Register Number | | | | | | | | | | | |

B.E/B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL/MAY 2012
ELECTRONICS AND COMMUNICATION ENGINEERING
FIFTH SEMESTER (REGULATION 2004)
EC 373 – DIGITAL SIGNAL PROCESSING

Time : 3 Hrs Max. Mark :100

Answer ALL Questions

PART-A **(10 x 2 = 20 Marks)**

1. Test whether the system is time invariant or not $y(n) = nx^2(n)$.
2. Determine the circular convolution of the sequences h(n) = {1,2} and x(n) = { 1,2,4}
3. What is meant by dead band?
4. What is meant by finite word length effects in digital filters?
5. What is the necessary and sufficient condition for linear phase characteristics in FIR filters?
6. What is meant by prewarping and why do we need it?
7. What are the advantages and disadvantages of bilinear transformation?
8. Give the equation of Hanning Window.
9. If the input to the decimator is x(n) = {1,2,-1,4,0,5,3,2}.What is the output?
10. What is an anti-imaging filter and where it is used?

PART-B **(5 x 16 = 80 Marks)**

11.(i) Find the 4-point IDFT of the sequence, X(k) = {3,(2+j),1,(2-j)} (6)

(ii) Find the 8-point DFT of the sequence, x(n) = {1,2,3,4,4,3,2,1} using DIF-FFT algorithm. (10)

12.a)(i) Convert the single pole low pass filter with system function $H(z) = 0.5(1+z^{-1})/[1-0.302z^{-2}]$ into a bandpass filter with upper and lower cutoff frequencies ϖ_u and ϖ_l respectively. The low pass filter has 3dB bandwidth $\varpi_p = \pi/6$ and $\varpi_u = 3\pi/4$ and $\varpi_l = \pi/4$. (8)

(ii) Use Bilinear transform to design a first order Butterworth LPF with 3dB cutoff frequency of 0.2π. (8)

(OR)

12.b) Design a Chebyshev Type-I low pass analog filter with the following specifications:

$$1 < |H(e^{j0})|_{db} < 0 \quad \text{for } 0 < \Omega < 1404 \text{ rad/s}$$
$$|H(e^{j0})|_{db} < -60 \quad \text{for } \Omega > 8268 \text{ rad/s}$$
(16)

13.a) Design a digital FIR filter with

$$H_d(e^{j\omega}) = 1, \quad 0 \le |\omega| \le \pi/4$$
$$= 0, \quad \pi/4 \le |\omega| \le \pi$$

Use (a) Hamming window with N=7. Realize the filter transfer function. (16)

(OR)

13.b)(i) Derive the frequency response of a linear phase FIR filter when the impulse response is symmetric and order N is odd. (8)

(ii) Obtain the transversal structure and linear phase realization structure for a filter given by h (n) = {0.5, 2.88, 3.404, 2.88, 0.5} (8)

(P.T.O)

14.a)(i) Explain the characteristics of limit cycle oscillations with respect to the system described by the difference equation y(n)=0.95y(n-1)+x(n) with an input x(n) = 0.75 at n=0 and 0 elsewhere. Determine the dead band of the filter. (10)

(ii) What is meant by truncation ?. Explain the error that arises due to truncation in floating point number. (6)

(OR)

14.b)(i) Consider the system y(n) = 0.875y(n-1) – 0.125y(n-2) + x(n). Determine the effect of coefficient quantization using truncation, maintaining a sign bit plus three other bits on the frequency response of the system. (10)

(ii) With a neat block diagram, explain in detail about the Harvard architecture. (6)

15.a)(i) Consider an audio signal of 4 KHz bandwidth is sampled at 32 KHz. If the signal is to be decimated by 2, what should be the response of anti-aliasing filter? Explain. (8)

(ii) With a neat diagram, explain the subband coding of speech signal in detail. (8)

(OR)

15.b)(i) Obtain the polyphase decomposition structure for a 11-tap FIR filter with a decomposition factor of 3. (8)

(ii) Explain the interpolation of sampling rate by an integer factor 'I' and derive the spectra for interpolated signal. (8)