

KATHMANDU UNIVERSITY  
End Semester Examination [C]  
June, 2018

Marks Scored:

Level : B.E./B.Sc.  
Year : IV

Course : COMP 407  
Semester: I

Exam Roll No.:

Time: 30 mins

F.M. : 10

Registration No.:

Date JUN 10 2018

SECTION "A"

[20 Q.×0.5=10 marks]

Select the most appropriate option.

1. The signals  $x[-9 - 3k]$  can be obtained from  $x[k]$  by
  - a. Compressing the signal by 3, reversing the signal then shifting the signal left by 9 units.
  - b. Expanding the signal by 9, reversing the signal then shifting the signal right by 3 units.
  - c. Expanding the signal by 3, reversing the signal then shifting the signal left by 9 units.
  - d. Compressing the signal by 3, reversing the signal then shifting the signal left by 3 units.
2. 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 left by 4 units.
  - c. Expanding the signal by 2, reversing the signal then shifting the signal right by 2 units.
  - d. Compressing the signal by 2, reversing the signal then shifting the signal left by 2 units.
3. If  $\alpha$  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
4. While combined signal operation, if  $\alpha$  is positive in  $x[\alpha(t + \beta/\alpha)]$  then
  - a. Signal is reversed.
  - b. Signal is left shifted by  $\alpha$
  - c. Signal is right shifted by  $\alpha$
  - d. Signal is not flipped.
5. The fundamental period of signal  $x(t) = \sin(40\pi t)$  is
  - a. 0.05 sec
  - b. 0.5 sec
  - c. 0.5 Hz
  - d. 0.05 Hz
6. For the system with input output relationship  $y[k] = 2x[k - 3]$ , the impulse response is:
  - a.  $2\delta[k]$ .
  - b.  $2\delta[k - 2]$ .
  - c.  $2\delta[k - 3]$ .
  - d.  $2x[k]$ .
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.  $2\delta[n - 1] + 2\delta[n - 4] + 2\delta[n - 5]$
  - c.  $2\delta[n - 2] + 2\delta[n - 3] + 2\delta[n - 5]$
  - d.  $2\delta[n - 1] + 2\delta[n - 2] + 2\delta[n - 3]$



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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 advantages of digital signal processing over analog signal processing [2]
- b. For the signal  $x[n] = |n|$ ;  $-2 \leq n \leq 4$  in graph and find [3]
- $x[2 - n]$
  - $x[n - 1]\delta[n - 3]$
  - Energy and Power of the signal
- 2.a. Explain Nyquist Sampling Theorem and aliasing with suitable diagram. [2.5]
- b. State and prove the periodicity property of DTFT. [2.5]
- c. For a LTI system, find the linear convolution between two signal  $x[n]$  and  $h[n]$ ,  
where  $x[n] = \begin{cases} 1; & -1 \leq n \leq 2 \\ 0; & \text{elsewhere} \end{cases}$  &  $h[n] = \begin{cases} 1; & -1 \leq n \leq 1 \\ 0; & \text{elsewhere} \end{cases}$  [3]
- 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 sequence using radix-2 decimation in time algorithm. [3]  
 $x(n) = \{\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, 0, 0, 0, 0\}$
- c. Determine the 4-point DFT of the signal  $x[n] = u[n] - u[n - 3]$ . [2.5]
- 4.a. What do you mean by region of convergence? State time shifting property of Z-transform.  
Find the inverse Z-transform of  $\frac{z(z+3)}{z^2-3z+2}$ , ROC  $1 < |z| < 2$  [1+1+2]
- b. What do you mean by recursive system? Realize the IIR system with the system function  $H(z)$  given below using Direct Form II structure.  $H(z) = \frac{1+0.56z^{-1}+0.8z^{-2}+0.08z^{-3}}{1+0.6z^{-1}+0.3z^{-2}-0.4z^{-3}}$ . [2+2]
- 5.a. Derive the mapping of poles relation in Bilinear Transformation Method. [5]
- b. The transfer function of analog filter is  $H_a(s) = \frac{3}{(s+2)(s+3)}$  with  $T=0.1$  sec. Design the IIR filter by using Bilinear Transformation. [5]

6.a. Discuss the following terms.

[2×1.5=3]

- i. Differentiate between FIR filter and IIR filter.
- ii. Gibbs Phenomena.

b. A low pass filter is desired to have frequency response  $H_d(w)$  as defined below. 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? [5]

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

The Hamming Window is defined as,

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