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 $f(t) = Sin(w_c t)$. [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 f 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 $ASinc(2w_c t)$.

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; $0 \le t \le 1$ ii) x(t) = t for $0 \le t \le 1$.

b) Find the z-transform of the sinusoidal signal $x[n] = Sin[bn]u[n]$.

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 $X(z) = 1/(1 + z) + 2z/(z - 0.2)$.

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