

KATHMANDU UNIVERSITY
End Semester Examination [C]
July, 2017

Level : B. E.
Year : III

Course : EEG 313
Semester : I

Exam Roll No. : _____ Time: 30 mins.

F. M. : 20

Registration No.: _____

Date : JUL 05 2017

SECTION "A"
[20 Q. × 1 = 20 marks]

Choose the most appropriate answer.

- 1) Discrete Time signals are those signals
 - a) which have non zero values only at a discrete set of points in time
 - b) whose value is known only at a discrete set of points in time.
 - c) which can take only a discrete set of values at any time.
 - d) for which all of above are true.

- 2) For a periodic continuous time signal with fundamental period T, which is true?
 - a) T must be a positive constant
 - b) T must be a constant either positive or negative
 - c) T must be a positive integer
 - d) T must be an integer either positive or negative

- 3) Which of the following is NOT a correct property of continuous time unit impulse signal for $a > 0$?

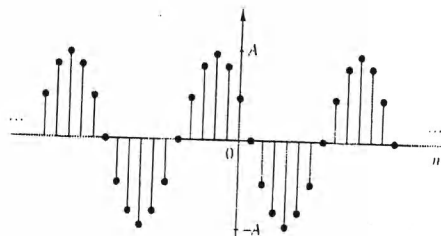
a) $\int_{-\infty}^t a\delta(\tau)d\tau = a u(t)$	b) $\delta(at) = \delta(t)$
c) $\delta(at) = \frac{1}{a}\delta(t)$	d) $\delta(a) = 0$

- 4) The discrete time system $y[n] = 2x[n]$

a) is causal but not memoryless	b) is neither causal not memoryless
c) is causal and also memoryless	d) is memoryless but not causal

- 5) The radian frequency of the DT signal shown is.....

a) $\frac{\pi}{2}$	b) $\frac{6}{\pi}$
c) $\frac{\pi}{12}$	d) $\frac{\pi}{6}$



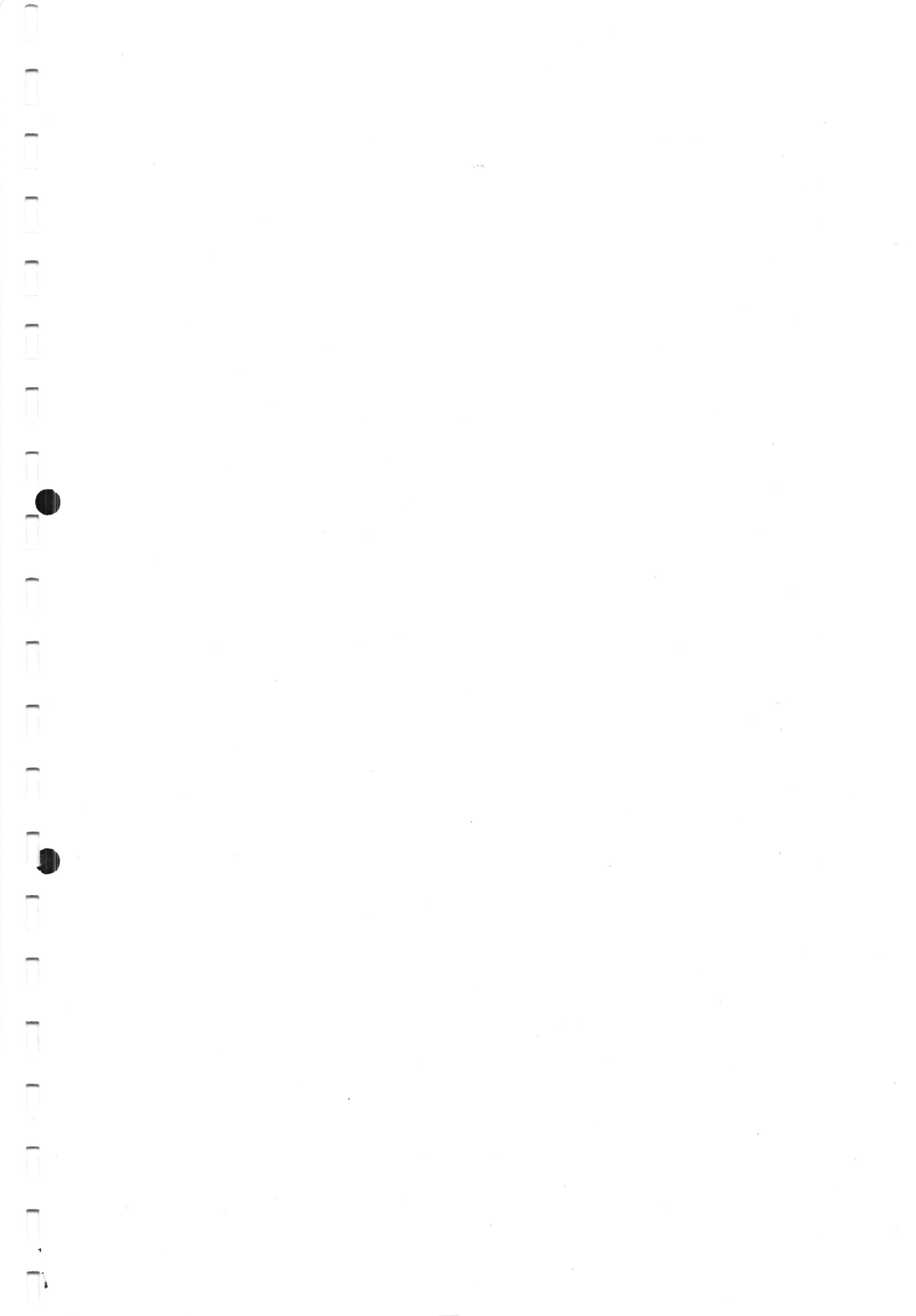
- 6) If a DT signals is defined as, $x[n] = \{1, 2, 3, 4, 5, 6\}$, the signal $y[n] = x[n - 2]$ is given as.....

