# Sardar Patel Institute of Technology

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

(Empowered Autonomous College Affiliated to University of Mumbai)

## MID Semester Examination

OCTOBER 2023

Max. Marks: 30 | Duration: 60 Min

Class: TE ELECTRONICS & TELECOMMUNICATION | Semester: V

Course Code: EC303 | Branch: EXTC – T.E.

Name of the Course: Digital Signal Processing

Instruction:

(1) All questions are compulsory.
(2) Use of scientific calculator is allowed.
(3) Draw neat diagram.
(4) Assume suitable data if necessary, with justification.

| | | Max. Marks | CO |
|---|---|---|---|
| Q.1 | Attempt the following Short Answer Questions. | | |
| | **a)** Let $x[t] = 10.2\cos(100t) + 2.80\cos(120t) - 15\sin(250t)$. If x(t) is sampled with Sampling frequency Fs = 200 Hz, What will be Discrete Time Signal x[n] at n=0 ? | 1 | CO1 |
| | **b)** Consider $x_1[n]$ is periodic with period = 4 and $x_2[n]$ is periodic with period = 6 . Let $x[n] = x_1[n] + x_2[n]$. What will be the period of x[n] ? | 1 | CO1 |
| | **c)** Let x[n] be the finite duration real valued sequence of length 8. Its corresponding DFT X[k] is as given below: X[k] = { (1), (4 + j2), (6 + j4), (2j), (6), (-2j), (6 – j4), (4 – j2) } A new sequence p[n] of length 8 is defined as p[n] = 0.5{x[n]+x[-n]} Find P[k] i.e. DFT of p[n] without performing DFT/ IDFT operations. | 1 | CO2 |
| | **d)** Let x[n]= { 1, 2, 3, 4, 5, 6 }. Compute $\sum_{n=0}^{5} \lvert X[k] \rvert^2$ | 1 | CO2 |
| | e) Let x[n] be a 8 pt sequence. How will you arrange the sequence for applying it as input to DIT-FFT flowgraph? | 1 | CO2 |
| Q.2 | Consider a Continuous time signal band limited to 3.4 KHz is sampled with sampling frequency of 8KHz. The samples thus obtained are converted to frequency domain using Fourier Transform.<br>a) How many real multiplications and real additions will be required to per second if DFT is used?<br>b) How many real multiplications and real additions will be required to per second if FFT is used by converting the sample count N per second to a radix 2 number? | 5 | CO2 |

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|---|---|---|---|
| **Q.3** | Consider the finite length sequence x[n] = δ[n] + 2 δ[n-5]<br>(a) Find 10-point DFT of x[n] [ 3 Marks]<br>(b) Find the sequence that has a DFT P[k]= $W_N^{-5k}$ X[k] where X[k] is 10-point DFT of x[n]. [2 Marks] | 5 | CO2 |
| **Q.4** | Given x[n] = $\delta[n]+2\,\delta[n-1]+3\delta[n-2]+2\,\delta[n-3]$ and x[n] = $\delta[n]+4\,\delta[n-2]$ Find Circular Convolution using FFT-IFFT. | 5 | CO2 |
| **Q.5** | Let x[n] = {a, b, c, d} and the corresponding DFT X[k] = {A, B, C, D}. Let q[n] = { a, 0, 0, b, 0, 0, c, 0, 0, d, 0, 0 } Find P[k] using X[k]. | 5 | CO2 |
| **Q.6** | Given $x(n)=\left(\frac{1}{2}\right)^n u(n)+3^n u(-n-1)$. Find the Energy of signal x[n]. | 5 | CO1 |