1. Prove Symmetry and periodicity property of twiddle factor   6m
2. Establish relation between DFT and Fourier Series   4m
3. Determine the circular convolution of the sequence x(n)={1,2,3,1} and h(n)={4,3,2,2} using DFT and IDFT equation 10m
4. Determine the linear convolution of the sequence x(n)={2,2,3} and h(n)={2,3} using DFT and IDFT equation   10m
5. Find the IDFT) of X(k) = {4, 1 -j, -2, 1+j}   4m
6. The five samples of the 8 point DFT X(k) are given as X(0) = 0.25, X(1)= 1.25 - j0.3018 , X(6)=X(4)=0, X(5)= 0.125-j0.0518. Determine the remaining sample if the sequence x(n) is real valued? 3m
7. Compute of the sequence x(n)=sin(3n $\pi/8$) for N=4 . Plot magnitude and phase of X(k) ((any x(n) can be given))   6m
8. What is the need of FFT? Determine the following for a 128 point FFT computation number of 1) Stages 2)Butterflies in each stage 3) Butterflies needed for entire computation 4) Total number of   complex multiplication 5) Total number of complex Addition 6)speed improvement factor compared with direct computation 8m
9. Determine the circular convolution of the sequence x(n)={1,2,3,1} and h(n)={0,3,1,2} using DIT FFT 10m (any sequence can be given)
10. Find the circular convolution of x(n)={4 ,3,2,1} and h(n)= {1, 0, 1, 0} using DIF-FFT algorithm (any sequence can be given). 10m
11. Find the IDFT X(k)={36, -4+i9.7, -4+i4, -4+i1.7, -4, -4-i1.7, -4-i4, -4-j9.7}   using DIF-FFT algorithm show clearly all intermediate steps 10m((any sequence can be given))
12. Determine the 8-point DFT of the sequence x(n)={8, 8, 8, 8, 1, 1, 0, 0}, sketch the magnitude and phase spectra . (any sequence can be given) 10m
13. What is in-place computation ? What is total number of complex addition and multiplication required for N=256, if DFT is computed directly and if FFT is used. 4m
14. Explain   bit   reversal   property   used   in   FFT   algorithm   for   N=16   4m
14. State and prove the circular (i) Time-shift and (ii) Frequency shift properties of an N-point sequence. **6M**

15. Define DFT and IDFT of a signal. Establish relation between DFT and Z-transform.   **6M**
 16. Let X(k) be a 14-point DFT of length - 14 real sequence x(n). The first K-samples of X(k) are given by   **X(0)=12, X(1)=-1+3j, X(2)=3+4j, X(3)=1-5j, X(5)=6+3j, X(6)=-2-3j), X(7)= 10.** Find the remaining samples of X(k).**Also** evaluate the following **i) X(0)   ii) X(7)   iii)**$\sum_{n=0}^{13} x(n)$ **iv)** $\sum_{n=0}^{13} |x(n)|$ **10M**
 17. In the direct computation of N-point DFT of x(n), how many (i) Complex additions (ii) Complex multiplications (iii) Real multiplication (iv)Real additions and   (v) Trigonometric functions, evaluations are required?   **10M**
 18. For x(n)={ 1, -2, 3-4, 5, -6} without computing its DFT find the following

    1) X(0) 2) $\sum_{k=0}^{5} X(k)$ 3) X(3) 4) $\sum_{k=0}^{5} |X(k)|^2$ 5) $\sum_{k=0}^{5} (-1)^k X(k)$ **10M**
19.   Derive   DIT-FFT   algorithm   for   N=4.   Draw   the   complete   signal   flow   graph.   **8M**

20.Find the 8-point DFT of the sequence x(n)=1   for n even
                                     0 for n odd,   8M

 21. Consider a signal of length 4 defined by x(n)={1 2 3 1}. Compute 4-point DFT by solving explicitly 4X4 system of linear equations defined by DFT formula .   **6M**

16. A 4-point sequence x(n)={1,2,3,4} has DFT X(k) fo r 0≤K≤3. Find the signal values which has DFT X((K-1))$_N$ without performing DFT and IDFT   **4M**
17.Compute 4 point circular convolution given by x(n)={1,8,1,8} and h(n)={2,9,2,9} using DFT and IDFT method.   **6M**
18. What is the need of FFT? Determine the following for a 128 point FFT computation number of

1) Stages 2)Butterflies in each stage 3) Butterflies needed for entire computation 4) Total number ofcomplex multiplication 5) Total number of complex Addition 6)speed improvement factor compared with direct computation   8M

19. Explain the shuffling of data and bit reversal as applied to DIT-FFT algorithm for N=8   4M

20. State and prove the following property

  1)symmetryproperty   2)parseval'stheorem   8M

22.Explain   bit   reversal   property   used   in   FFT   algorithm   for   N=16   3M

24. Find the IDFT **X(k)={36, -4+i9.7, -4+i4, -4+i1.7, -4, -4-i1.7, -4-i4, -4-j9.7}**   using DIF-FFT algorithm show clearly   all   intermediate   steps   .   10M

25. An analog signal is sampled at 10 kHz and the DFT of 512 samples is computed. Determine the frequency spacing   between   the   spectral   samples   of   DFT.   5M

26. consider the finite length sequence length **x(n)=δ (n)-2 δ(n-5)** Find i)The 10 point DFT of x(n) ii) sequence y(n) that has a DFT Y(k)=$e^{-j4\pi k/10}$ X(k)W(k) where X(k) is 10 point DFT of x(n) and W(k) is 10 point DFT of

  W(n)=u(n)-u(n-6)   12M

27.Given the 8 point sequence **x(n)= 1 ; 0≤n≤3**

$$= 0 ; 4≤n≤7.$$

Compute DFT of the sequence **x₁(n)= 1 ; n=0**

$$= 0; 1≤n≤4$$

$$= 1; 5≤n≤7.$$ Using Properties of DFT.

28. Given the sequences **x(n)= cos(n $\pi/2$)**   and h(n)=2^n.Compute 4-point circular convolution.   5M

29.Given that **x(n)={2,1}, w(n)=x(n)*y(n) and w(n)={6,-1,7,-4 }.** Compute the sequence **y (n)** using DFT.   7M

30. Consider the sequence **x1(n)={0,1,2,3,4}, x2(n)={0,1,0,0,0}, s(n)={1,0,0,0,0}** and their 5 point DFT's. Determine 1) a sequence y(n) so that **Y(k)=X1(k).X2(k)** and 2) Is there any sequence x3(n) such that **S(k)=X1(k).X3(k)**   10M

31. Explain how the DFT can be used to compute N equi spaced samples of Z-Transform of an N point sequence   on   a   circle   of   radius   r.   4M

32. Let x(n) be a given sequence with N points with X(k) the corresponding DFT. Denote the operation of finding the DFT a s follows: **X(k)=F(x(n)).**What is the resulting sequence x(n) operated upon 4 times i.e determine   **Y(k)=F(F(F(F(x(n))))).**   **6M**

33. What is linear filtering? Explain how DFT is used in Linear filtering?   6M