Bharatiya Vidya Bhavans'
Sardar Patel Institute Of Technology
Munshinagar, Andheri(W), Mumbai-400058

IT/Computer Engineering Department

Subject : Foundation of Signal Processing Class : TE Computer / IT SEM-VI

Assignment-3 Topic : Fast Fourier Transform Date : 10-3-2023

NOTE : [1] All questions are Compulsory.
[2] Do not write answers for FAQs in your assignment. But you should be in a position to answer FAQs at the time of correction.
[3] Deadline for submission of corrected assignment is 20th March 2023.
[4] After deadline you will have to attempt all questions.

Module : 03

References :

[1] Proakis and Manolakis, "Digital Signal Processing", 4th Edition, Pearson Education.

[2] Ashok Ambardar, 'Digital Signal Processing ' , Cengage Learning, 2007, ISBN : 978-81-315-0179-5.

[3]. Emmanuel C. Ifeachor, Barrie W. Jervis, "Digital Signal Processing: A Practical Approach", Pearson Education ISBN 0-201-59619- 9

[4] S. Salivahanan, A. Vallavaraj, C. Gnanapriya, 'Digital Signal Processing ' TataMcgraw Hill Publication First edition (2010). ISBN 978-0-07-066924-6.

➢ FFT Algorithms [Attempt any Two]

Q(1) Given x[n] = { 1, 1, 1, 1, 0,0,0,0}
Find X[k] using DIT-FFT and DIF-FFT.

Q(2) Let x[n] = {a, b, c, d} and the corresponding DFT X[k] = {A, B, C, D}.
Let p[n] = {a, 0, 0, b, 0, 0, c, 0, 0, d, 0 , 0} Find P[k] using X[k].

ANS : P[k] = { A, B, C, D, A, B, C, D, A, B, C, D}

Q(3) Let p[n] = { 1, 2, 3, 4 } and q[n]= { 5, 6, 7, 8 }. Find DFT of each of the sequence using FFT only once.

Q(4) Given that x[n] = { (1 + 2 j), (1 + j) , (2 + j), (2 + 2 j) }

(a) Find X [k] using DIT–FFT algorithm.

(b) Using the results in and not otherwise find the DFT of p[n] and q[n] where p[n] = { 1, 1 , 2, 2 } and q[n] = { 2, 1, 1, 2 }.

➢ Linear Convolution and Circular Convolution using FFT [Attempt Any one]

Q(5) Given x[n] = { x[0], x[1], x[2], x[3] } and h[n] = { h[0], h[1], h[2] }. Give step by step procedure to obtain Circular Convolution using FFT–IFFT.

Q(6) Given x[n] = {x[0], x[1], x[2], x[3]} and h[n] = {h[0], h[1], h[2]}. Both are non-periodic finite length sequences. Give step by step procedure to obtain linear convolution using FFT–IFFT.

Q(7) Impulse response of 3rd order Linear Phase Low-Pass FIR filter is given by h[n]={ 1, 2, 2, 1 }. Give step by step procedure to find output of the filter to the input x[n] = { 1, 2, 3, 4} using FFT-IFFT.

ANS : Output of Digital filter is linear convolution of x[n] with h[n].

➢ Linear FIR Filtering [Attempt Any one]

Q(8) Given h[n]= { 1, 0, 2 } Find the response of a Digital FIR filter to the input x[n] = { 1, 2, 3, 4, 0, 0, 1, 2, 3, 4 } using Overlap **Add** Method.

Q(9) Given h[n]= { 1, 0, 2 } Find the response of a Digital FIR filter to the input x[n] = { 1, 2, 3, 4, 0, 0, 1, 2, 3, 4 } using Overlap **Save** Method.
