1. Derive the decimation-in-frequency radix-2 FFT algorithm for evaluating DFT of the discrete-time sequence and draw flow graph for 8-point DFT computation.

2. Using FFT algorithm find the inverse DFT of

$$X(k) = \{7, -\frac{1}{\sqrt{2}} - \frac{j}{\sqrt{2}}, -j, \frac{1}{\sqrt{2}} - \frac{j}{\sqrt{2}}, 1, \frac{1}{\sqrt{2}} + \frac{j}{\sqrt{2}}, j, -\frac{1}{\sqrt{2}} + \frac{j}{\sqrt{2}}\}$$

3. Find the 8 point DFT of the following sequence using DIT (decimation in time) FFT algorithm

x(n) a {1.-1,-1,-14,1.1,-1}.

4. State and prove the circular frequency shift and *circular time shift* properties of DFT.

5. Explain the calculation of inverse DFT **using** FFT **algorithm.**

6. State and prove any four properties of DFT

7. Find 8 point DFT of *given* sequence *x(n)* = {1,2,3,4} using radix-2 DIT-FFT

8. State and prove circular convolution

9. Determine the DFT (8-point) for a continuous time signal, $x(t)=\sin(2\pi ft)$ *with* f=50Hz.

10. Determine the response of LTI system by radix-2 FFT. The input sequence is given by *x(n)* = {-1, 1, 2, 1, -1} and impulse response is *h (n)* = {-1, 1,-1,1}

11. Explain the important features of Decimation in frequency FFT algorithm.

12. Obtain the DFT of *x(n)* = {1, 2, 3, 4, 4, 3, 2, 1} using Decimation in time FFT algorithm.

13. Compute the N point DFT of *x{n) = an u(n)* for cases |a| < 1 and |a| = 1.

14. State and prove the circular time shift property of DFT

UNIT-II

1. Explain the desirable characteristics of the window function.

2. Draw the Cascade realization using minimum number of multipliers for the system

$$H(Z)=\left(1+\left(\frac{1}{4}\right)Z^{-1}+Z^{-2}\right)\left(3+0.5Z^{-1}+3Z^{-2}\right).$$

3. Design a digital Chebyshev filter to meet the constraints :

$$\frac{1}{\sqrt{2}} \le |H(w)| \le 1, \quad 0 \le w \le 0.2\pi$$
$$0 \le |H(w)| \le 0.1, \quad 0.5\pi \le w \le \pi$$

by using bilinear transformation with sampling Period T = 1 sec.

4. Design and realize a digital low pass filter using the bilinear transforms method to satisfy the following characteristics:

- Monotonic stop band and pass band
- 3.01 dB cutoff frequency of 0.5 ∏ rad
- Magnitude down at least 15 dB at 0.75∏r rad.

5. Obtain a parallel realization for the following

$$H(z)=\frac{8z^3-4z^2+11z-2}{\left(z-\frac{1}{4}\right)\left(z^2-z+\frac{1}{2}\right)}$$

Use direct form II realization for each section

6. Compare Butterworth and Chebyshev approximations

7. Design a Butterworth low pass digital filter satisfying the following conditions using bilinear transformation

$$0.89 \le |H(\omega)| \le 1.0 \; ; \; 0 \le \omega \le 0.2\pi$$
$$|H(\omega)| \le 0.18 \; ; \; 0.3\pi \le \omega \le \pi$$

8. Explain the properties of Chebychev filters.

9. Find the order N and the transfer function of analog Chebychev low pass filter for the following specification: Pass band ripple 3 dB and pass band cut off frequency 1 KHz, stop band attenuation of 16 dB at stop band frequency of 2 KHz.