6. (a) List the properties of region of convergence. (4)

(b) Find the inverse Z transform of (6)

$x(z) = z(z^2 - 4z + 5)/(z - 3)(z - 1)(z - 2)$

with (i) $|z| > 3$ (ii) $|z| < 1$

(c) Find Z-transform and sketch the ROC

$X(n) = (-1)^n 2^{-n} u(n)$. (5)

7. (a) State and prove sampling theorem. Find the nyquist rate and nyquist interval for the following signal :

$x(t) = (1/2\pi)(\cos(4000\pi t).\cos(1000\pi t))$. (6)

Find the Laplace transform of

$x(t) = 5e^{4t} + 6t^3 - 3\sin 5t + 2\cos 2t$. (4)

Specify all possible ROCS for the function X(s) given below. Also find x(t) in each case :

$X(s) = 4s/(s+2)(s+4)$. (5)

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306301

December, 2019

B.Tech. (EIC) 3rd SEMESTER

Signal and Systems (ECC-01)

Time : 3 Hours] [Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART - A

1. (a) Distinguish between energy and power signal. (1.5)

(b) State mathematical expression for unit step and rectangular signals. (1.5)

(c) Define unit impulse function and find its fourier transform. (1.5)

(d) List the merits and limitations of fourier transform. (1.5)

(e) Define causal and non-casual system. (1.5)

(f) State initial and final value theorem of laplace transforms. (1.5)

(g) Find the laplace transform of unit step function. (1.5)

(h) Explain significance of pole zero plot. (1.5)

(i) Described the properties of state transition matrix. (1.5)

(j) State Parseval's theorem. (1.5)

PART - B

2. (a) Define a signal and system. Explain any *two* properties of a system. (5)

(b) Test $y(t) = x(2t)$, whether the system is (i) linear (ii) time variance (iii) stable. (5)

(c) Plot the signal with respect to time

$$x(t) = u(t) - r(t-1) + 2r(t-2) - r(t-3) + u(t-4) - 2u(t-5)$$

State whether the signal is energy or power signal? Find corresponding energy or power as the case may be. (5)

3. (a) Find the convolution of $x(n) = \{1\ 2\ 3\ 4\}$ and $h(n) = \{5\ 4\ 3\ 2\ 1\}$. (6)

(b) Compute the output $y(t)$ for an continuous time LTI system whose impulse response $h(t)$ and its input $x(t)$ are given by $h(t) = e^{-t}.u(t)$, $x(t) = u(t) - u(t-2)$. (6)

(c) Prove the following :

$x(n)*[h_1(n) + h_2(n)] = x(n)*h_1(n) + x(n)*h_2(n)$. (3)

4. (a) State and prove the following properties of DTFT

(i) Frequency differentiation (ii) Convolution. (6)

(b) Find the Fourier transform of $x(t) = e^{-at}.u(t)$. Also plot magnitude and phase spectrum. (5)

(c) Find the Fourier transform of Gaussian pulse. (4)

5. (a) Find the output, given the input and initial conditions, for the system described by the following differential equation:

$x(t) = e^{-t}.u(t)$, $y(0) = -1/2$, $y'(0) = 1/2$,

$y''(t) + 5y'(t) + 6y(t) = x(t)$. (5)

(b) Perform the 4 points circular convolution of the following two sequences using analytical method :

$x_1(n) = \{1\ 2\ 2\}$, $x_2(n) = \{1\ 2\ 3\ 4\}$. (10)