CBCS SCHEME

USN | | | | | | | | | |

17EE54

Fifth Semester B.E. Degree Examination, Aug./Sept.2020
Signals and Systems

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define signals and system. Explain classification of signals. **(06 Marks)**

b. State whether the following signals given are periodic or not. If periodic find the fundamental period.

i) $x(t) = (\cos(2\pi t))^2$

ii) $x(n) = \cos(\frac{1}{5}\pi n)\sin(\frac{1}{3}\pi n)$. **(06 Marks)**

c. Sketch and label for each of the following for the given signal x(t) and y(t) shown in Fig.Q1(c)(i), Fig.Q1(ii).

i) $x(t)\,y(t-1)$

ii) $x(t-1)\,y(-t)$

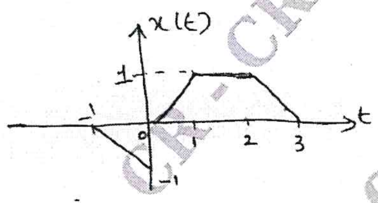

Fig.Q1(C)(i)

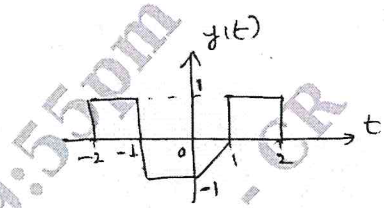

Fig.Q1(C)(ii) **(08 Marks)**

OR

2 a. Find out the even and odd component of the following signal.

i) $x(t) = (1 + t^3)\cos^3(10t)$

ii) $x(t) = 1 + t + 3t^2 + 5t^3 + 9t^4$

iii) $x(t) = \cos(t) + \sin(t) + \sin(t)\cos(t)$. **(06 Marks)**

b. For the trapezoidal pulse x(t) shown Fig.Q2(b) find the total energy.

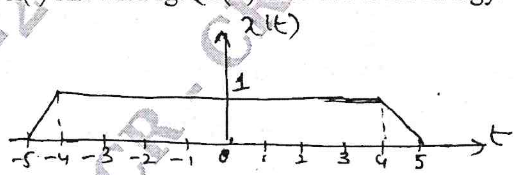

Fig.Q2(b) **(06 Marks)**

c. Determine whether the system $y(t) = x(t/2)$ is

i) Linear ii) Time invariant iii) Causal iv) Stability. **(08 Marks)**

Module-2

3 a. Evaluate the discrete time convolution sum of signal $y(n) = (\frac{1}{2})^n u(n-2) * u(n)$. **(08 Marks)**

b. Consider a LTI system with unit impulse response $h(t) = e^{-t}$. If the input applied to this system is $x(t) = e^{-3t}\{u(t) - u(t-2)\}$ find the output y(t) of the system. **(08 Marks)**

c. Find the step response for the LTI system represented by the impulse response $h(n) = (\frac{1}{2})^n u(n)$. **(04 Marks)**

OR

4 a. Find the forced response for the system described by

$$\frac{d^2y(t)}{dt^2}+\frac{5\,dy(t)}{dt}+6y(t)=2x(t)+\frac{dx(t)}{dt} \text{ with input } x(t)=2e^{-t}u(t).$$ **(08 Marks)**

b. Sketch the direct form – I and direct form II implementations for the difference equation :
$y(n)+\frac{1}{2}y(n-1)-y(n-3)=3x(n-1)+2x(n-2)$. **(08 Marks)**

c. Determine a discrete – time LTI system characterized by impulse response $h(n)=(\frac{1}{2})^n u(n)$ is i) stable ii) causal. **(04 Marks)**

Module-3

5 a. Find the Fourier transform of $x(t)=e^{-a|t|}$; $a>0$. Draw its spectrum. **(06 Marks)**

b. Find the inverse Fourier transform of $X(j\omega)=\frac{-j\omega}{(j\omega)^2+3j\omega+2}$. **(06 Marks)**

c. The impulse response of a continuous time LTI system is given by $h(t)=\frac{1}{RC}e^{-t/RC}u(t)$. Find the frequency response and plot the magnitude and phase response. **(08 Marks)**

OR

6 a. State and prove the following properties in continuous time Fourier transform :
i) Linearity ii) Time shift iii) Convolution. **(08 Marks)**

b. Find the frequency response and the impulse response of the system described by the differential equation : $\frac{d^2y(t)}{dt^2}+\frac{5dy(t)}{dt}+6y(t)=\frac{-dx(t)}{dt}$. **(08 Marks)**

c. Find the Fourier transform of unit step function. **(04 Marks)**

Module-4

7 a. State and prove : i) frequency shift ii) Parseval's theorem in discrete time domain. **(10 Marks)**

b. Find the DTFT of the signal $x(n)=\alpha^n u(n)$; $|\alpha|<1$. Draw the magnitude spectrum. **(05 Marks)**

c. Find the inverse DTFT of the signal $X(e^{j\Omega})=1+2\cos\Omega+3\cos2\Omega$. **(05 Marks)**

OR

8 a. Obtain the frequency response and the impulse response of the system having the output $y(n)=\frac{1}{4}(\frac{1}{2})^n u(n)+(\frac{1}{4})^n u(n)$ for the input $x(n)=(\frac{1}{2})^n u(n)$. **(10 Marks)**

b. Find the difference equation description for the system having impulse response :
$h(n)=\delta(n)+2(\frac{1}{2})^n u(n)+(-\frac{1}{2})^n u(n)$. **(05 Marks)**

c. Find the frequency and the impulse response of the system described by the difference equation : $y(n)+\frac{1}{2}y(n-1)=x(n)-2x(n-1)$. **(05 Marks)**

Module-5

9 a. What is Z–transform? Mention properties of Region Of Convergence (ROC). **(04 Marks)**

b. Find the Z–transform of the signal using appropriate properties.

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

ii) $x(n) = n \sin\left(\frac{\pi}{2} n\right) u(-n)$. **(08 Marks)**

c. Find the discrete –time sequence x(n) which has Z – transform,

$$x(z) = \frac{-1+5z^{-1}}{\left(1-\frac{3}{2}z^{-1}+\frac{1}{2}z^{-2}\right)} \text{ with ROC; } |z|>1.$$ **(08 Marks)**

OR

10 a. A causal system has input $x(n) = \delta(n) + \frac{1}{4}\delta(n-1) - \frac{1}{8}\delta(n-2)$ and output $y(n) = \delta(n) - \frac{3}{4}\delta(n-1)$. Find the impulse response of the system. **(08 Marks)**

b. Solve the difference equation, y(n) + 3y(n–1) = x(n) with x(n) = u(n) and the initial condition y(–1) = 1. **(08 Marks)**

c. Determine whether the system described is causal and stable $H(z) = \frac{2z+1}{z^2+z-\frac{5}{16}}$. **(04 Marks)**

* * * * * *