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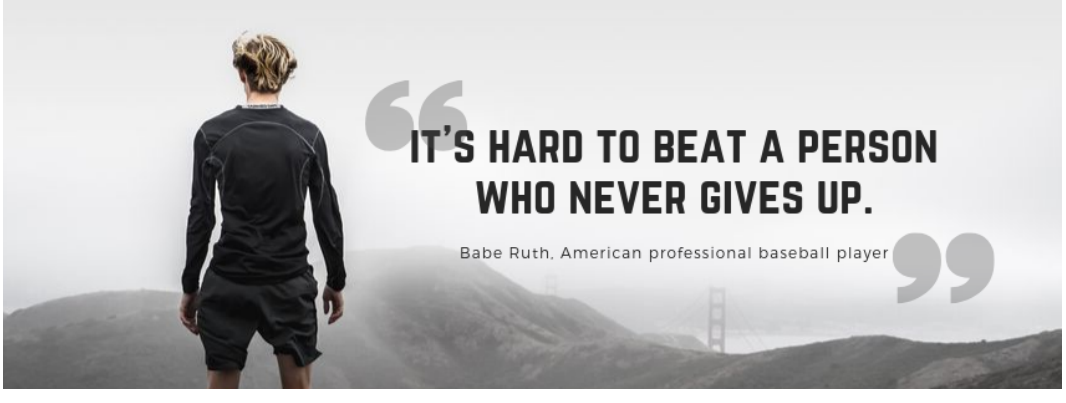

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B.E. (Information Technology) Seventh Semester (C.B.S.)

Elective - II : Digital Signal Processing

P. Pages : 3 **NRT/KS/19/3591**

Time : Three Hours * 0 3 0 8 * Max. Marks : 80

Notes : 1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.

1. a) What are the basic elements of Digital signal processing? Explain in details? **6**

b) The analog signal given below is sampled by 600 sample per second. **7**
$y(t) = 2\sin(240\pi t) + 3\sin(660\pi t)$
calculate
i) Nyquist sampling rate
ii) Folding frequency
iii) Frequencies in radian of y(n)

OR

2. a) A discrete – time signal has given as **8**
$x(n) = \{-3, 0.5, \underset{\uparrow}{1}, 1, 1, 0.5\}$
Sketch the following
i) x(n-3) ii) x(3-n)
iii) x(2n) iv) $x(n)\cdot\mu(3-n)$

b) Obtain the cross correlation of the following sequences using Graphical method. **5**
$x_1(n) = \{\underset{\uparrow}{2}, 3, 4\}$ and $x_2(n) = \{\underset{\uparrow}{1}, 2, 3\}$

3. a) Determine Z transform of the following signals and comment on the result. **8**
i) $x(n) = a^n\,\mu(n-1)$ ii) $x(n) = a^n\,\mu(-n-1)$
iii) $x(n) = -(a^n)\mu(n-1)$ iv) $x(n) = -(a^n)\mu(-n-1)$

b) Explain any four properties of Z transform. **6**

OR

4. a) Determine IZT of $X(Z) = \dfrac{1}{1-4Z^{-1}+3Z^{-2}}$ if ROC is **7**
i) $|Z| > 3$ ii) $|Z| < 1$

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b) A causal discrete time LTI system is described by **7**

$$y(n)-\frac{3}{4}y(n-1)+\frac{1}{8}y(n-2)=x(n)$$

Determine

a) System function H(Z)
b) Find the impulse response h(n)
c) Find the step response s(n)

5. a) Find the Fourier transform of the following signals **6**

i) $x(n)=\left\{\alpha^n \sin wo\, n\right\}\mu(n)$ ii) $x(n)=\left(\frac{1}{2}\right)^n \mu(n)$

b) Determine the Response of FIR filter using DFT if **7**

$x(n)=\{\underset{\uparrow}{1},2\}$ and $h(n)=\{\underset{\uparrow}{2},2\}$

OR

6. a) Compute the 8 point circular convolution for following sequence. **7**

$x_1(n)=\{1,1,1,1,0,0,0,0\}$

$x_2(n)=\sin\left(\frac{3\pi n}{8}\right)\ 0\le n\le 7$

b) Compute the DFT of the sequence $x(n)=\{0,1,2,1\}$. Sketch the magnitude and phase spectrum. **6**

7. Design a digital IIR Butterworth low pass filter using Bilinear transformation with following specification. **14**

i) Pass band ripple 1.5 dB upto 4 rad/sec
ii) Stop band attenuation 20 dB beyond 8π rad/sec
iii) sampling frequency 25Hz

OR

8. a) Convert the analog filter with system function. **7**

$$Ha(s)=\frac{2}{(s+2)+(s+1)}$$

into a digital IIR filter using Billinear transformation assume T = 0.15

b) Convert the analog filter with system function **7**

$$Ha(s)=\frac{s+02}{(s+0.2)2+16}$$

into a digital IIR filter by means of impulse invariance method.

9. **13**

Design a filter with $H\partial(e^{-jw})=\begin{cases} e^{-j3w}, & \frac{-3\pi}{4}\le w\le\frac{3\pi}{4} \\ 0, & \frac{3\pi}{4}<|w|\le\pi \end{cases}$

using a Hamming window m = 7

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OR

10. A low pass filter is to be designed with the following desired frequency response **13**

$$H(e^{jw}) = \begin{cases} e^{-2jw}, & \frac{-\pi}{4} \le w \le \frac{\pi}{4} \\ 0, & \frac{\pi}{4} < |w| \le \pi \end{cases}$$

Determine the filter coefficients $h_d(n)$ using hamming window M=5

11. Given $x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$ find x(k) using DIT. FFT algorithm. **13**

OR

12. Find and Draw the radix- 2, 16 point DIT FFT algorithm for the following sequence **13**
$x(n) = \mu(n) - \mu(n) - 16$

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The best time to plant a tree was 20 years ago. The second best time is now.

~ Chinese Proverb