07/07/23.

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 **Duration:** 3hrs
Class: T. Y. B. Tech **Semester:** VI
Course Code: IT303 **Branch:** Computer/IT
Name of the Course: Foundation of Signal Processing

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)	(i) With the help of example, show that the product of two even signals or two odd signals is an even signal and that the product of an even signal and that of an odd signal is an odd signal [5 Marks]. (ii) A signal x[n] is given, which is 0 for n less than 3. Let y[n] be a signal which is, $y(n) = x[1-n] + x[2-n]$. Find the range of n, where y[n] is guaranteed to be zero. Also comment on the type of signal. [5 Marks].	10	CO1
Q. 1 (b)	Let $x(t) = \sin(480\pi t) + 3\sin(720\pi t)$ is sampled with Fs = 600 times per second. (1) Determine the Nyquist rate. (2) What are the Frequencies in radians in the resulting DT signal x[n] ? **(OR)** (1) Determine whether the following DT signals are periodic or not. If periodic, find the period. (i) $x[n] = \cos(0.22\pi n)\, u[n]$ (ii) $x[n] = \cos(0.22\pi n + 0.5\pi)\, u[n]$ (2) Determine whether the following DT signals are Energy signal, Power Signal or Neither Energy nor Power Signal. (i) $x[n] = (0.25)^n u[n]$ (ii) $x[n] = \cos(0.3\pi n)\, u[n]$	10	CO1

Q. 2 (a)	Find the eight point DFT of the sequence $x[n] = \begin{cases} 1 & 0 \le n \le 3 \\ 0 & 4 \le n \le 7 \end{cases}$ Compute the DFT of the following sequence using X[k] only. $p[n] = \left\{ \begin{array}{ll} 1 & n = 0 \\ 0 & 1 \le n \le 4 \\ 1 & 5 \le n \le 7 \end{array} \right\}$	10	CO2
Q. 2 (b)	The real sequence of length 8 is given as x[n] = { 1, 1, 2, 1, 1, 1, 1 } Find the 8 point DFT X[k], by using 4 point DFTs only. **(OR)** Assume that a real multiplication takes 1 microsecond & a real addition takes 1 microsecond. 1. How much time does it take to compute 1024-point DFT directly? 2. How much time it will take to find the output of FIR filter with M=13 point h[n] and L= 88 point x[n] using DFT.	10	CO2
Q. 3 (a)	Find the values of the discrete time signal: x[n] = sin(0.5πn) radians for n = 0,1,2,3. Compute the FFT of the x(n). Plot Squared Magnitude Spectrum.	10	CO2
Q. 3 (b)	Let x[n] = {1, 0, 2, 0, 3, 0, 2, 0 }. Find X[k] using DIT-FFT. Find the DFT of p[n] = { 1, 2, 3, 2 } using X[k] and not otherwise.	10	CO2
Q. 4 (a)	Low Pass FIR filter has causal impulse response h[n] = [2, 2, 1] . Determine the output sequence response to the following input sequence using Overlap Add Method. Given input sequence : x[n] = { 3, 0, -2, 0, 2, 1 ,0, -2, -1, 5, 4, 2 }	10	CO3
Q. 4 (b)	Determine the circular convolution of two sequences using DIT-FFT $x_1[n]$ = {1, 2, 3, 1} and $x_2[n]$ ={4, 3, 2, 2}	10	CO3
Q. 5 (a)	A real-time earthquake detection system based on vibration sensor and high-speed DSP processor is required to be designed. If the peak value of the signal is greater than user defined threshold value, then an appropriate error message should get displayed on the screen. (1) Draw block diagram of the complete DSP system. Justify the need of each block. (2) Write Algorithms/Flowchart to address the problem.	10	CO4
Q. 5 (b)	Measure the degree of similarity between two sampled audio passwords using Carl Pearson's Coefficient of Correlation. Test Signal : $x_1[n]$ = { 2, 4, 6, 8 } Stored Signal : $x_2[n]$ = { 2.5, 4.1, 5.8, 7.3 }	10	CO4

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