CBCS SCHEME

USN | | | | | | | | | | |　　　　**15MT73**

Seventh Semester B.E. Degree Examination, Dec.2018/Jan.2019
Signal Process

Time: 3 hrs.　　　　Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Find the even and odd component of the given signals.
(i) $x_1(t) = 1 + t^2 + 2t^3 + 4t^5$ (ii) $x_2(t)$ is as shown in Fig Q1(a)

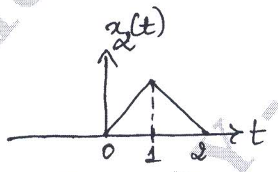

Fig Q1(a) **(08 Marks)**

b. Sketch the following for $x(n) = \left(\frac{1}{2}, \underset{\Uparrow}{1}, 2, 4, 8\right)$
i) $y_1(n) = x(n-3)$ ii) $y_2(n) = x(-n-2)$ **(08 Marks)**

OR

2 a. Two signals x(t) and g(t) are as shown in Fig Q2(b), explain the signal x(t) interms of g(t). **(08 Marks)**

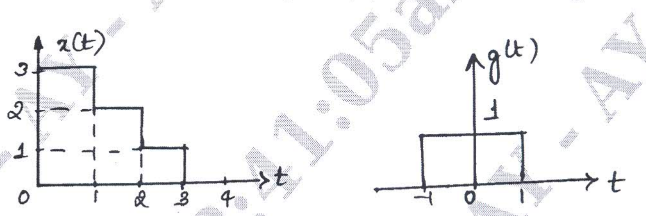

Fig Q2(b)

b. Check whether the signal is energy signal or power signal $x(n) = \cos(n\pi)$. **(04 Marks)**

c. Check whether the following system is memory, causual, time invariant, linear $y(t) = x(t) + 10$. **(04 Marks)**

Module-2

3 a. Determine the convolution of
$x(n) = \{2, 4, \underset{\uparrow}{1}, -2, 7\}$ and
$h(n) = \{1, 3, -\underset{\uparrow}{5}, 2, 7, 5\}$ **(08 Marks)**

b. Derive an expression for convolution sum. **(08 Marks)**

OR

4 a. State and prove commutative and distribution property for convolution sum. **(08 Marks)**

b. Evaluate the convolution sum of $x(n) = \left(\frac{1}{2}\right)^n u(n)$ and $h(n) = u(n-3)$.. **(08 Marks)**

Module-3

5 a. Compute the N – point DFT of $x(n) = a^n$ for $0 \le n \le N-1$. **(04 Marks)**

b. State and prove Parsanel's theorem. **(04 Marks)**

c. Calculate the 8-point DFT of a sequence $x(n) = (-1)^{n+1}$, $0 \le n \le 7$. **(08 Marks)**

OR

6 a. Develop the radix – 2 D.I.F – FFT algorithm for N = 8. Draw the signal flow graph. **(08 Marks)**

b. A long sequence x(n) is filtered through a filter with a impulse response h(n) to yield the output y(n). If x(n) = [1, 4, 3, 0, 7, 4, -7, -7, -1, 3, 4, 3] and h(n) = [1, 2]. Compute y(n) using overlap Add technique. Use 4-point circular convolution. **(08 Marks)**

Module-4

7 a. Compare Butterworth and Chebyshev filters. **(08 Marks)**

b. Find H(z) of the analog filter with transfer function $H_a(s) = \frac{1}{s^2 + 2s + 2}$ using impulse invariance method. **(08 Marks)**

OR

8 a. Derive an expression of the order of Butterworth law pass filter. **(08 Marks)**

b. Design a digital filter H(z) that when used in a A/D – H(z) – D/A structure gives an equivalent analog filter with the following specifications,

Passband Ripple	:	≤ 3.01dB
Passband edge	:	500Hz
Stop band attenuation	:	≥ 15 dB
Stop band edge	:	750 Hz
Sampling Rate	:	2KHz

The filter is to be designed by performing a bilinear transformation on a analog system function, use butterworth prototype. **(08 Marks)**

Module-5

9 a. A lowpass filter is to be designed with the following desired frequency response

$$H_d(e^{jw}) = H_d(w) = \begin{cases} e^{-j2w}, & |w| < \frac{\pi}{4} \\ 0, & \frac{\pi}{4} < |w| < \pi \end{cases}$$ **(10 Marks)**

Determine the filter coefficients $h_d(n)$ and h(n) if w(n) is a rectangular window defined as

$$W_R(n) = \begin{cases} 1 & 0 \le n \le 4 \\ 0 & \text{otherwise} \end{cases}$$

b. Realize the following system function in cascade form

$$H(z) = \frac{1 + \frac{1}{5}z^{-1}}{\left(1 - \frac{1}{2}z^{-1} + \frac{1}{3}z^{-2}\right)\left(1 + \frac{1}{4}z^{-2}\right)}$$ **(06 Marks)**

OR

10 a. Design a low pass filter with a cutoff frequency $w_c = \frac{\pi}{4}$, a transition width $\Delta w = 0.02\pi$ and a stopband ripple $\delta_s = 0.01$ use Kaiser window. **(10 Marks)**

b. Realize the linear phase FIR filter with the following impulse response

$$h(n) = \delta(n) + \frac{1}{2}\delta(n-1) - \frac{1}{4}\delta(n-2) + \delta(n-4) + \frac{1}{2}\delta(n-3).$$ **(06 Marks)**

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