USN

Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017

Signals and Systems

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain about power and energy signal with example. Determine whether signal given in Fig Q1(a) is power or energy signal, find corresponding value. **(06 Marks)**

b. Find out the even and odd component of the following signals. **(06 Marks)**

i) $x(t) = \cos t + \sin t + \sin t \cos t$ ii) $x(t) = 1 + t + 3t^2 + 6t^3 + 9t^4$

iii) $x(t) = 1 + t\cos t + t^2 \sin t + t^3 \sin t \cos t$

c. For the given signal x(t) shown in Fig Q1(c) sketch and label

(i) $x(0.5t)$ (ii) $x(t+3)$ (iii) $x(3t+2)$ (vi) $x(-3(t-1))$ **(08 Marks)**

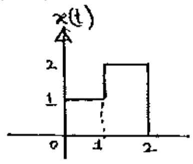


Fig Q1(a)

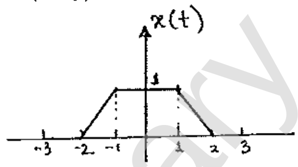


Fig Q1(c)

2 a. Impulse response of a system is given by $h[n] = \begin{cases} 1 & n = 0 \\ 1/2 & n = 1 \\ 0 & \text{otherwise} \end{cases}$

Input for the given system is $x[n] = \begin{cases} 2 & n = 0 \\ 4 & n = 1 \\ -2 & n = 2 \\ 0 & \text{otherwise} \end{cases}$

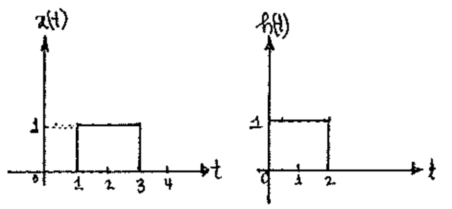
Find out the output y[n] of the system. **(06 Marks)**

b. Given impulse response of the system $h[n] = \left[\frac{1}{2}\right]^n u[n-2]$. Find out step response of the system. **(08 Marks)**

c. Draw direct form – I and direct form – II implementation for the following difference equation. $y[n] + \frac{1}{4}y[n-1] - \frac{1}{8}y[n-2] = 2x[n] + 3x[n-1]$ **(06 Marks)**

3 a. Obtain the convolution integral for a system with input x(t) and impulse response h(t), as shown in Fig Q3(a). **(08 Marks)**

Fig Q3(a)



b. For the given impulse response determine whether system is memory less, stable and causal, justify your answer. $h[n] = [2]^n u[-n]$. **(04 Marks)**

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.

c. Find out the complete solution for the system described by the following differential equation.

$$\frac{d^2y(t)}{dt^2}+5\frac{d}{dt}y(t)+6y(t)=x(t),\ \text{Where } x(t)=e^{-t}u(t)$$

With initial conditions $y(0)=-\frac{1}{2}, \left.\frac{d}{dt}y(t)\right|_{t=0}=\frac{1}{2}$ **(08 Marks)**

4 a. Determine the Fourier series representation of the square wave shown in Fig Q4(a)

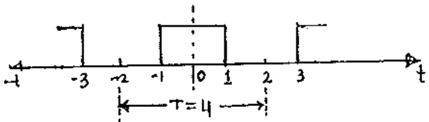


Fig Q4(a) **(08 Marks)**

b. Determine the discrete Fourier series representation for the following signal.

$x[n]=\cos{\pi/3}\,n+\sin{\pi/4}\,n$ **(06 Marks)**

c. State and prove the time shift and frequency shift property of Fourier series. **(06 Marks)**

PART – B

5 a. Using the properties of Fourier Transform find out Fourier transform of the following signals.

i) $x(t)=\sin(\pi t)e^{-2t}u(t)$ ii) $x(t)=e^{-3(t-2)}$ **(12 Marks)**

b. Obtain the Fourier Transform of the following signals.

i) $x(t)=u(t)$ ii) $x(t)=e^{-\alpha t}u(t)$

iii) $x(t)=1 \quad -0.5\le t\le 0.5$

$\quad\ =0 \quad$ elsewhere. **(08 Marks)**

6 a. Find DTFT of the following signal

i) $x[n]=\left[\frac{1}{2}\right]^{n+2}u[n]$ ii) $x[n]=n\left[\frac{1}{2}\right]^{2n}u[n]$ iii) $x[n]=-\left[\frac{1}{2}\right]^{n}u(-n-1)$ **(12 Marks)**

b. An LTI causal system is having a frequency response as $H(e^{j\Omega})=\frac{e^{j\Omega}}{1+\cos\Omega}$. Obtain linear constant difference equation of the system. **(08 Marks)**

7 a. Obtain z transform and the ROC and location of poles and zero's of x(z), for the following x[n].

i) $x[n]=\left[\frac{1}{2}\right]^{n}u[n]+\left(-{1/3}\right)^{n}u[n]$ ii) $x[n]=-\left({3/4}\right)^{n}u(-n-1)+\left(-{1/3}\right)^{n}u[n]$ **(10 Marks)**

b. Obtain inverse 'z' transform of the given x(z) using partial fraction expansion

$x(z)=\frac{1-z^{-1}+z^{-2}}{\left(1-{1/2}z^{-1}\right)\left(1-2z^{-1}\right)\left(1-z^{-1}\right)}$ i) with ROC $1<|z|<2$ ii) with ROC $|z|<\frac{1}{2}$ **(10 Marks)**

8 a. Use convolution property of 'z' transform to obtain x(z) for the given x(n)

$x(n)=u(n-2)*\left(\frac{2}{3}\right)^{n}u(n)$ **(06 Marks)**

b. Obtain inverse z transform of $x(z)=\frac{2+z^{-1}}{1-{1/2}z^{-1}}$ with ROC $|z|>\frac{1}{2}$ **(06 Marks)**

c. Solve the following linear constant coefficient difference equation using z transform method

$y[n]-\frac{1}{2}y[n-1]=x[n]$ with given input $x[n]=\left(\frac{1}{3}\right)^{n}$ and initial condition $y[-1]=1$ **(08 Marks)**