Total No. of Questions – [04] Total No. of Printed Pages 02

G.R. No.	

U359-131 (T1)

OCTOBER 2019/ INSEM (T1)

T. Y. B. TECH. (E & TC) (SEMESTER - I)

COURSE NAME: Discrete Time Signal Processing
COURSE CODE: ETUA31171
(PATTERN 2017)

Time: [**1 Hour**] [Max. Marks: **30**]

(*) Instructions to candidates:

1) **Answer Q.1 OR Q.2 and Q.3 OR Q.4.**
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) A digital communication link carries binary-coded words representing samples of an input signal [6 marks]

$$x(t) = 3 \cos 600\pi t + 2 \cos 1800\pi t$$

The link is operated at 10,000 bits/s and each input sample is quantized into 1024 different voltage levels.

(i) What is the sampling frequency and the folding frequency?
(ii) What are the digital frequencies in the resulting discrete time signal x(n)?
(iii) What is the resolution or quantization step size?
(iv) What should be the Nyquist rate for the signal x(t)?

b) Determine the overall impulse response for the cascade of two LTI systems having impulse response [6 marks]

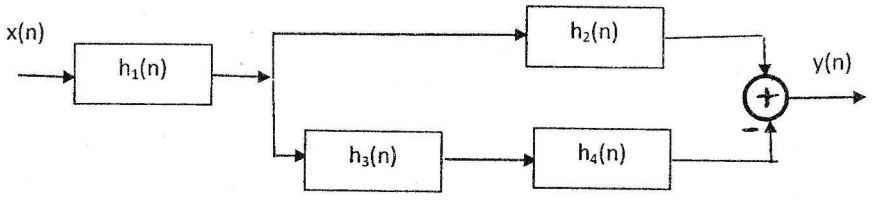
$$h_1(n) = (2/5)^n u(n) \quad \& \quad h_2(n) = (1/5)^n u(n)$$

c) Explain the block diagram of digital signal processing system. Justify the use of low pass filter prior to sampling. [4 marks]

OR

Q.2) a) Consider the interconnection of LTI systems [6 marks]
Determine the overall impulse response, h(n), when,

$h_1((n) = \{ 1/2 , 1/4, 1/2 \}$
$h_2(n) = h_3(n) = (n+1) u(n)$
$h_4(n) = \delta (n-2)$



b) An analog signal contains frequency upto 10 KHz. [6 marks]

(i) Suppose we sample this signal with a sampling frequency, Fs = 8 KHz, what is the folding frequency?

(ii) If the signal frequency is 10KHz, write the equation of sampled signal.

(iii) Examine what happens to the frequency F1 = 5 KHz.

(iv) Examine what happens to the frequency F2 = 9 KHz.

c) State any four advantages of digital signal processing over analog signal processing. [4 marks]

Q.3) a) Compute linear convolution and circular convolution of following sequences using DFT IDFT method. [6 marks]

$x(n) = \{1, 2\}$ $h(n) = \{2, 1\}$

b) Determine 4 point DFT of the sequence using radix- DIT FFT algorithm. $x(n) = \{ 1, 1, 1, 1\}$. Draw butterfly diagram [4 marks]

c) Given the sequence and its DFT, verify circularly frequency shifted (anticlockwise by 2 samples) property for the given sequence. [4 marks]

$x(n) = \{1, 2, 3, 4\}$ $X(k) = \{ 10, -2+2j, -2, -2-2j \}$

OR

Q.4) a) An FIR filter has unit impulse response $h(n) = \{ 2, 1, 2\}$. Determine the response to input, $x(n) = \{3, 0, -2, 0, 2, 1, 0, -2, -1, 0\ 3, 0\}$ using overlap save method. Take the size of each block as 8. [6 marks]

b) 8 point DFT of the sequence is given as: [4 marks]

$X(k) = \{ 12, 1+j0.414, 0, 1+j2.414, 0\ 1-j2.414, 0, 1-j0.414\}$

Compute and plot the magnitude and phase spectrum.

c) Given the sequence and its DFT [4 marks]

$x(n) = \{1, 2, 3, 4\}$ $X(k) = \{ 10, -2+2j, -2, -2-2j \}$

Determine the DFT of circularly time shifted (anticlockwise) sequence by 2 samples.

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