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END TERM EXAMINATION

SEVENTH SEMESTER [B.TECH./M.TECH.]- DECEMBER 2010

Paper Code: IT401 **Subject: Digital Signal Processing**
Paper ID: 15401

Time : 3 Hours **Maximum Marks : 60**

Note: Attempt five questions including Q.1 which is compulsory.

Q1 (a) Discuss minimum phase and maximum phase transfer function. **(5)**

(b) A linear time invariant system is characterized by system function $H(z)=\frac{3-4z^{-1}}{1-3.5z^{-1}+1.5z^{-2}}$. Determine h(n). **(5)**

(c) Check if the system is LTI or not (i) $y(n)=\sum_{K=-\infty}^{n}x(k)$ (ii) y(n)=x(-n). **(5)**

(d) Derive the relationship between DFT (i) Z-transform (ii) Fourier series. **(5)**

Q2 (a) Compute the convolution y(n)=x(n)*h(n), $x(n)=\begin{cases}1 & n=-2,0,1\\ 2 & n=-1\\ 0 & elsewhere\end{cases}$,

$h(n)=\delta(n)-\delta(n-1)+\delta(n-4)+\delta(n-5)$. **(8)**

(b) Determine whether the signals are energy or power signal and also compute its value (i) $x(n)=e^{2n}u(n)$ (ii) $x(n)=(1/3)^n u(n)$. **(2)**

Q3 (a) Check if lt following signal are causal or not:- **(3)**

(i) $y(n)=x(n)+x^2(n-1)$

(ii) $y(n)=x(2n)$

(iii) $y(n)=\sum_{K=-\infty}^{n+1}x(k)$

(b) Discuss sampling theory in frequency domain. **(2)**

(c) Find the cross correlation of two finite length sequence x(n)={1,2,1,1} and y(n)={1,1,2,1}. Also, show that $r_{xy}(l)=x(l)*y(-l)$. **(5)**

Q4 (a) Given the sequence $x_1(n)$={1,2,3,4}, $x_2(n)$={1,1,2,2}. Compute- **(8)**

(i) $x_3(n)=x_1(n)\ \ x_2(n)$.

(ii) Linear convolution using circular convolution.

(b) Derive the parseval's theorem. **(2)**

Q5 (a) Determine the causal signal x(n) having Z-transform $X(Z)=\frac{1}{(1-2z^{-1})(1-z^{-1})^2}$. **(6)**

(b) Prove the following property of DFT where X(K) is the N point DFT of x(n). if x(n) is real and even then X(K) is real and even. **(4)**

Q6 Find the DFT of a sequence x(n)={1,2,3,4,4,3,2,1} using OIT algorithm. Draw the structure and also show bit reversal. **(10)**

Q7 Find the IDFT of the sequence X(K)={4, 1-j2.414, 0, 1-j0.414, 0, 1+j0.414, 0, 1+j2.414} using DIF algorithm. **(10)**

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Q8 Draw the direct form II, cascade and parallel structure for the system described by the difference equation

$$y(n)=\frac{3}{4}y(n-1)-\frac{1}{8}y(n-2)+x(n)+\frac{1}{3}x(n-1).$$ **(10)**

Q9 (a) Explain the design of IIR filter using (i) impulse invariance method (ii) Bilinear transformation method. **(4)**

(b) Realize the following system function using minimum no. of multipliers:- **(6)**

(i) $H(z)=1+\frac{1}{3}z^{-1}+\frac{1}{4}z^{-2}+\frac{1}{4}z^{-3}+\frac{1}{3}z^{-4}+z^{-5}$

(ii) $H(z)=(1+z^{-1})\left(1+\frac{1}{2}z^{-1}+\frac{1}{2}z^{-2}+z^{-3}\right)$

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