

Code No: 113AW

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, December-2014

SIGNALS AND SYSTEMS

(Common to ECE, EIE, BME)

Time: 3 Hours

Max. Marks: 75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit.

Each question carries 10 marks and may have a, b, c as sub questions.

Part- A

(25 Marks)

- 1.a) State and prove any two properties of unit impulse. [2m]
- b) Derive the expression for Mean Square Error. [3m]
- c) Derive the Fourier transform of an arbitrary constant. [2m]
- d) Define sampling theorem for band pass signals. [3m]
- e) Define transfer function. [2m]
- f) Sketch the frequency response of ideal LPF, HPF and BPF. [3m]
- g) Derive the relation between PSDs of input and output for an LTI system. [2m]
- h) Find the auto correlation of $f(t) = \sin(\omega_c t)$. [3m]
- i) Prove that the Laplace transform of even function is even function. [2m]
- j) Find the z-transform the sequence $x[n] = (-2)^{-n}u[-n - 1]$. [3m]

Part- B

(50 Marks)

- 2.a) Approximate the function described below by a wave form $\sin t$ over the interval $(0, 2\pi)$. The function is $f(t) = 1 \quad 0 < t < \pi$
 $= -1 \quad \pi < t < 2\pi$.
- b) Discuss the concept of trigonometric Fourier series and derive the expressions for coefficients.
- c) State the properties of complex Fourier series.

OR

- 3.a) Define orthogonal signal space and bring out clearly its application in representing a signal.
- b) Obtain the Fourier series representation of half-wave rectified sine wave.
- c) Explain the significance of waveform symmetry in Fourier analysis.
- 4.a) Find the Fourier transform of symmetrical gate pulse and sketch the spectrum.
- b) State and prove time convolution and time differentiation properties of Fourier transform.
- c) What is aliasing? Explain its effect on sampling.

OR

- 5.a) Find the Fourier transform of symmetrical triangular pulse and sketch the Spectrum.
- b) State and prove frequency shifting and scaling properties of Fourier transform.
- c) Determine the minimum sampling rate and Nyquist interval of the following function. $f(t) = \sin(200\pi t) + \sin(100\pi t)$.

- 6.a) Draw a circuit diagram of a physically realizable LPF. Sketch its impulse response.
- b) The transfer function of an LTI system is $H(w) = \frac{16}{4 + jw}$. Find the response $y(t)$ for an input $x(t) = u(t)$.
- c) What are the conditions for distortion less transmission from through a system?

OR

- 7.a) Explain causality and physical reliability of a system and hence give poly-wiener criterion.
- b) Show that from the knowledge of the impulse response $h(t)$ of a linear system, the response of any arbitrary function can be obtained.
- c) Differentiate between causal and non-causal systems.
- 8.a) State and prove frequency Convolution property of Fourier transform.
- b) Find the correlation of symmetrical gate pulse with amplitude and time duration '1' with itself.
- c) Find the total energy of the Sinc pulse $A \text{Sinc}(2w_c t)$.

OR

- 9.a) Derive the expression for energy in frequency domain.
- b) Compute the signal energy for $x(t) = e^{-4t} u(t)$.
- c) Explain briefly detection of periodic signals in the presence of noise by correlation.
- 10.a) Determine the Laplace transform and the associate region convergence for each of the following functions: i) $x(t) = 1; 0 \leq t \leq 1$ ii) $x(t) = t$ for $0 \leq t \leq 1$.
- b) Find the z-transform of the sinusoidal signal $x[n] = \text{Sin}[bn]u[n]$.
- c) State and prove any two properties of Z-transforms.

OR

- 11.a) If $x(t)$ is an even function, prove that $X(s) = X(-s)$ and if $x(t)$ is odd prove that $X(s) = -X(-s)$.
- b) Derive the relation between Laplace transform and Z-transform.
- c) Find the inverse z-transform of $X(z) = 1/(1+z) + 2z/(z-0.2)$.
