B.E. (Electrical Engineering (Electronics & Power)) Eighth Semester (C.B.S.)

Elective - II : Digital Signal Processing

P. Pages : 2 **TKN/KS/16/7657**

Time : Three Hours * 0 8 4 2 * 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.
8. Due credit will be given to neatness and adequate dimensions.

1. a) Given the discrete time signal $x(n) = n$ for $-3 \le n \le 2$. **6**

$x(n) = 0$ otherwise

sketch i) $x(n+3)$ ii) $x(n-2)$ iii) $x(-n)$

b) State Nyquist Sampling Theorem. An analog signal $x(t) = \sin 480\pi t + 3\sin 720\pi t$ is sampled at 600 times / sec. **7**

Calculate :

i) Nyquist Sampling Rate

ii) Folding Frequency

iii) What are frequencies in radians in the resulting signal.

OR

2. a) Determine whether the following systems are static / dynamic, linear or non linear, time invariant or variant. causal or non causal. **6**

(a) $y(n) = \cos x(n)$ (b) $y(n) = n\,x(n)$

b) The impulse response of LTI system is : $h(n) = \{2 \underset{\uparrow}{4} 6\ 7\}$ Determine the response of **7**

the system to the input signal $x(n) = \{1\ 2\ 3\ 1\}$ using graphical convolution.

3. a) Determine the Fourier Transform and energy density spectrum of the sequence **6**

$x(n) = A \quad 0 \le n \le L-1$

$= 0$ otherwise

b) By use of DTFT determine. Convolution of the sequences. **7**

$x_1(n) = x_2(n) = \{1 \underset{\uparrow}{1} 1\}$

OR

4. a) Determine the DTFT of **6**

a) $2^n u(n)$ b) $x(n) = u(n) - u(n-6)$

b) State and prove linearity and time shifting property of DTFT. **7**

5. a) **7**

Determine the Z transform of $x(n) = \left(\frac{1}{2}\right)^n \mu(n) + \left(\frac{1}{3}\right)^n \mu(n)$ showing ROC.

b) Prove the time shifting property and differentiation property of Z transform. **7**

OR

6. a) Determine the inverse Z transform of the following X(Z) by the partial fraction expansion method. **9**

$$x(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$$

if ROC i) $|Z| > 1$ ii) $|Z| < 0.5$

iii) $0.5 < |Z| < 1$

b) What is region of conversion? Explain. **5**

7. Obtain the direct form I, direct form II. Cascade and parallel structures for **13**

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

OR

8. a) Obtain direct form and cascade form realisation for the transfer function of an FIR system given by **10**

$$H(Z) = \left(1 - \frac{1}{4}Z^{-1} + \frac{3}{8}Z^{-2}\right)\left(1 - \frac{1}{8}Z^{-1} - \frac{1}{2}Z^{-2}\right)$$

b) What all pass systems and minimum phase systems? **3**

9. a) Design digital filter using bilinear transformation for following analog filter. **6**

$$H(S) = \frac{2}{(S+1)(S+3)} \text{ with } Ts = 0.1\text{sec}.$$

b) For the analog transfer function determine $H(Z)$ using impulse invariance technique $Ts = 1\text{sec}$. **7**

$$H(S) = \frac{1}{(S+1)\ (S+2)}$$

OR

10. The Specifications of desired low pass filter is : **13**

$0.8 \le |H(\omega)| \le 1$ $\quad 0 \le \omega \le 0.2\pi$

$|H(\omega)| \le 0.2$ $\quad 0.32\pi \le \omega \le \pi$

Design Butterworth digital filter using impulse invariance method.

11. Given $x(n) = \{1\ 2\ 3\ 4\ 4\ 3\ 2\ 1\}$ find X(K) using DIT FFT algorithm. **14**

OR

12. a) Find DFT of $\{1\ 2\ 3\ 4\}$. **5**

b) Compute circular convolution of **9**

$\{1\ 2\ 1\ 2\}$ $\quad \{1\ 2\ 3\ 4\}$

Using DFT & IDFT.

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