



# Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058,  
India

(Autonomous College Affiliated to University of Mumbai)

## End Semester Examination-May 2023

**Max. Marks:** 100

**Class:** T. Y. B. Tech

**Course Code:** IT303

**Name of the Course:** Foundation of Signal Processing

**Duration:** 3hrs

**Semester:** VI

**Branch:** Computer/IT

### Instruction:

- (1) All questions are compulsory
- (2) Draw neat diagrams
- (3) Assume suitable data if necessary
- (4) If answers of explain or discuss are identical or appears to be copied, NO student gets marks for those questions

Q. No.		Marks	CO
Q. 1 (a)	(1) Justify unit step is a power signal whereas unit impulse is a energy signal [5 Marks] (2) Let $x[n]$ is defined which is non-zero for $-1 \leq n \leq 2$ . Let signal $y[n]$ is defined as $y[n] = 2 x[\frac{2-n}{2}]$ , then compute the width of $y[n]$ for which it is non -zero. [5 Marks]	10	CO1
Q. 1 (b)	The impulse response of LTI System $h(n) = (\frac{1}{2})^n u(n)$ Find the response of the system when input $x(n) = (2)^n u(n)$ by using Formula Method. Calculate and plot the first five values of the output signal.	10	CO1
Q. 2 (a)	Given $x(n) = \{ 1, 1, 1, 1, 0, 0, 0, 0 \}$ . Find 8 Point $X[k]$ . Find the DFT of the following sequences in terms of $X[k]$ . (1) $p[n] = \{ 0, 0, 0, 0, 1, 1, 1, 1 \}$ (2) $q[n] = \{ 1, 1, 1, 1, 1, 1, 1, 1 \}$	10	CO2
Q. 2 (b)	Let $X[k] = \{ 1, -2-2j, 1-j, 4-2j, 0, \dots \}$ is the 8 point DFT of a real valued sequence. What is the 8 point DFT $Y[k]$ such that $y[n] = (-1)^n x[n]$ ?  (OR)  A 4-point DT signal $x(n)$ is given by $x(n) = [1, 2, 0, 2]$ . A student found the DFT of this sequence as $X[k] = [5, (-1+j2), -3, (-1-j2)]$ Guess whether this answer is correct or not, without performing DFT. Justify your guess.	10	CO2

Q. 3 (a)	Find the values of discrete time signal:  $x[n] = \cos[0.5\pi n]$ radians for $n=0,1,2,3$ . Compute the FFT of the $x[n]$ .  Also, verify the result using IFFT	10	CO2
Q. 3 (b)	Suppose that we have a 1025 point data sequence ( 1 more than $N = 2^{10}$ ). Instead of discarding the final value, we zero pad the sequence to make it of length $N = 2^{11}$ so that we can use a radix-2 FFT algorithm. (1) How many multiplications and additions are required to compute DFT using a radix-2 FFT Algorithm. (2) How many multiplications and additions would be required to compute a DFT of 1025 point directly.	10	CO2
Q. 4 (a)	Obtain 4-point fast circular convolution for a X-filter fed through an DT input $x[n] = \sin(\frac{2\pi n}{N})$ having impulse response formulated as $h[n] = \cos(\frac{2\pi n}{N})$ , where $n = 0, 1, 2, \dots, N-1$ .  <b>(OR)</b> Let the FIR filter with impulse response $h[n] = \{ 4, 5 \}$ . Calculate the response of the filter to the input $x[n] = \{ 1, 2, 3 \}$ using FFT.	10	CO3
Q. 4 (b)	A 2 <sup>nd</sup> order Low Pass FIR filter has causal impulse response $h[n] = [ 2, 0, 1 ]$ . Determine the output sequence response to the following input sequence using Overlap Save Method. Given input sequence : $x[n] = \{ 3, 0, -2, 0, 2, 1, 2, -2, -1, 1, 3 \}$	10	CO3
Q. 5 (a)	A real-time filtering of speech signal is required to be processed for noise filtering using fast Algorithm and the filtered signal is encrypted so that unauthorized persons can not decode the secret message. (a) Draw block diagram of the complete DSP system. Justify the need of each block. (b) Write Algorithms/Flowchart to address the problem.	10	CO4
Q. 5 (b)	Calculate Carl Pearson's Coefficient of Correlation of the following Discrete Time signals. Also comment on the type of correlation.  $x_1[n] = 3\delta(n) - 2\delta(n-1) + \delta(n-3)$  $x_2[n] = 4\delta(n-2) - 2\delta(n) - 3\delta(n-3)$	10	CO4