7E4045

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7E4045

B. Tech. VII Semester (Main/Back) Examination, Nov-Dec - 2011
Electronics & Communication Engineering
7EC2 Digital Signal Processing
(Common for 7EC2, 7AI2 & 7EI2)

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt any **five questions** selecting **one question from each unit**. All questions carry **equal marks**. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Unit - I

1. a) In the system shown in Fig.1(a), $X_c(j\Omega)$ is defined as $X_c(j\Omega) = 0$; $|\Omega| \geq \pi/T$

and $H\left(e^{jw}\right) = \begin{cases} e^{-jw} & ; \quad |w| < \pi/L \\ 0 & ; \quad \pi/L < |w| \leq \pi \end{cases}$

Determine the relation between *y(n)* and input signal $x_c(t)$ **(10)**

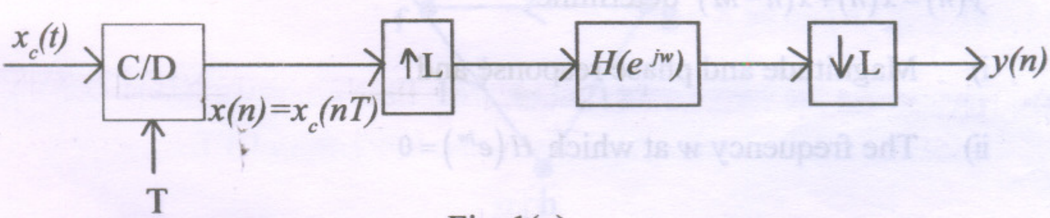

Fig. 1(a)

b) Explain the discrete time processing of continuous time signal **(6)**

OR

1. a) The spectrum of a signal g(t) is shown in Fig.1′(a). This signal is sampled with a periodic train of rectangular pulses of duration $50/3\ ms$. Plot the spectrum of the sampled signal for frequency upto 50 *Hz* for following two condition

i) Sampling rate is equal to the nyquist rate

ii) Sampling rate is equal to the 10 sample/sec. **(8)**

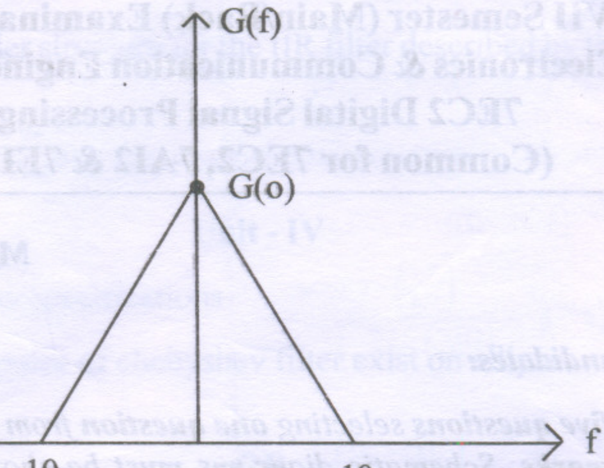

Fig.1'(a)

b) Determine the Nyquist sampling frequency and Nyquist interval for following signals

i) $\left[\dfrac{\sin 100\pi t}{\pi t}\right]^2$

ii) $15\,\text{rect}\left(\frac{t}{2}\right)$ **(8)**

Unit - II

2. a) A multichannel is defined by the following difference equation

$y(n) = x(n) + x(n-M)$ determine

i) Magnitude and phase response and

ii) The frequency w at which $H(e^{jw}) = 0$ **(8)**

b) A signal *y(n)* is defined as the sum of a primary signal *x(n)* and two echos as.

