ANNA UNIVERSITY :: CHENNAI – 600 025

MODEL QUESTION PAPER

V SEMESTER

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

EC333 - DIGITAL SIGNAL PROCESSING

Time: 3hrs **Max Marks: 100**

Answer all Questions

PART – A (10 x 2 = 20 Marks)

1. What is the system impulse response if the input and output are $x(n)=(1/2)^n u(n)$, $y(n)=(1/2)^n u(n)$ respectively?
2. Determine the **circular convolution** of the sequence $x_1(n)=\{1,2,3,1\}$, $x_2(n)=\{4,3,2,2\}$
3. What are the advantages and disadvantages of FIR over IIR filter?
4. Convert the non-recursive system $H(z)=1+z^{-1}+z^{-2}+ z^{-3} +z^{-4}$ into recursive system.
5. How are the limit cycle oscillations due to overflow minimized?
6. Determine the direct form realizations for the filter h (n)={1,2,3,4,3,2,1}
7. What is the effect of product **Quantization due to finite word length**?
8. What are the advantages of multistage implementation in multirate signal processing?
9. Define periodogram? How can it be smoothed?
10. Where will you place zero & poles in a filter to eliminate 50 Hz frequency in a sampled signal at sampling frequency F=600Hz?

PART – B (5 x 16 = 80 Marks)

11. **Using FFT algorithm compute the output of linear filter described by h (n)={1,2,3,2,1} and input x (n)={1,1,1,1}**

12.a) Design a **Chebyshev digital low pass filter** with the following specifications. pass band ripple $\leq$ 1 dB, pass band edge = 4Khz,stop band attenuation $\geq$ 40 dB, stop band edge = 6Khz & sampling rate = 24Khz. Use **bilinear transformation**.

(OR)

12.b) Design a **Butterworth IIR filter** with the following specifications

$$0.8 \leq |H(e^{jw})| \leq 1 \qquad 0 \leq \omega \leq 0.2\pi$$

$$|H(e^{jw})| \leq 0.2 \qquad 0.6\pi \leq \omega \leq \pi$$

Use **Impulse Invariant method**.

13.a) Design an **FIR linear phase digital filter** approximating the ideal frequency response,

$$H_d(\omega) = \begin{cases} 1, & 0 \le |\omega| \le \pi/6 \\ 0, & \pi/6 < |\omega| \le \pi \end{cases}$$

Determine the coefficients of a 13-tap filter based on **window method**. Use **hamming window**.

(OR)

13.b) Design an **FIR digital filter** whose frequency spectral samples are

$$H(k) = e^{-j16\pi k/17} \quad 0 \le k \le 4$$
$$= 0 \quad 5 \le k \le 12$$
$$= e^{-j16\pi(k-17)/17} \quad 13 \le k \le 16$$

Use **Hanning window**.

14.a) Consider the system $y(n) = 0.8575\, y(n-1) - 0.125\, y(n-2) + x(n)$

i) Compute the poles & Design the cascade realizations of the system.

ii) Quantize the coefficients of the system using truncation, maintains a sign bit plus three other bits. Determine the poles of the resulting system.

iii) Determine the resulting frequency at –3dB. Assume sampling frequency as F_s= 1000Hz.

(OR)

14.b) The transfer function for an **FIR filter** is given by $H(z)=1-1.334335z^{-1}+ 0.9025z^{-1}$ Draw the realization diagram for each of the following cases. (i) Transversal structures (ii) a two-stage lattice structure. Calculate the values of the coefficients for the lattice structure

15.a) Consider the signal $x(n)=a^n u(n)$, $|a|<1$.Determine the spectrum $X(\omega)$.The signal x(n) is applied to a decimator that reduces the rate by a factor of 2. Determine the output spectrum. Discuss the design criteria for anti-aliasing filter.

(OR)

15.b) Determine the **Power Spectral density estimate** of the signal $x(n)=(0.9)^n, 0 \le n \le 20$ using **Blackman-Tukey** method.
