain about ROC of Z-transform and its properties.

(7 marks)

Or

(b) Determine the inverse Z-transform of $X(Z) = \frac{1}{(1+Z^{-1})(1-Z^{-1})^2}$ for the ROC: $|Z| > 1$.

(15 marks)

[4 × 15 = 60 marks]