Marks Obtained:

KATHMANDU UNIVERSITY
End-Semester Examination [C]
July, 2017

Level : B. E.		Course	: COMP 407
Year : IV		Semester	: I
Exam Roll No. :	Time: 30 mins.	F. M.	: 10
Registration No.:		Date	: JUL 0 5 2017

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Select the most appropriate option.

1. The signals $x[-4-2k]$ can be obtained from $x[k]$ by
   a. Compressing the signal by 2, reversing the signal then shifting the signal right by 2 units.
   b. Expanding the signal by 2, reversing the signal then shifting the signal right by 4 units.
   c. Expanding the signal by 2, reversing the signal then shifting the signal left by 2 units.
   d. Compressing the signal by 2, reversing the signal then shifting the signal left by 2 units.

2. If α is positive in signal $x(t)$=$e^{\alpha t}$, then the output of the signal is
   a. dc signal
   b. exponential growing signal
   c. exponential decaying signal
   d. sinc signal

3. The function $f(x) = x^2 + 4$ is
   a. Even Signal b. Odd signal c. DC signal d. Random Signal

4. The fundamental period of signal $x(t) = sin\ (40\pi t)$ is
   a. 0.05 sec. b. 0.1 sec. c. 0.2 sec. d. 0.2 Hz

5. While combined signal operation, if α is negative in $x[\alpha(t + \beta/\alpha)]$ then
   a. Signal is reversed.
   b. Signal is left shifted by α
   c. Signal is right shifted by α
   d. Signal is not flipped

6. For the system with input output relationship $y[k] = x[k-3]$, the impulse response is:
   a. $3\delta[k]$ b. $\delta[k-3]$ c. $3\delta[k-3]$ d. $x[k]$

7. If $x[n] = 2\ \delta[n] + 2\delta[n-3] + 2\delta[n-4]$ then $x[n-1]$ is ....
   a. $2\delta[n] + \delta[n-4]$
   b. $2\delta[n-1] + 2\delta[n-2] + 2\delta[n-5]$
   c. $2\delta[n-1] + 2\delta[n-2] + 2\delta[n-3]$
   d. $2\delta[n-1] + 2\delta[n-4] + 2\delta[n-5]$

8. If the analog signal $x(t) = 2cos(4000\pi t)$ is sampled at the rate of F_s=5000 Hz. The discrete time signal obtained after sampling is
   a. $2\cos\left(\frac{4\pi n}{5}\right)$ b. $4\cos\left(\frac{4\pi n}{5}\right)$ c. $2\cos\ (\pi n)$ d. $4\cos\left(\frac{\pi n}{5}\right)$

9. If f_s is samping frequency and f_n is highest frequency of the signal then for perfect reconstruction of signal, the minimum value of sampling frequency must be
   a. $f_n + \pi$ b. $f_n/2$ c. $2f_n$ d. $2f_n + \pi$

JUL 0 5 2017

10. The expression for impulse train is
a. $s(t) = \sum_{n=-\infty}^{n=0} \delta(n-t)$
b. $s(t) = \sum_{n=-\infty}^{n=\infty} \delta(t-n)$
c. $s(t) = \sum_{n=-\infty}^{n=\infty} \delta(t-nt)$
d. $s(t) = \sum_{n=0}^{n=\infty} \delta(t-nt)$

11. Which of the following relations are true if $x(n)$ is real?
a. $X(\omega) = X(-\omega)$
b. $X^*(\omega) = X(-\omega)$
c. $X^*(\omega) = -X(-\omega)$
d. $X(\omega) = -X(-\omega)$

12. The Fourier transform
a. converts the phasor domain to the magnitude domain.
b. converts the frequency domain to the time domain.
c. converts the time domain to the frequency domain.
d. is used to make real time spectrum analyzers

13. The fourier transform of rectangular function is
a. sinc function b. sin function c. cos function d. delta function

14. The value of twiddle factor W_8^3 is
a. 0 b. $0.707 - j0.707$ c. $-0.707 - j0.707$ d. 1

15. The value of twiddle factor W_4^0 is
a. j b. 1 c. -1 d. -j

16. The total number of complex multiplication required for N point DFT is
a. $\frac{N}{2} * log_2 N$ b. N^2 c. $4N^2$ d. $N * log_2 N$.

