Printed Pages : 4

NEC-303

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 131314

Roll No.

B. Tech.

(SEM. III) (ODD SEM.) THEORY EXAMINATION, 2014-15

SIGNALS AND SYSTEMS

Time : 3 Hours] [Total Marks : 100

Note: - Attempt **all** questions. All questions carry equal marks. Missing data if any may be suitably assumed and mentioned.

1. Attempt any **four** parts of the following: **(5X4=20)**

a) Determine whether or not signal is periodic. If periodic find its fundamental period.

i) $X(t) = sin 15\pi t$ ii) $x(n) = cos\left(\frac{\pi n}{5}\right) sin\left(\frac{\pi n}{5}\right)$

b) Determine the system is linear, time invariant, causal and memory.

i) $Y(n) = x^2(n)$ ii) $y(t) = \frac{d}{dt}[e^{-t}x(t)]$

c) Find the Laplace and ROC of the following function.

$x(s) = \frac{s+2}{s^2+4s+5}$ then find the Laplace of y(t)=tx(t)

d) Obtained the Discrete time Fourier transform of $x(n) = a^n u(n) + a^{-n}u(-n-1)$

e) Determine the output sequence of the system with impulse response $h(n) = \left(\frac{1}{4}\right)^n u(n)$ when input is complex exponential sequence $x(n) = Ae^{\frac{j\pi n}{2}}$

f) Find the convolution of $x_1(n)$ and $x_2(n)$ using Z-transform

i) $x_1(n) = (1,3,4,5)$ ii) $x_2(n) = (5,1,2,6,3,4,5)$

2. Attempt any **four** parts of the following: **(5X4=20)**

a) Find Energy and Power of the signal.

i) X(t) = cos(t)

ii) $x(t) = Ae^{-\alpha t}u(t),\ \alpha > 0$

b) Obtained the convolution of x(t)=u(t) and h(t)=1 for $-1 \le t \le 1$

c) i) Find the Laplace transform of $x(t) = e^{-2t}u(t+1)$

ii) Find the z- transform of $x(n) = \begin{cases} n & 0 \le n \le N-1 \\ N & N \le n \end{cases}$

d) Find the Fourier transform of the following function using the properties of Fourier transform.

$$y(t) = \frac{d}{dt}te^{-3t}u(t) * e^{-2t}u(t)$$

e) (i) Explain group delay and phase delay.

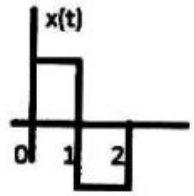
(ii) A signal, x(t) has a Fourier transform given by $X(w) = \frac{1}{(1+w^2)}$, write down the Fourier transform of $x(\frac{3t}{2} - 1)$.

f) Determine inverse Z-Transform of the following function.

$$H(Z) = \frac{3 + 3.6Z^{-1} + 0.6Z^{-2}}{1 + 0.1Z^{-1} - 0.2Z^{-2} + Z^{-3}}$$

3. Attempt any **two** parts of the following: **(10X2=20)**

a) Evaluate the convolution integral of x(t)*x(2-t), where x(t) is shown in figure below-



b) LTI System, which is initially at rest is described by differential equation. $\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = \frac{dx(t)}{dt}$. Calculate system transfer function and impulse response.

c) If $X(s) = \frac{2s+3}{(s+1)(s+2)}$. Find x(t) for

(i) System is stable.

(ii) System is causal.

(iii) System is non causal.

4. Attempt any **two** parts of the following: **(10X2=20)**

a) i) Determine inverse Z-transform of the following signal $x(n) = \frac{z^3 - z^2 + z}{(z-0.5)(z-2)(z-1)}$; $1 < z < 2$

ii) Obtained DTFT of a Signal $X(n) = r^n \sin(w_o n)u(n)$, $r < 1$

b) For a linear shift invariant system $h(n) = u(n-1) + u(n-2) + u(n-3)$. Find the frequency response $H(e^{jw})$. and plot the magnitude and phase response.

c) An LTI system represented by the following difference equation $3y(n) = 5\,y(n-2) - 7y(n-3) + 4x(n-1)$ for $n \geq 0$, determine-

i) Impulse response h(n)

ii) Obtain cascade and parallel form realization for discrete time system.

5. Attempt any **two** parts of the following: **(10X2=20)**

a) When the input to an LTI system is $x(n) = (\frac{1}{3})^n u(n) + (2)^n u(-n)$

1) and the corresponding $y(n) = 5(\frac{1}{5})^n u(n) - 5(\frac{2}{3})^n u(n)$.

i) Find the system function H(z) of the system & its ROC.

ii) Find the impulse response h(n) of the system.

iii) Is system Stable & causal?

b) $5\frac{d^2y(t)}{dt^2} + 8\frac{dy(t)}{dt} + 4y(t) = 3x(t)$ for the given system described by the above differential equation, determine whether the system is under damped, over damped or critically damped. And find the impulse response of the system.

c) i) Prove Parseval's theorem for continuous time system.

ii) Explain System bandwidth and rise time for low pass filter and prove that $t_r = 0.35/B$.