Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058, India
(Autonomous College Affiliated to University of Mumbai)

Mid Semester Examination

March 2020

Max. Marks: 20 Duration: 1 Hr.

Class: T.E. Semester: VI

Course Code: CE63 Branch: COMP

Name of the Course: Digital Signal Processing

Instruction:

(1) All questions are compulsory
(2) Draw neat diagrams
(3) Assume suitable data if necessary

Q. No.	Synoptic	Max. Marks	CO-BL-PI
1	Determine and sketch the linear convolution y(n) of the signals using tabular method $x(n)=\begin{cases}\frac{1}{3}n, & 0 \le n \le 6\\ 0, & elsewhere\end{cases}$ $h(n)=\begin{cases}1, & -2 \le n \le 2\\ 0, & elsewhere\end{cases}$ **Solution:** **1. folding 1M** **2. index calculation and left shift 1M** **3. Tabular representation 1M** **4. correct values of y(n) 3M**	6	2-3-2.2.3
2	A discrete-time signal x(n) is defined as $\begin{cases}1+\frac{n}{3}, & -3 \le n \le -1\\ 1, & 0 \le n \le 3\\ 0, & elsewhere\end{cases}$ a) sketch the signal that result if we, 1. First fold x(n) and then delay the resulting signal by 4 samples . 2. First delay x(n) by 4samples and then fold the resulting signal. b) Sketch the signal x(-n+4) c) Compare the results in parts (b) and (c) and derive a rule for obtaining signal x(-n+k) from x(n) d) Can you express the signal ,x(n) in terms of signals δ(n) and u(n)	5	2-3-2.1.3

Solution: a) resultant signal +graph =2M

$$x(-n) = \left\{\ldots 0, 1, 1, 1, \underset{\uparrow}{1}, \frac{2}{3}, \frac{1}{3}, 0, \ldots\right\}.$$

After delaying the folded signal by 4 samples, we have

$$x(-n+4) = \left\{\ldots 0, \underset{\uparrow}{0}, 1, 1, 1, 1, \frac{2}{3}, \frac{1}{3}, 0, \ldots\right\}.$$

On the other hand, if we delay x(n) by 4 samples we have

$$x(n-4) = \left\{\ldots \underset{\uparrow}{0}, 0, \frac{1}{3}, \frac{2}{3}, 1, 1, 1, 1, 0, \ldots\right\}.$$

Now, if we fold $x(n-4)$ we have

$$x(-n-4) = \left\{\ldots 0, 1, 1, 1, 1, \frac{2}{3}, \frac{1}{3}, 0, \underset{\uparrow}{0}, \ldots\right\}$$

b) resultant signal +graph =1M

$$x(-n+4) = \left\{\ldots \underset{\uparrow}{0}, 1, 1, 1, 1, \frac{2}{3}, \frac{1}{3}, 0, \ldots\right\}$$

c)Justification for comparison=1M

d) express the signal ,x(n) in terms of signals δ(n) and u(n)=1M

$$x(n) = \frac{1}{3}\delta(n-2) + \frac{2}{3}\delta(n+1) + u(n) - u(n-4)$$

3	Describe Time Variant and Time Invariant System. Write a procedure to test for time invariance . Test the following system for time invariance $y(n) = x(n^2)$ ***Solution:*** **Description of Time Variant and Time Invariant System= 1M** **Procedure= 1M** **Test the following system for time invariance= 2M** **OR**	4 4	1-2- 1.3.1 1-2- 1.3.1

	Describe Linear and nonlinear system with suitable diagram. Test the following system for linearity $y(n) = x(n^2)$ ***Solution:*** **Description of Linear and nonlinear system = 1M** **Diagram = 1M** **Test the following system for linearity = 2M**		
4	Discover the Relation between DFT and DTFT. State and explain properties of DFT ***Solution:*** **the Relation between DFT and DTFT =2M** **Properties of DFT= 1M each(3M)**	5	3-2-1.3.1