a) $y[n] = \{0, 0, 1, 2, 3, 4, 5, 6\}$	b) $y[n] = \{1, 2, 3, 4, 5, 6, 0, 0\}$
c) $y[n] = \{1, 2, 3, 0, 0, 4, 5, 6\}$	d) $y[n] = \{3, 4, 5, 6, 1, 2\}$

- 7) The Fourier transform of continuous time sinc signal is

a) a rectangular pulse	b) constant
c) a triangular pulse	d) A sinc signal

- 17) The impulse response of a zero-order hold circuit is
- a) a sinc function
 - b) an impulse
 - c) a triangular pulse
 - d) a rectangular pulse
- 18) Which of following is NOT CORRECT regarding Butterworth filter?
- a) It has higher roll off in transition band than same order Chebyshev filter
 - b) Has monotonic decay in both pass band and stop band.
 - c) Its normalized form has half power frequency at $\omega = 1$.
 - d) Its normalized magnitude square response is $|T_n(j\omega)|^2 = \frac{1}{1+\omega^{2n}}$
- 19) Total energy of a power signal is....
- a) zero
 - b) finite
 - c) infinite
 - d) a constant between 0 and 1
- 20) Which of the following variation of amplitude modulation requires least bandwidth and power?
- a) DSB
 - b) DSB-SC
 - c) SSB-SC
 - d) SSB-full carrier



Level : B. E.
Year : III
Time : 2 hrs. 30 mins.

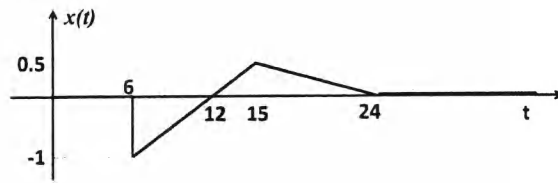
Course : EEG 313
Semester : I
F. M. : 55

SECTION "B"
[5Q × 11 = 55 marks]

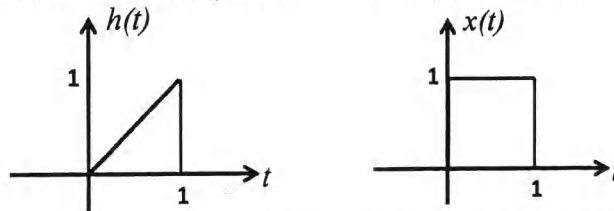
Attempt ANY FIVE questions.

