CBCS SCHEME

USN | | | | | | | | | | |

15MT73

Seventh Semester B.E. Degree Examination, June/July 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. Define a signal and a system with example. **(04 Marks)**

b. Explain the classification of signals with an example. **(08 Marks)**

c. Given the signal x(t) sketch the following :

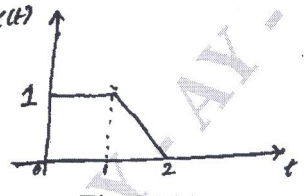

Fig.Q1(c)

i) $x(-2t+3)$ ii) $x\left(\frac{t}{2}-2\right)$ **(04 Marks)**

OR

2 a. With neat sketches and mathematical representation explain basic elementary signals. **(10 Marks)**

b. Determine whether the following systems are i) static or dynamic ii) linear or non-linear iii) shift variant or invariant iv) causal or non-causal v) stable or unstable.

i) $y(t) = x(t+10) + x^2(t)$ ii) $y(n) = \sum_{k=-\infty}^{n+1} x(k)$. **(06 Marks)**

Module-2

3 a. Obtain the convolution of two functions given below :

$x(t) = 2$ for $-2 \le t \le 2$
0 else where
$h(t) = 4$ for $0 \le t \le 2$
0 else where **(10 Marks)**

b. Derive an expression for convolution integral **(06 Marks)**

OR

4 a. Determine the convolution of two given sequences :

$x(n) = \{1, \underset{\uparrow}{2}, 3, 4\}$ and $h(n) = \{\underset{\uparrow}{1}, 1, 3, 2\}$. **(06 Marks)**

b. State and prove the properties of impulse response representation for LTI systems. **(10 Marks)**

Module-3

5 a. Compute the circular convolution of two sequences using DFT and 1DFT.

$x_1(n) = \{2, 1, 2, 1\}$ $x_2(n) = \{1, 2, 3, 4\}$. **(06 Marks)**

b. Consider a FIR filter with impulse response $h(n) = \{3, 2, 1, 1\}$. If the input is $x(n) = \{1, 2, 3, 3, 2, 1, -1, -2, -3, 5, 6, -1, 2, 0, 2, 1\}$

Find the output using overlap add method assuming the length of block as 7. **(10 Marks)**

OR

6 a. Using DIF – FFT algorithm compute DFT of the sequence $x(n) = \{1, 2, -1, 2, 4, 2, -1, 2\}$. **(08 Marks)**

b. Find the sequence x(n) corresponding to the 8-poin DFT
$x(k) = \{4, 1 - J2.41, 0, 1 - J0.414, 0, 1 + J0.414, 0, 1 + J2.414\}$
using DIT – IFFT algorithm. **(08 Marks)**

Module-4

7 a. Design an analog filter with maximally flat response in the passband and acceptable attenuation of – 2dB at 20 radiance/second. The attenuation in the stopband should be more than 10dB beyond 30 r/s. **(10 Marks)**

b. Let $H(s) = \frac{1}{s^2 + s + 1}$ represent the transfer function of a lowpass filter with pass band of 1 rad/sec. Use frequency transformation to find the transfer function :
i) A high pass filter with a cut-off frequency of 10 rad/sec
ii) A band pass filters with a pass band of 10 rad/sec and a centre frequencies 100 rad/sec. **(06 Marks)**

OR

8 a. Design a butterworth filter using the bilinear transformation for the following specifications.
$0.8 \leq H(e^{j\omega}) \leq 1 \quad \text{for} \quad 0 \leq \omega \leq 0.2\pi$
$|H(e^{j\omega})| \leq 0.2 \quad \text{for} \quad 0.6\pi \leq \omega \leq \pi.$ **(10 Marks)**

b. The transfer function of analog filter is given by $H_a(s) = \frac{1}{(s+1)(s+2)}$ find H(z) using impulse invariance method. T = 0.2s. **(06 Marks)**

Module-5

9 a. The desired frequency response of the lowpass filter is given by

$$H_d(e^{j\omega}) = e^{-J3\omega} \quad |\omega| < \frac{3\pi}{4}$$
$$0 \quad \frac{3\pi}{4} < |\omega| < \pi$$

(10 Marks)

Determine the frequency response of the FIR if the hamming window is used with N = 7.

b. Determine the FIR filter coefficients h(n) which is symmetric lowpass with linear phase. The desired frequency response is

$$H_d(\omega) = e^{-J\left(\frac{M-1}{2}\right)\omega} \quad 0 \leq |\omega| \leq \frac{\pi}{4}$$
$$0 \quad \text{otherwise}$$

Employ rectangular window with M = 7. **(06 Marks)**

OR

10 a. Realize the following system function by linear phase FIR structure.

$$H(z) = 1 + \frac{2}{3}z^{-1} + \frac{15}{8}z^{-2} + \frac{2}{3}z^{-3} + z^{-4}.$$ **(04 Marks)**

b. A difference equation described by

$$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + \frac{1}{2}x(n-1)$$

Draw disect form I and direct form II structures. **(04 Marks)**

c. Determine the parameters km of the lattice filter corresponding to FIR filter described by the system function :

$$H(z) = 1 + 1.38z^{-1} + 1.311z^{-2} + 1.337z^{-3} + 0.9z^{-4}.$$ **(08 Marks)**

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