Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **B.Tech**
PET5I102

5th Semester Regular / Back Examination 2019-20
DIGITAL SIGNAL PROCESSING
BRANCH : ECE, ETC
Max Marks : 100
Time : 3 Hours
Q.CODE : HRB168

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.
The figures in the right hand margin indicate marks.

Part- I

Q1 **Only Short Answer Type Questions (Answer All-10)** **(2 x 10)**

a) Why the ROC of Z-transform cannot contain any pole?
b) Why it is not possible to take the DFT of sequence having infinite length?
c) What do you mean by 'twiddle factor' of DFT & show how it is cyclic?
d) Give the computational efficiency of FFT over DFT.
e) What is frequency warping effect?
f) Give the various steps involved in the design of IIR filter.
g) What are the three quantization errors due to finite word length registers in digital filters?
h) List the various features of DSP processors.
i) What is the role Barrel shifter in ADSP-21xx?
j) What do you mean by symmetric and anti-symmetric FIR filters?

Part- II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Determine the response of the relaxed system characterized by the impulse response $h[n]= 0.5^n u[n]$ and input $x[n]=2^n u[n]$
b) Check whether the given systems are linear, shift variant, causal and stable
a. $y[n] = x[4n+1]$
b. $y[n] = x[n]+nx[n+1]$
c) Find the Fourier transform of sgn(n) and sketch the spectra.
d) With the help of N = 8, explain radix-2 decimation-in-frequency (DIF) FFT algorithm for computation of DFT. Give the computational efficiency of FFT over DFT.
e) Realize the given system in direct form-I $y[n] = 0.5y[n-1] – 0.25y[n-2] +x[n]+ 0.4 x[n-1]$.
f) State the desirable properties required to convert an analog filter to an digital IIR filter give methods for the same.
g) Explain with a suitable example the steps for design of linear phase filters using hamming window.
h) Write short note on Architecture of ADSP series of digital signal processors.

i) A discrete-time system is defined by the difference equation, y[n] = x[n] +x [n - 10]. Compute and sketch its magnitude and phase response for frequency 0 to 2π. Determine output y[n] of this system if the input to it is, x[n] = cos (nπ/10) + 3sin((nπ/3)+(π/10)).

j) Show why Hilbert Transformer is termed as a 90-degree phase shifter. How can it be used to calculate instantaneous frequency?

k) Compare Chebyshev and Butterworth filters.

l) Obtain the coefficients of a linear phase 13 order FIR filter to meet the specifications given below using the window method :

stopband attenuation = 20 dB

Transition width = 0.5KHz

Sampling frequency = 8 KHz

Passband edge frequency = 1.5 KHz

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Two 4-point sequences are defined as x[n] = cos(nπ/2) and h[n] = 2^n for n = 0,1,2,3. Calculate 4-point DFTs, *X(k)* and *H (k)*. Calculate 4-point circular convolution of x[n] and h[n] directly. Calculate inverse DFT of the product of *X(k)* and *H(k)* and compare it with the previous result. **(16)**

Q4 Find the output response of the discrete time system described by the following difference equation. y[n]-0.75y[n-1] + 0.166y[n-2] = x[n] where x[n]= $(1/5)^n$ u[n] subjected to the initial conditions y[-1] = 0 and y[-2] = 1. Also find out the step response. **(16)**

Q5 For the analog transfer function$F(s) = \frac{2}{(s+1)(s+2)}$. Determine its digital equivalent using impulse invariance method and bilinear transformation method taking T= 1sec **(16)**

Q6 For a real, causal sequence x[n], it is given that $Im\{X(e^{j\omega})\} = 3sin\omega + \sin(3\omega)$. Calculate x[n] and show if you can get a unique solution of it. If it is additionally mentioned that, $X(e^{j\omega}) = 3\ at\ \omega = \pi$, what would be the value of x[n]? Hence, calculate $Re\{X(e^{j\omega})\}$. **(16)**