Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII EXAMINATION – SUMMER 2016

Subject Code:171003 Date:10/05/2016

Subject Name:Digital Signal Processing

Time:02:30 PM to 05:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Determine if the systems described by the following input-output relations are causal or non-causal. **07**

(i) $y(n)= x(n)-x(n-1)$ (ii) $y(n)= ax(n)$

(iii) $y(n)= x(n)+ 3x(n+4)$ (iv) $y(n)= x(-n)$.

Also give an example of LTI system.

(b) Determine if the systems described by following input-output relations are linear or non-linear. **07**

(i) $y(n)= nx(n)$ (ii) $y(n)= x(n^2)$

(iii) $y(n)= Ax(n)+B$ (iv) $y(n)=x^2(n)$

Also give an example of stable system.

Q.2 **(a)** Determine the z-transform of the signals $\cos \omega_o n\, u(n)$ and $\sin \omega_o n\, u(n)$. **07**

(b) Determine the inverse-z transform of the function $X(z)=\log(1+az^{-1})$. **07**

OR

(b) Determine the inverse z-transform of the function **07**

$$X(z) = \frac{1}{(1-1.5z^{-1}+0.5z^{-2})}, \quad |z| > 1$$

Q.3 **(a)** Convert the analog filter with system function **07**

$$H(s)= \frac{s+0.1}{(s+0.1)^2+9}$$

into a digital IIR filter by means of the impulse invariance technique.

(b) Describe bilinear transformation method of IIR filter design. **07**

OR

Q.3 **(a)** Compare FIR and IIR filters. **07**

(b) List the steps involved in design of an FIR filter using Kaiser window. **07**

Q.4 **(a)** By means of DFT and IDFT, determine the circular convolution of two sequences $x_1(n) =\{1,2,3,4\}$ and $x_2(n)=\{2,1,2,1\}$. **07**

(b) State and prove time reversal property of the DFT. **07**

OR

Q.4 **(a)** Give parallel –form realization for system function **07**

$$H(z)= \frac{-14.75-12.90\, z^{-1}}{1-(7/8)\, z^{-1}+(3/32)z^{-2}} + \frac{24.50 +26.82\, z^{-1}}{1-z^{-1} +0.5\, z^{-2}}$$

(b) Draw Direct form-I and Direct form-II realizations for any IIR system. **07**

Q.5 **(a)** What is FFT ? How do we save number of computations in Decimation-in-time algorithm? **07**

(b) Draw first stage of decimation-in-frequency FFT algorithm. **07**

OR

Q.5 **(a)** Give salient features of DSP architecture. **07**

(b) Compare undersampling and oversampling from frequency domain analysis point of view. **07**