CBCS SCHEME

USN | | | | | | | | | | **17EE54**

Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020

Signals and Systems

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Explain operations performed on the independent variables of a continuous time signals. **(06 Marks)**

b. Explain even and odd component of the signal and derive its equation. Also find and sketch the even and odd component of the signal. $x(t)=e^{-t/4}\ u(t)$. **(06 Marks)**

c. Sketch the signal :

i) $x(t)=-u(t+3)+2u(t+1)-2u(t-1)+u(t-3)$

ii) $x(t)=r(t+1)-r(t)+r(t-1)$. **(08 Marks)**

OR

2 a. Explain energy and power signals with its equation. **(06 Marks)**

b. For the system, determine whether the system is linear, time invariant, memoryless, causal and stable. $H\{x(n)\}=x(n-n_d)$. **(06 Marks)**

c. Find total energy of

i) $x(t)=\begin{cases}\frac{1}{2}[\cos\omega t+1]; & \frac{-\pi}{2}\le t\le\frac{\pi}{2}\\ 0; & \text{otherwise}\end{cases}$

ii) $x(n)=\begin{cases} n; & 0\le n\le 5\\ 10-n; & 5<n\le 10\\ 0; & \text{otherwise}\end{cases}$. **(08 Marks)**

Module-2

3 a. Find the total response of the system given by : $\frac{d^2y(t)}{dt^2}\frac{3dy(t)}{dt}+2y(t)=2x(t)$

With $y(0)=-1$ and $\left.\frac{d}{dt}y(t)\right|_{t=\infty}=1$ and $x(t) = \cos u(t)$. **(06 Marks)**

b. Find the difference equation corresponding to the block diagram shown in Fig.Q3(b). **(06 Marks)**

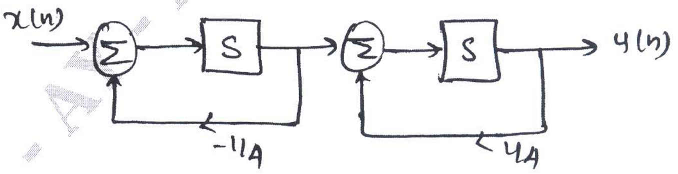

Fig.Q3(b)

c. Evaluate the convolution of x(n) and h(n), where

$x(n)=1;\quad 0\le n\le 4;\quad h(n)=\alpha^n;\quad 0\le n\le 6$

$\quad\ =0;\ \text{otherwise};\qquad\quad =0;\quad \text{otherwise}$. **(08 Marks)**

OR

4 a. Find the forced response of the system described by the difference equation :

$$y(n) = \frac{5}{6}y(n-1) + \frac{1}{6}y(n-2) = x(n)$$

Where $x(n) = 2^n : n \geq 0$ **(06 Marks)**

$= 0 \quad$: elsewhere

b. Explain the following properties of impulse response representation of LTI system

i) Distributive ii) Associative iii) Causal. **(06 Marks)**

c. Evaluate $y(t) = x(t) * h(t)$ for $x(t) = e^{-3t}\{u(t) - u(t-2)\}$ and $h(t) = e^{-t}u(t)$. **(08 Marks)**

Module-3

5 a. Describe the following properties of CTFT :

i) Parsavel's theorem
ii) Frequency differentiation
iii) Frequency shift. **(06 Marks)**

b. Obtain the CTFT of the signal $x(t) = e^{-at}u(t)$; $a > 0$. Draw its magnitude and phase spectra. **(06 Marks)**

c. Find CTFT of the signal :

i) $x(t) = t\, e^{-2t}\, u(t)$. Obtain its magnitude and phase spectra.
ii) x(t) is describe by the following Fig.Q5(c). **(08 Marks)**

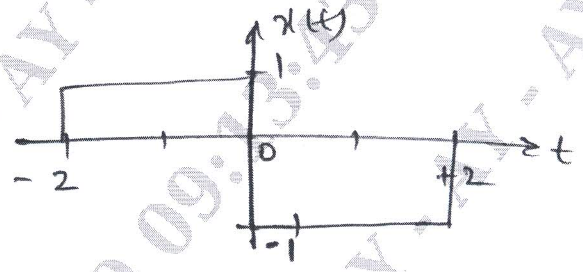

Fig.Q5(c)

OR

6 a. Explain the following properties of CTFT.

i) Scaling
ii) Integration
iii) Modulation. **(06 Marks)**

b. Find the Fourier transform of the signum function described by

$\text{sgn}(t) = 1 \quad : t > 0;$

$= -1 \quad : t < 0$

Draw its magnitude and phase spectra. **(06 Marks)**

c. Evaluate the Fourier transform of the signal

$x(t) = 1 + \cos \pi t : |t| \leq 1$

$= 0 \quad : |t| > 1$

$x(t) = e^{-3(t)} \sin 2t$: using appropriate properties. **(08 Marks)**

Module-4

7 a. Discuss the properties of DTFT for i) Linearity ii) Scaling iii) Modulation. **(06 Marks)**

b. Find the DTFT of the signal i) $x(n) = \alpha^n u(n) : |\alpha| < 1$. Draw its magnitude spectrum $x(n) = \{1, 3, \underset{\uparrow}{5}, 3, 1\}$ and evaluate DTFT at $\Omega = 0.[X(e^{i\Omega})$ at $\Omega = 0]$. **(06 Marks)**

c. Find the DTFT of the signal with the magnitude spectrum :

i) $\delta(n)$

ii) $x(n) = 1 : |n| \le m$

$= 0 | n | > m$

Where x(n) is an rectangular pulse. **(08 Marks)**

OR

8 a. Describe the properties of DTFT for i) Time shift ii) Time scaling iii) Convolution. **(06 Marks)**

b. Find the DTF of the signal described by : i) x(n) = u(n) ii) x(n) = u(n) – u(n – 6). **(06 Marks)**

c. Find the DTFT of the signal

i) $x(n) = a^{|n|} : |a| < 1$

ii) $x(n) = \{1, 1, 0, \underset{\uparrow}{0}, 0, 1 - 1\}$

Derive the expression for phase and magnitude spectra. **(08 Marks)**

Module-5

9 a. Define region of convergence and derive an equation for ROC. **(06 Marks)**

b. Find the Z–transform of the signal $x(n) = 7(\frac{1}{3})^n u(n) - 6(\frac{1}{2})^n u(n)$ also find the ROC. **(06 Marks)**

c. Describe the following properties of Z-transform :

i) Scaling in Z–domain

ii) Time reversal

iii) Time expansion. **(08 Marks)**

OR

10 a. Describe the properties of region of convergence in z – plane. **(06 Marks)**

b. Determine the Z-transform of $x(n) = -u(-n-1) + (\frac{1}{2})^n u(n)$. Find the ROC and pole zero location s of X(z) in Z plane. **(06 Marks)**

c. Using appropriate properties, find the Z-transform of the signal,

i) $x(n) = 3.2^n u(-n)$

ii) $x(n) = n^2 (\frac{1}{2})^n u(n-3)$. **(08 Marks)**

* * * * *