1. a. Explain following system properties with suitable examples: [3]
i) Linearity
ii) Time Invariance

- b. For the CT signal $x(t)$ shown below, find and sketch: [4]
i) $y_1(t) = x\left(\frac{t}{1.5} - 4\right)$
ii) $y_2(t) = 3x(-2t + 4)$
iii) $y_3(t) = 3x(-2t + 4)u(t)$
iv) $y_4(t) = 3x(-2t + 4)\delta(t - 1)$



- c. Using graphical shift and fold method, find the convolution of following signals. [4]



2. a. State commutative, distributive and associative property of convolution. What are the consequences of these properties in parallel and series connection of LTI systems? [3]

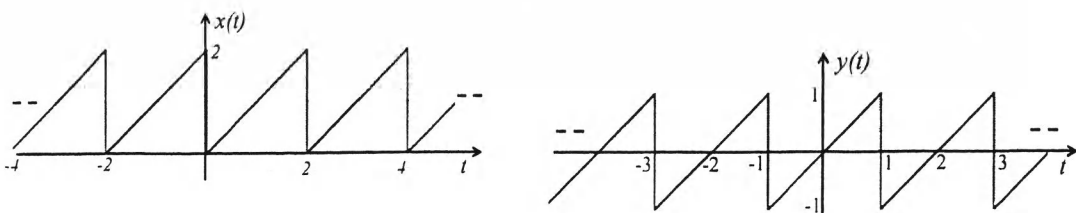
- b. A discrete time LTI system with impulse response $h[n]$ is supplied with the input signal $x[n]$. Compute and sketch the output of the system by evaluating the convolution sum expression if, [4]
 $x[n] = \{2, 0.5, 2\}$ and $h[n] = \{1, 1, 1, 2\}$

- c. Using the definition for exponential Fourier series, evaluate the exponential Fourier Series Coefficients of the following continuous time periodic signal. [4]
One period of the signal is defined as :

$$x(t) = e^{-t}, \quad 0 < t < 1.$$

Also find the values of coefficients for $k = \pm 1$.

3. a. State and prove time shifting property of the CT Fourier Series. [4]
If a_k denote the Fourier Series coefficients of signal $x(t)$ shown below, using properties of FS, write how the FS coefficient of the signal $y(t)$ are related to a_k .



- b. Find Fourier transform of the following signal. Also obtain the expressions for magnitude and phase spectrum. [4]

$$x(t) = e^{-a|t|} \text{ where, } a > 0$$

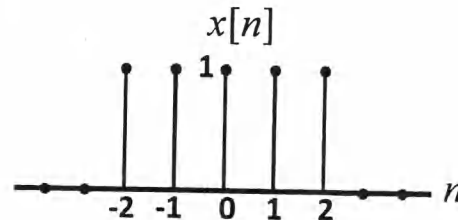
- c. Derive the conditions that its impulse response should satisfy for the LTI system to be causal and stable. [3]

4. a. If $X(j\omega)$ represent the Fourier transform of the signal $x(t)$, what does $|X(j\omega)|^2$ represent in relation to $x(t)$? Prove your answer. [3]

- b. Find the signal $x(t)$ if its Fourier transform is given as $X(j\omega) = \frac{j\omega}{(1+j\omega)^2}$. [4]

- c. A DT rectangular pulse is defined as: [4]

$$x[n] = \begin{cases} 1, & -2 \leq n \leq 2 \\ 0, & \text{otherwise} \end{cases}$$



Find the DTFT of the pulse.

5. a. Derive the expressions for synthesis and analysis equations of Discrete Time Fourier Series (DTFS). [4]

- b. What do you mean by an ideal *low pass filter*? Obtain the impulse response of the ideal low pass filter from its frequency response. Hence, show that it is a noncausal system. [4]

- c. Consider the sinusoidal signal $x(t) = \cos\left(\frac{\omega_s}{2}t + \phi\right)$. Show that if the signal is sampled at the sampling frequency ω_s (exactly twice the frequency of sinusoid), the reconstructed signal is given by $x_r(t) = (\cos \phi) \cos\left(\frac{\omega_s}{2}t\right)$. Also prove that exact reconstruction is possible only when $\phi = 0$. [3]

6. a. Explain impulse train sampling and ideal reconstruction using suitable mathematical expressions and figures. [4]

- b. Explain Double Side Band Suppressed Carrier (DSB-SC) AM with related time domain and frequency domain spectrums. [4]

- c. Provided is [3]

$$x_0(t) = \begin{cases} e^{-t}, & 0 \leq t \leq 1 \\ 0, & \text{elsewhere} \end{cases}$$

Obtain the Fourier Transform of $x_0(t)$. Also find the Fourier Transform of the signal provided below using the properties of Fourier Transform.

