# GUJARAT TECHNOLOGICAL UNIVERSITY
## BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2018

**Subject Code: 2171003**                                         **Date: 29/11/2018**
**Subject Name: Digital Signal Processing**
**Time: 10:30 AM TO 01:00 PM**                               **Total Marks: 70**
**Instructions:**
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

|       |     |                                                                                                                                                                                                                                                                                                                                                 | MARKS |
|-------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Q.1   | (a) | Define the given terms in context of digital signal processing. (1) Energy signal (2) Time invariant system (3) Folded signal                                                                                                                                                                                                                    | 03    |
|       | (b) | Compare IIR and FIR system with example.                                                                                                                                                                                                                                                                                                         | 04    |
|       | (c) | Where sampling in time domain is required in Digital Signal Processing? Explain relation between frequency of continuous time signal (in Hz) and discrete frequency(in Radian) of any signal. Show how all frequency ranges (i.e. $-\infty \le f \le \infty$) of continuous time signals transform to the discrete frequency range of $-\pi \le \omega \le \pi$. | 07    |

|       |     |                                                                                                                                                                                                                                                     | MARKS |
|-------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Q.2   | (a) | What is Linear phase system?  Explain it in brief with example.                                                                                                                                                                                    | 03    |
|       | (b) | Explain/prove how linear convolution become easier with the help of Z transforms.                                                                                                                                                                  | 04    |
|       | (c) | What is frequency domain sampling? Why it is required? Explain relation between number of samples (L) of a discrete time signal $x(n)$ and its frequency domain samples (N) . What happens if we choose L $\ge$ N?                                   | 07    |

**OR**

|       |     |                                                                         | MARKS |
|-------|-----|-------------------------------------------------------------------------|-------|
|       | (c) | Prove time shifting property of Z-Transform, also give an example.      | 07    |

|       |     |                                                                                      | MARKS |
|-------|-----|--------------------------------------------------------------------------------------|-------|
| Q.3   | (a) | Show relationship between Z transform and DFT.                                        | 03    |
|       | (b) | What is ROC in context of Z-Transform? List various properties of ROC.               | 04    |
|       | (c) | Find Z- transform of sequence $x(n) = cos(\omega_0 n)u(n)$ , where $x(n)$ is causal.  | 07    |

**OR**

|       |     |                                                                                                                                                                          | MARKS |
|-------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Q.3   | (a) | Compare DTFT and DFT.                                                                                                                                                   | 03    |
|       | (b) | What is decimation (down sampling)? Where it can be used? What care must be taken before decimation process?                                                            | 04    |
|       | (c) | Find out sequence $x(n)$  if its Z transform is given by $X(z)=1/(1\text{-}1.5z^{-1} + 0.5z^{-2})$ with ROC is $0.5 < |z| < 1$. Use partial fraction method.            | 07    |

| Q.4   | (a) | Prove periodicity property of DFT.                                                                                                                                      | 03    |
|-------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|       | (b) | Calculate numbers of complex addition and multiplication required when computing 512 point DFT using direct method. Also do the same if radix -2 FFT is used. Give your comment. | 04    |

| | | | |
|---|---|---|---|
| | **(c)** | If impulse response of a linear phase system is given by $h(n)=\{1,0.5,-0.25,0.5,1\}$. Realize the structure for the same. | **07** |

<div align="center">OR</div>

| | | | |
|---|---|---|---|
| **Q.4** | **(a)** | Give limitations of Impulse Invariance method of designing IIR filter. | **03** |
| | **(b)** | Draw cascade structure for the system function $H(z) = (1+ 0.25\ z^{-1} + z^{-2})(\ 1+ 0.5\ z^{-1} + z^{-2})$ | **04** |
| | **(c)** | Explain Radix-2 decimation in frequency FFT algorithm with neat diagram. | **07** |
| **Q.5** | **(a)** | Explain steps to design FIR filter using windowing. | **03** |
| | **(b)** | Explain echo cancellation using adaptive filtering. | **04** |
| | **(c)** | For the sequence $x(n)=\{1,2,1\}$ and impulse response $h(n)=\{1,2\}$, find the linear convolution using circular convolution. Match result of same using tabulation/matrix method. | **07** |

<div align="center">OR</div>

| | | | |
|---|---|---|---|
| **Q.5** | **(a)** | List disadvantages of digital filters. | **03** |
| | **(b)** | Explain bilinear transformation method to design IIR filter. | **04** |
| | **(c)** | Explain any two real world application of Digital Signal Processor. | **07** |

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