Reg. No: | | | | | | | | | | | | |

Question Paper Code: 72054

B.E./B.Tech. DEGREE EXAMINATION, APRIL / MAY 2017

Fifth/Sixth Semester

Information Technology

IT 6502 – DIGITAL SIGNAL PROCESSING

(Regulations 2013)

Time: Three Hours **Maximum: 100 Marks**

Answer All Questions

PART – A (10 X 2 = 20 Marks)

1. What is meant by aliasing? How can it be avoided?
2. Find energy of $(1/4)^n$ u (n)
3. The first 5 DFT coefficient of a sequence x (n) are X (0) = 2, X (1) = 0.5 – j 1.206, X (2) = 0, X (3) = 0.5 – j 0.206, X (4) = 0. Determine DFT Coefficients.
4. Calculate % saving in computing through radix – 2, DFT algorithm of DFT coefficient. Assume N = 512
5. What does frequency warping mean? What is the effect on magnitude and phase response?
6. Given the transfer function of LPF, H (s) = $\frac{1}{s+1}$, find the transfer function of HPF having a cut off frequency of 10 rad / sec.
7. State the advantages and disadvantages of FIR and IIR filter.
8. Define Gibb's Phenomenon.
9. What is zero input limit cycle oscillation?
10. Define truncation error for sign magnitude representation and for 2's complement representation?

PART – B (5 X 16 = 80 Marks)

11. a. i. Check whether the system described by the equation is, 1. y (n) =x (n) cos wn
2. y (n) = $|x\ (n)|$ static or dynamic, causal or non-causal, linear or non-linear, time Variant or invariant, stable or unstable? (8)

ii. Find the response of the system for the input signal x (n) = {1, 2, 2, 3},
h (n) = {1, 0, 3, 2} (8)

(or)

b. Determine the inverse z – transform of X (Z) = $\frac{1}{1-1.5z^{-1}+0.5z^{-2}}$ if ROC Z > 1, Z < 0.5 and
0.5 < Z < 1 (16)

12. a. Explain the filtering methods based on DFT and FFT. (16)

(or)

b. Determine the response of LTI system when input sequence x (n) = {-1, 1, 2, 1}
and impulse response h (n) = {-1, 1, -1, 1} by radix – 2 DIT – FFT. (16)

13. a. Design a digital Chebyshev filter satisfying the following constraints,

$0.8 \le |H(e^{j\omega})| \le 1, \quad 0 \le \omega \le 0.2\pi$

$\le |H(e^{j\omega})| \le 0.2, \; 0.6\pi \le \omega \le \pi$ with T = 1 sec using IIT. (16)

(or)

b. i. Determine the system function of the IIR digital filter for the analog transfer function,
H (S) = $\frac{10}{s^2+7s+10}$ T = 0.2 sec using impulse invariant method. (8)

ii. Obtain the direct form I, direct form II form realization of the
Following system function,
y (n) = -0.1 y (n-1) + 0.2 y (n-2) + 3 x (n) + 3.6 x (n-1) + 0.6 x (n-2) (8)

14. a. Design an ideal filter with a frequency response using hamming window N = 7

$$Hd\ (\omega) = \begin{cases} e^{-j3\omega}, & -\frac{\pi}{8} \le \omega \le \frac{\pi}{8} \\ 0, & \omega \le \frac{\pi}{8} \end{cases}$$ (16)

(or)

b. Determine the filter coefficient h (n) of length M = 15 obtaining by sampling and its frequency response as H ($\frac{2\pi K}{15}$) = 1, K = 0, 1, 2, 3, 4
= 0.4, K = 5
= 0, K = 6, 7 (16)

15. a. i. Explain the characteristics of a limit cycle oscillation with respect to system described by the equation y (n) = 0.95 y (n-1) + x (n). Determine dead band of the filter. (12)

ii. Bring out the difference between fixed point and floating point arithmetic. (4)

(or)

b. i. Explain in detail about finite word length effects in digital filter. (8)

ii. Consider the transfer function H (Z) = H1 (Z) H2 (Z) where H1 (Z) = $\left(\frac{1}{1-a1z^{-1}}\right)$

H2(Z) = $\left(\frac{1}{1-a2z^{-1}}\right)$ if b = 3 bits, Find the output round off noise power.

Assume a1 = 0.5 and a2 = 0.25 also find the output round off noise power. (8)