$y(n) = x(n) + \frac{1}{2}x(n-n_d) + \frac{1}{4}x(n-2n_d)$ Determine a realizable filter which will recover *x(n)* from *y(n)*. **(8)**

OR

2. a) Determine whether the following systems are of minimum phase

i) $h(n) = \left(\underset{\uparrow}{10}, 9, -7, -8, 0, 5, 3\right)$ and

ii) $h(n) = (5, 4, -3, -4, 0, 2, 1)$ **(4)**

b) Determine the minimum phase system whose squared magnitude response is given by.

i) $$\left|H\left(e^{jw}\right)\right|^2 = \frac{\left(5/4\right) - Cos\, w}{\left(10/9\right) - \left(2/3\right) Cos\, w}$$

ii) $$\left|H\left(e^{jw}\right)\right|^2 = \frac{2\left(1-a^2\right)}{\left(1+a^2\right) - 2a\cos w}\ ;|a|<1$$ **(12)**

Unit - III

3. a) A linear time invariant system is described by the signal flow graph shown in Fig.3(a). Determine

i) System function $H(z)$

ii) Difference equation relating to the input $x(n)$ to the output $y(n)$. **(8)**

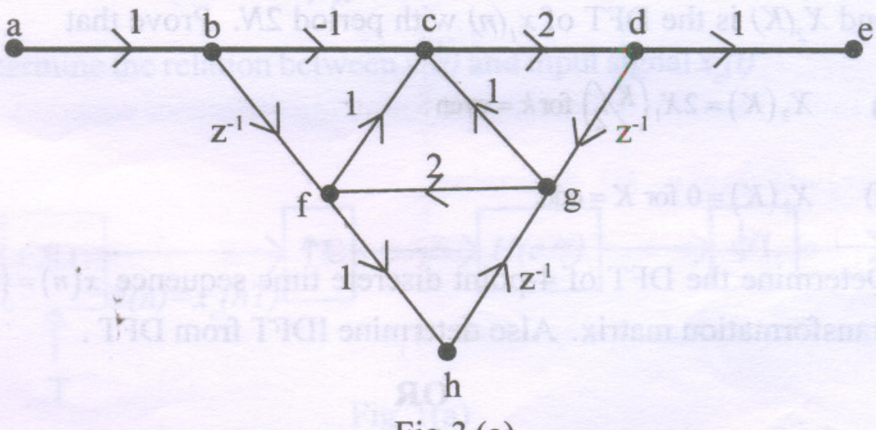

Fig.3 (a)

b) Obtain the parallel form structure for the following difference Equation.

$$y(n) - \frac{13}{12}y(n-1) + \frac{9}{24}y(n-2) - \frac{1}{24}y(n-3) = x(n) + 2x(n-1)$$ **(8)**

OR

3. a) Obtain the lattice structure for given system $H(z)=\frac{10}{1+0.5z^{-1}+0.25z^{-2}+0.55z^{-3}}$ **(8)**

b) Obtain the ladder structure for the IIR filter described by the system function.

$$H(z)=\frac{2+8z^{-1}+6z^{-2}}{1+8z^{-1}+12z^{-2}}$$ **(8)**

Unit - IV

4. a) Explain the filter specifications **(6)**

b) Prove that the poles of chebyshev filter exist on ellipse **(10)**

OR

4. Design a Type-I chebyshev digital bandstop filter whose specifications are as follow

$$\left|H(e^{jw})\right|=\begin{cases}-2dB \; ; & 0\le w\le 0.07\pi \text{ and } 0.8\pi\le w\le\pi \\ -10dB \; ; & 0.2\pi\le w\le 0.3\pi\end{cases}$$

Transformation technique = Bilinear transformation **(16)**

Unit - V

5. a) If the sequence $x_1(n)$ is a periodic sequence with period N and it is also periodic with period $2N$. Assume that $X_1(K)$ is DFT of $x_1(n)$ with period N and $X_2(K)$ is the DFT of $x_1(n)$ with period $2N$. Prove that

i) $X_2(K)=2X_1\left(K/2\right)$ for k = even

ii) $X_2(K)=0$ for K = odd **(8)**

b) Determine the DFT of 4-point discrete time sequence $x(n)=\{1,2,3,4\}$ using transformation matrix. Also determine IDFT from DFT. **(8)**

OR

5. a) Explain "Linear Predictive Coders" **(10)**

b) Using DFT-IDFT method determine the response of FIR filter with impulse response $h(n)=\left\{\underset{\uparrow}{1},2,3\right\}$ to the input sequence $x(n)=\left\{\underset{\uparrow}{1},2,2,1\right\}$. **(6)**