C 15642 (Pages : 2) Name....................................

Reg. No....................................

FOURTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2011

EE 09 403/PTEE 09 402—SIGNALS AND SYSTEMS

(2009 admissions)

Time : Three Hours   Maximum : 70 Marks

Part A

Answer all questions.
Each question carries 2 marks.

1. Sketch the function $x(t) = u(t) - 2u(t-2) + 3u(t-4) - u(t-5)$.

2. When a discrete time system is BIBO stable.

3. Define poles and zeros of a transfer function.

4. What is meant by aliasing ?

5. What are the properties of region of convergence ?

$(5 \times 2 = 10 \text{ marks})$

Part B

Answer any four questions.
Each question carries 5 marks.

1. Test whether the following system of equation represent LTI system :—

   (i) $y(t) = [\cos 3t] x(t)$.   (2.5 marks)

   (ii) $y[n] = x[-n]$.   (2.5 marks)

2. What is the total energy DT signal $x[n]$ which takes the values of unity at $n = -1, 0$ and 1 ?

3. Plot pole-zero diagram of the following transfer functions :—

   (i) $\dfrac{s+2}{s^2 + 2s + 2}$.   (2.5 marks)

   (ii) $\dfrac{s+3}{s(s^2 + 4)(s+2)(s+1)}$.   (2.5 marks)

4. Find the DTFT of the following :—

   $x[n] = 13n - 2 - nu[-n-1]$.

5. State and prove convolution theorem of Z transform.

Turn over

6. Find the Laplace transform of the following :—

    (i) $x_1(t) = e^{-3t} u(t)$.   (2.5 marks)

    (ii) $x_2(t) = \cos 4t \, u(t)$.   (2.5 marks)

[4 × 5 = 20 marks]

Part C

*Answer any **four** questions.*
Each question carries 10 marks.

1. (a) Determine whether the following systems are static or dynamic, linear or non-linear, shift variant or invariant, causal or non-causal, stable or unstable :

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

    (ii) $dy(t)/dt + 10y(t) = x(t)$.   (5 marks)

Or

  (b) The input and output of a causal LTI system are related by the differential equation, $d^2 y(t)/dt^2 + 6 dy(t)/dt + 8y(t) = 2x(t)$. Find the impulse response of the system.

2. (a) Consider a causal Discrete time LTI system whose input $x[n]$ and output $y[n]$ are related by the difference equation :

$$y[n] - \frac{1}{4} y[n-1] = x[n]$$

    Find the Fourier series representation of output $y[n]$ if $x[n] = \sin(n\, 3\pi/4)$.

Or

  (b) Define Trigonometric Fourier series and derive the Fourier coefficients with example.

3. (a) State and prove properties of DTFS.   (5 marks)

  (b) Write short notes on over sampling.   (5 marks)

Or

  (c) Consider an LTI system for which the input $x(t)$ and output $y(t)$ satisfy the linear constant coefficient differential equation is given by $dy(t)/dt + 3y(t) = x(t)$. Find the response $h(t)$.

4. (a) Find the Z transform of the following :—

    (i) $x[n] = -a^n u[-n-1]$.   (5 marks)

    (ii) $x[n] = 7(1/3)^n u[n] - 6(1/2)^n u[n]$.   (5 marks)

Or

  (b) Define Z-transform and its properties.

[4 × 10 = 40 marks]