Total No. of Questions – [08]

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G.R. No.	

Paper Code: U359-131 (ESE)

DECEMBER 2019/ENDSEM
T. Y. B. TECH. (E & TC) (SEMESTER - I)
COURSE NAME: Discrete Time Signal Processing
COURSE CODE: ETUA31171
(PATTERN 2017)

Time: [**2 Hours**]

[Max. Marks: **50**]

(*) Instructions to candidates:

1) **Answer Q.1, Q.2, Q.3, Q.4, Q.5 OR Q.6, Q.7 OR Q.8**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed**
4) **Use suitable data where ever required**

Q.1) a) The analog signal is represented as **[6 marks]**

$x(t) = \sin(100\pi t) + 2\sin(20\pi t) - 2\cos(30\pi t)$

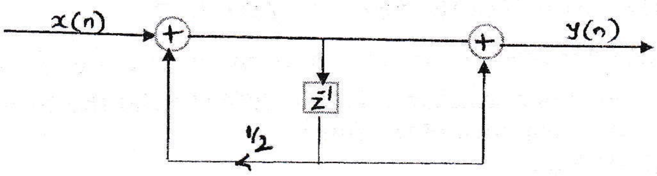
i. What is the Nyquist rate of the signal

ii. If the signal is sampled with sampling frequency 20Hz, what is the discrete time signal obtained after sampling?

iii. What is the recovered signal?

OR

b) Consider the discrete time system shown below: **[6 marks]**



i) Determine the input output relation.

ii) Compute first four samples of impulse response

iii) Apply input x(n) = u(n) and calculate first four samples of output

Q.2) a) Using DFT and IDFT, calculate circular convolution of sequences x1(n)= {1,1,2,2} and x2(n)={1,2,3,4} **[6 marks]**

OR

b) Compute 4 ~~pnt~~ point DFT of x(n)=cos $\left(\frac{\pi}{2}\right) n$, using DIT FFT. **[6 marks]**

Compare the computations with Direct DFT approach

Q.3) a) Compute the response of the system **[6 marks]**

y(n)= 0.7y(n-1)- 0.12y(n—2) + x(n-1) + x(n-2) to an input nu(n).

Is the system stable?

OR

b) Determine the signal whose Z transform is given by $X(Z) = \log(1+az^{-1})$
Hint: Use Differentiation property **[6 marks]**

Q.4) a) An analog filter has a transfer function $(s) = \frac{1}{S+1}$. **[4 marks]**
Using bilinear transformation determine digital transfer function of the filter and also write difference equation of the filter.
Assume T=1.

OR

b) Draw cascade realization of $H(Z) = \frac{3z^2+3.6z-0.6}{z^2+0.1z-0.2}$ **[4 marks]**

Q. 5) a) Design a digital high pass filter to meet the following specifications.
Cut off frequency = 250Hz, Sampling rate 1000smaples/sec, N =7.
Use Hamming window. **[6 marks]**

b) Transfer function of FIR filter has 2 poles at z=0 and two zeros at z = -1 with DC gain of 8. Find the transfer function and impulse response of the filter. Is it a causal filter? Is it linear phase filter? **[4 marks]**

c)Explain Gibb's phenomenon in windowing technique of FIR filters **[4 marks]**

OR

Q.6) a) Using frequency sampling method, design a band pass filter With, Fs = 8000Hz, Fc1 = 1000Hz, Fc2 = 3000Hz, N=7. **[6 marks]**

b) A linear phase FIR filter rejects a frequency component at $\omega_0 = \frac{2\pi}{3}$. **[4 marks]**
It's frequency response is normalized so that H(0)=1.Find the transfer Function and impulse response of the filter.

c) Compare FIR and IIR filters **[4 marks]**

Q.7) a) Sampling rate of a signal is to be reduced from 96 KHz to 1KHz. **[6 marks]**
Frequency band of interest is up to 450Hz. $\delta p = 0.01$ and $\delta s = 0.001$.
Design a two stage decimator with decimation factors 32 and 3 respectively for stage1 and stage2.

b) Explain sampling rate conversion by non-integer factor **[4 marks]**

c) Justify the statement mathematically: **[4 marks]**
Decimation process is time variant.

OR

Q.8) a) Draw the block diagram of decimation process and draw the Spectra of signals at each stage. **[6 marks]**

b) Sampling rate of a signal is to be reduced from 96 KHz to 1KHz. **[4 marks]**
Frequency band of interest is up to 450Hz. $\delta p = 0.01$ and $\delta s = 0.001$.
Design a single stage decimator

c) Discuss, how multirate signal processing is applied in CD Hifi systems. **[4 marks]**