DTSP BE EXTC Sem VII 19/5/14

QP Code : **MV-19989**

(3 Hours) **[Total Marks : 100**

N.B. (1) Question No. 1 is **compulsory.**
(2) Out of **remaining** questions attempt any **four** questions.
(3) In all **five** questions to be attempted.
(4) **Figures** to the **right** indicate **full** marks.

1. (a) Obtain a digital filter transfer function H(ω) by applying Imputse invariance transformation on the analog TF. **5**

$$H_a(s) = \frac{s}{s^2 + 3s + 2}.$$ Use f_s = 1 K samples/sec .

(b) Consider a filter with TF : **5**
$H(z) = (z^{-1} - a) / (1 - a z^{-1})$
Identify the type of filter and justify it.

(c) Find the number of complex multiplications and complex additions required to find DFT for 32 point sequence. Compare them with the number of computations required if FFT algorithm is used. **5**

(d) Consider the sequence $x(n) = \delta(n) + 2\delta(n-2) + \delta(n-3)$. **5**
Find DFT of x(n).

2. (a) A sequence is given as x(n) = {1 + 2j , 1 + 3j, 2 + 4j, 2 + 2j} **6**
(i) Find X(k) using DIT-FFT algorithm.
(ii) Using the results in (i) and not otherwise find DFT of p(n) and q(n) where
p(n) = { 1, 1, 2, 2 }
q(n) = { 2, 3, 4, 2 }

(b) X(K) = { 36, –4 + j9·656, –4 + j4, –4 + j 1·656, –4, –4 –j 1·656, –4 –j4, –4 –j9·656 } **10**
Find x(n) using IFFT algorithm (use DIT IFFT).

(c) Explain the properties of symmetricity and periodicity of phase factor. **4**

3. (a) By means of FFT-IFFT method (DIT algo) compute Circular convolution of **8**
x(n) = { 2, 1, 2, 1 } h(n) = { 1, 2, 3, 4 }

(b) An 8 point sequence x(n) = { 1, 2, 3, 4, 5, 6, 7, 8 }
(i) Find X(K) using DIF FFT algorithm. **5**
(ii) Let $x_1(n)$ = { 5, 6, 7, 8, 1, 2, 3, 4 } Using appropriate DFT property and answer of previous part, determine $X_1(K)$. **5**
(iii) Again use DFT property and find $X_2(K)$ where $x_2(n) = x(n) + x_1(n)$. **2**

4. (a) Draw the Lattice filter realization for the all pole filter 10

$$H(z) = \frac{1}{1 + \frac{3}{4}z^{-1} + \frac{1}{2}z^{-2} + \frac{1}{4}z^{-3}}$$

(b) Obtain DF-I, DF-II, cascade (first order sections) and parallel (first order sections) structures for the system described by 10

$y(n) = -0{\cdot}1\ y(n-1) + 0{\cdot}72\ y(n-2) + 0{\cdot}7\ x(n) - 0{\cdot}252\ x(n-1)$.

5. (a) Design a FIR low pass digital filter using Hamming window for N = 7 10

$H_d(e^{j\omega}) = e^{-3j\omega} \quad -0{\cdot}75\pi \le \omega \le 0{\cdot}75\pi$

$= 0 \quad 0{\cdot}75\pi \le |\omega| \le \pi$

(b) A LPF has following specifications :— 10

$0{\cdot}8 \le |H(\omega)| \le 1 \quad$ for $0 \le \omega \le 0{\cdot}2\pi$

$|H(\omega)| \le 0{\cdot}2 \quad$ for $0{\cdot}6\pi \le \omega \le \pi$

Find filter order and analog cut off frequency if

(i) Bilinear transformation is used for designing

(ii) Impulse invariance is used for designing.

6. (a) Explain up sampling by an integer factor with neat diagram and waveforms. 10

(b) Explain the need of a low pass filter with a decimator and mathematically prove that $\omega_y = \omega_x D$. 10

7. Write notes on any **four** of the following :— 20

(a) Frequency sampling realization of FIR filters

(b) Goertzel algorithm

(c) Set top box for digital TV reception

(d) Adaptive echo cancellation

(e) Filter banks.
