Code No: R1632044 **R16** SET - 1

III B. Tech II Semester Supplementary Examinations, February-2022

DIGITAL SIGNAL PROCESSING

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A (14 Marks)

1. a) Find whether the following signal, $x(n)$, is power or energy signal. [2M]

$$x(n) = e^{j\,\frac{\pi}{4}n+\frac{\pi}{2}}$$

b) What is the importance of FFT algorithm? [2M]

c) Define warping effect. [2M]

d) What is the necessary and sufficient condition for linear phase characteristic in FIR filter? [3M]

e) The signal $x(n) = \{1, 3, 5, 7, 2, 6, -1\}$ is passed through a down sampler with a factor of 3. Find the output of a down sampler, $y(n)$. [3M]

f) What is the difference between Von Neumann and Harvard architecture? [2M]

PART –B (56 Marks)

2. a) Explain the following with an example: [6M]
(i) Causal and non-causal systems
(ii) Time invariant and time variant systems

b) Determine the step response of the following discrete time system described by the difference equation [8M]

$$y(n) = y(n-1) + 0.5\,y(n-2) + x(n) + x(n-1)$$

3. a) Find the discrete Fourier series representation the periodic signal [7M]

$$x(n) = \left(Cos\frac{2\pi}{3}n\right)\left(Sin\frac{2\pi}{5}n\right)$$

Also, sketch its magnitude and phase spectra.

b) Develop mathematically 4-point DITFFT structure and also draw the butterfly diagram. [7M]

4. a) Design an analog Butterworth low pass filter that has 2 dB pass band attenuation at a frequency of 20 rad/sec and atleast 10 dB stop band attenuation at 30 rad/sec. [7M]

b) Obtain the direct form II and transposed direct form II structures for the system described by the difference equation [7M]

$$y(n) = \frac{1}{2}y(n-1) - \frac{1}{4}y(n-2) + x(n) + x(n-1)$$
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5. a) Design an FIR filter with [7M]

$$H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega} & for\ -\frac{\pi}{4} \le \omega \le \frac{\pi}{4} \\ 0 & for\ \frac{\pi}{4} \le |\omega| \le \pi \end{cases}$$

use Hanning window with N = 7.

b) Discuss the Lattice structure of an FIR filter? Also, mention its advantages. [7M]

6. a) Obtain the expression for frequency domain representation of decimator? Also discuss the importance of anti-aliasing filter. [7M]

b) Discuss about digital filter banks. [7M]

7. a) Explain the special addressing modes in programmable DSPs. [7M]

b) Discuss about on-chip peripherals of TMS320C5X DSP processor. [7M]

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