UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: B.Tech CSE (BAO, BFSI) **Semester – V**
Subject (Course): Digital Signal Processing **Max. Marks : 100**
Course Code : ELEG 317 **Duration : 3 Hrs**
No. of page/s: 2

Section (A) 20 Marks

All questions are compulsory and carry equal marks.

1) The DFT of a real signal is {1, A,-1,B,0,-2j,C,-1+j}.Find A,B and C.

2) Explain with the block diagram the basic Elements of Digital Signal processing.

3) Compare direct form I and direct form II realization of IIR systems.

4) a) Give the comparison between IIR and FIR filters.
b) Give the comparison between Analog and Digital filters.

Section (B) 40 Marks

All questions are compulsory and carry equal marks.

5) Find the convolution of the following sequence
$X(n)=2\delta(n+1)- \delta(n)+ \delta(n-1)+ 3\delta(n-2)$ & $h(n)= 3\delta(n-1)+ 4\delta(n-2)+ 2\delta(n-3)$.

6) Determine the impulse response for the systems given by the following Difference equations.
i. $y(n)+3y(n-1)+2y(n-2)=2x(n)-x(n-1)$
ii $y(n)=x(n)+3x(n-1)-4x(n-2)+2x(n-3)$

7) State and prove differentiation in Z-domain, Initial value theorem and find x (∞), If
$X(z)=\frac{2z+3}{(z+1)(z+3)(z-1)}$

8) Compute the DFT of the 3-point sequence x(n)={2,1,2}.Using the same sequence, compute the 6-point DFT and compare the two DFT's

Section(C) 40 Marks

Attempt any two questions and each carry equal marks.

9) Obtain the i) Direct forms ii) cascade iii) parallel form realizations for the following system y (n) = -13/12y(n-1) – 9/24 y(n-2) -1/24y(n-3)+ x(n) +4 x(n-1)+3x(n-2) .

10) A causal LTI system is defined by the difference equation 2y(n)-y(n-2)=x(n-1)+3x(n-2)+2x(n-3) find the frequency response, magnitude response and phase response and also sketch the magnitude response and phase response.

11) (a) Given $x(n)=2^n$ and N=8,find X(K) using DIF-FFT algorithm. and also plot its magnitude and phase spectrum.

(b) Determine H(Z) using impulse invariant technique for the analog system function

$H(S)=\frac{1}{(S+1)(S^2+S+2)}$ for a sampling frequency of 4 samples per second

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Section (A) 20 Marks

All questions are compulsory and carry equal marks.

1) Distinguish between Analog Signals and Digital Signals. In addition, explain the differences between Discrete Time Signals and Digital Signals.
2) (a)What is BIBO stability? What are the conditions for BIBO stability?
   (b) How FFT is more efficient to determine DFT of sequence?
3) Compute the DFT of x (n) = {1, 2, 5, 6) and compare the result with DIF radix 2 FFT algorithm
4) Let X(K) be a 12-point DFT of a length 12 real sequence x(n).The first 7 samples of X(K) are given by X(0)=8,X(1)=-1+j2,X(2)=2+j3, X(3)=1-j4,X(4)=2+j2,X(5)=3+j,X(6)=-1-3j Determine the remaining samples of X(K).

Section (B) 40 Marks

All questions are compulsory and carry equal marks.

5) State and prove the properties of symmetry, time reversal, differentiation in frequency domain with respect to DTFT.
6) A causal LTI system is described by the difference equation y(n)=y(n-1)+y(n-2)+x(n)+2x(n-1) Find the system function and frequency response of the system. Plot the poles and zeroes and indicate the ROC.Also determine the stability and impulse response of the system.
7) (a) Perform the linear convolution of the input sequence x(n)={2,-1,2,4} and impulse response h(n)={1,-2,4,-9}.
   (b) Define odd signal? And find the even and odd components of the signal $x(n)=\sin^2 n+2\sin n+2\sin^2 n \cos n$.

8) For the analog transfer function H(s) = 2 / (s+1) (s+3) .Determine H (z) using bilinear transformation With T=0.1 sec

Section(C) 40 Marks

Attempt any two questions and each carry equal marks.

9) Check with the proof whether the following systems are

(a) Memory less-memory b) Linear or non-linear c) causal or non-causal d) Shift-invariant or shift-variant. (e) Stable or unstable.

i) $Y(n)= a^n u(n)$ ii) $y(n)= -ax(n-1)+x(n)$ iii) $y(n) = \frac{x(n-1) + x(-n-1)}{2}$

10) Obtain the i) Direct forms ii) cascade iii) parallel form realizations for the following systems

$y(n) = 3/4(n-1) - 1/8\ y(n-2) + x(n) + 1/3\ x(n-1)$.

11)(a) Compute the FFT for the sequence $x(n) = n+1$ where $N = 8$ using DIT algorithm and also plot its magnitude and phase spectrum. [15+5]

(b) Find inverse Z-transform of $X(Z) = \log(1-0.5z^{-1})$; $|z|>0.5$ using differentiation property