Q.P. Code : 27524

[Time: 3 Hours] **[Marks: 80]**

Please check whether you have got the right question paper.

N.B: 1. Question **No.1** is compulsory.
2. Attempt any **Three** from remaining **five** questions
3. Assume any suitable data if needed.

1. Answer **any four** questions. **20**

a) Find whether the given signal is energy signal or power signal, x(n) = u(n) – u(n-6)

b) For the causal signal x(n) = [2, 2, 4, 4] compute four point DFT using DIT FFT flow graph.

c) Compute x(n) if X(k) = [6, -2 + j2, -2, -2 -j2]

d) Convert the analog filter with system function $H_a(s)=\frac{S+0.1}{(S+0.1)^2+16}$ into a digital filter by means of the impulse invariant technique. Assume T_s = 1 sec.

e) Find the frequency response of the filter and check whether the system is linear phase or not. $y(n)=\frac{1}{4}x(n)+\frac{1}{2}x(n-1)+\frac{1}{4}x(n-2)$

2. a) Find the circular convolution of x(n) = [1, 2, 3, 4] and h(n) = [1, 2] **05**

b) Find the impulse response of the causal system given by **08**

$$H(z)=\frac{1}{(1+z^{-1})(1-z^{-1})^2}$$

c) Find the energy of the signal x(n) = [1, 2, 3, 4] using Parseval's Theorem for DFT; verify using time domain method. **07**

3. a) Find DFT of the following sequences by calculating DFT only once and not otherwise, using the property of DFT, x(n) = [4, 3, 2, 1] and h(n) = [4, 6, 2, 3] **10**

b) Derive and draw the flow graph for 8 – point, radix-2 DIF FFT, and calculate DFT of the sequence x(n) = [1, 2, 3, 4, 0, 0, 0, 0] **10**

4. a) Explain overlap and save method for performing linear convolution of the sequences **10**
x(n) = [1, 2, 3, 4, 5, -1, 0, 1, 2, -3]
h(n) = [1, 2, 1]

b) Consider a LTI system with the following Transfer function **10**

$$H(z)=\frac{1+\frac{1}{5}z^{-1}}{\left(1-\frac{1}{2}z^{-1}+\frac{1}{3}z^{-2}\right)\left(1+\frac{1}{4}z^{-1}\right)}$$ Realize the system using

a) Direct form –I
b) Direct form – II
c) Cascade form

5. a) Determine the transfer function of a Butterworth filter that satisfy the following specifications **10**

$0.707 \le |H(\omega)| \le 1.0 \qquad 0 \le |\omega| \le \pi/2$

$|H(\omega)| \le 0.2 \qquad \frac{3\pi}{4} \le |\omega| \le \pi$ with T_s = 1s, use the bilinear transformation.

b) The desired frequency response of a low-pass filter is **10**

$$H_d(\omega) = e^{-j3\omega} : \frac{-3\pi}{4} \le \omega \le \frac{3\pi}{4}$$

$$= 0 \qquad : \frac{3\pi}{4} < \omega \le \pi$$

Determine $H(e^{j\omega})$ of the designed filter, use Hamming window.

6. a) Explain the application of correlation in Biomedical Engineering. **05**

b) Draw the architecture of any one digital signal Processor; explain briefly. **08**

c) A low pass-filter has the desired frequency response as given below. **07**

$$H_d(e^{j\omega}) = e^{-j3\omega} \qquad 0 \le |\omega| < \pi/2$$

$$= 0 \qquad \frac{\pi}{2} \le |\omega| \le \pi$$

Determine the filter co-efficient h(n) using Type-1 frequency sampling techniques. Assume M = 7.

---------- ----------