Section D

7. What is Multirate Signal Processing ? Why anti-aliasing filter is required in decimator ? Discuss the Decimator in Transform domain. **10**

8. If the sampling rate is to be changed from 8 kHz to 12 kHz, what will be the sampling rate conversion factor ? If a signal is passed through an L fold expander, how the spectrum of signal will be affected ? Derive the Z-domain relation for an Expander/Interpolator. **10**

(Compulsory Question)

9. (a) Discuss in brief whether sampling in general is invertible/non-invertible process. If a continuous time signal $3\cos\left(20\pi t+\frac{\pi}{4}\right)$ is sampled at 100 Hz, what will be the frequency of resulting discrete time signal ?

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July-22-00383

B.Tech. EXAMINATION, 2022

Semester VI (CBCS) (ECE)

DIGITAL SIGNAL PROCESSING

EC-604

Time : 3 Hours *Maximum Marks : 60*

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt *Five* questions in all, selecting *one* question from each Sections A, B, C and D. Q. No. **9** is compulsory.

Section A

1. Describe the relationship among frequency variables of continuous time and discrete-time signals complex exponential/sinusoidal signals. Find the magnitude

response of DTFT of $x(n) = \{0.5, 0.5\}$. What is the frequency at which null point occurs ? How many complex multiplication and addition are required in computing (N = 16) point DFT using Divide and Rule Approach if N = 4 × 4. **10**

2. How the response of LTI systems to arbitrary inputs is determined using Convolution Sum ? In the process of computing convolution between two signals what steps are performed ? What is the convolution output of $x(n) = \delta(n - 1) + \delta(n + 1)$ and an arbitrary signal $y(n)$? If two systems with impulse response $h_1(n) = \{1, 1, 1, 1\}$, and $h_2(n) = \{1, 0, 1, 0\}$ are in cascade, what will the impulse response of ever all system ? **10**

Section B

3. A Designer has available a number of 8 point FFT Chips. How explicitly he should interconnect three such chips in order to form a 24 point DFT. **10**

4. Discuss the sampling of Discrete Time Fourier Transform (DTFT) to get Discrete Fourier Transform (DFT). What is the minimum number of samples required in frequency domain so as to reconstruct the signal in time from its frequency samples ? Compute the 4 point DFT of the sequence $x(n) = \{0\ 1\ 2\ 3\}$ using Linear transformation. **10**

Section C

5. Obtain direct form-I and direct form-II structure of the system described by the difference equation $y(n) = -0.5y(n - 1) + 2n(n - 1) + 0.25y(n - 2)$. Discuss whether this system is stable or not ? **10**

6. What is difference between FIR and IIR systems ? How the recursive systems differ from non-recursive systems ? Can we implement a FIR system using recursive system ? Show that the IIR systems can be described using the constant coefficient difference equation. **10**

(b) Find 4-point DFT of $x(n) = \{1, 1, 1, 1\}$ using radix 2 Decimation in frequency algorithm.

(c) Discuss the mapping of s-plane to z-plane in impulse invariance method.

(d) Check the system of $y(n) = x(-n)$ for causality and time invariance property. Is this system invertible ? **4×5=20**

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