17. The ROC of signal $X[z] = 2z^3 + 2z^2 + 2z + 2z^{-1}$ is
a. Entire Z plane except z=0 and z=∞
b. Entire Z plane except z=-∞
c. Entire Z plane except z= 0
d. Entire Z plane except z=∞

18. $If\ x[n] = |n|\ for\ -4 \leq n \leq 3$, then signal $(x[n-1] * \delta[n-1])$ is
a. causal signal b. anti causal signal c.two sided signal d. unit step signal

19. In ideal case, attenuation in pass band is
a. 0 b. 1 c. ∞ d. -∞

20. Impulse Invariance method of IIR filer are .... mapping, from s-domain to z- domain.
a. one to one b. many to one c. many to many d. one to many

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Year : IV
Time : 2 hrs. 30 mins.

Course : COMP 407
Semester : I
F. M. : 40

SECTION "B"
[5Q × 8 = 40 marks]

Attempt *ANY FIVE* questions.

1. a. Discuss the following terms: [1+1]
   i. Relationship between Unit step and delta function (with suitable diagram).
   ii. LTI System
   b. For the signal $x[n] = |n|; -5 \leq n \leq 1$ in graph and find [3]
   i. $x[2-n]$.
   ii. $x[n-1]\delta[n-3]$.
   iii. Energy and Power of the signal.
   c. Determine the causality, linearity, and time invariance of $y[n] = (\cos\pi n)x[n]$. [3]

2. a. Explain Nyquist Sampling Theorem and aliasing with suitable diagram. [2]
   b. State and prove the frequency shifting properties of DTFT. [3]
   c. For a LTI system, find the linear convolution between two signal x[n] and h[n], [3]
   where $x[n] = \begin{cases} 1; & -2 \leq n \leq 2 \\ 0; & elsewhere \end{cases}$ & $h[n] = \begin{cases} 1; & -1 \leq n \leq 1 \\ 0; & elsewhere \end{cases}$.

3. a. Compute the circular convolution of following sequences [3]
   $x[n] = \{1,2,3,4\}$ & $h[n] = \{1,3,5,7\}$.
   b. Use the butterfly diagram to compute 8-point FFT of the following [5]
   sequence using radix-2 decimation in time algorithm, $x(n) = \{1,1,0,0,-1,-1,0,0\}$.

4. a. State time shifting property of Z-transform. Find the inverse Z-transform [1+3]
   of $H(z) = \frac{z(z+3)}{z^2-3z+2}$, ROC 1<|z|<2.
   b. What do you mean by recursive system? Realize the IIR system with the system function H(z) given below using [2+2]
   Direct Form II structure. $H(z) = \frac{1+0.56z^{-1}+0.8z^{-2}+0.08z^{-3}}{1+0.6z^{-1}+0.3z^{-2}-0.4z^{-3}}$.

5. a. Differentiate between FIR and IIR Filters. [3]
   b. Explain Butterworth Filter Approximations with suitable diagram. [2]
   c. The transfer function of analog filter is $H_a(s) = \frac{3}{(s+2)(s+3)}$ with T=0.1 sec. [3]
   Design the IIR filter by using Bilinear Transformation.

6. a. Discuss the following terms. [1.5× 2 = 3]
   i. Frequency warping.
   ii. Matched Z-Transform.

   b. A low pass filter is desired to have frequency response $H_d(\omega)$ as defined below. [5]
   Design FIR filter using Hamming window to meet the following requirement, if the cut-off frequency $w_c = \pi/3$, and order $N = 5$. Does this filter have linear phase?

$$H_d(\omega) = \begin{cases} e^{-j\left(\frac{N-1}{2}\right)\omega} ; & 0 \leq |\omega| \leq c \\ 0; & otherwise \end{cases}.$$

The Hamming Window is defined as,

$$W[n] = \begin{cases} 0.54 - 0.46cos\frac{2\pi n}{N-1}, & 0 \leq n \leq N-1 \\ 0, & otherwise \end{cases}.$$