[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.

a) Consider the following continuous signal for the current i(t) = 7 Cos (20 π t), which is sampled at 12.5 ms will the resultant discrete signal will be periodic or not if periodic, find the period. **05**

b) Find IDFT of X(k) = [2, 1 –j, 0, 1 + j] **05**

c) Compare IIR and FIR filters. **05**

d) Prove the circular time shifting property of DFT. **05**

e) Convert the analog filter into a digital filter with the system transfer function given by **05**
$H(s)=\frac{S+0.2}{(S+0.2)^2+9}$ using impulse invariant technique, Assume T = 1s.

2. a) Let a system is described by the input output relation $y(n) = e^{x(n)}$, where x(n) is the input and y(n) is the output, check whether the system is linear or not, time invariant or not. **05**

b) Find the linear convolution of the signal x(n) = (1, 2, 3) and the impulse response **04**
$\underset{\uparrow}{}$
h(n) = (1, 2) using circular convolution method only.
$\underset{\uparrow}{}$

c) Consider a system with system function **05**
$H(z)=\frac{2-\frac{5}{2}z^{-1}}{\left(1-\frac{1}{2}z^{-1}\right)\left(1-2z^{-1}\right)}$ find the impulse response of the system if i) causal ii) stable.

d) Find DFT of the signal x(n) = (1, 3, 5, 7) and from the DFT of x(n) only, find DFT of $x_1(n)$ = (1, 7, 5, 3) **06**

3. a) Derive the 8 –point Radix – 2 DIFFFT algorithm and draw the flow graph and find the DFT of the signal x(n) = [0, 1, 2, 3, 4, 5, 6, 7] **10**

b) Explain the overlap and save method of filtering long data sequence with the following example. **10**
$x(n)=[1,-1,0,1,-1,-3,1,-1,3,0,1,--]$
$h(n)=[1,2,-1,1]$

4. a) Design a digital Butter worth filter that satisfy the following specifications. **10**

$0.9 \le |H(\omega)| \le 1.0 \qquad 0 \le |\omega| \le \pi/2$

$|H(\omega)| \le 0.2 \qquad \frac{3\pi}{4} \le |\omega| \le \pi$

Using bilinear transformation. Assume T_s = 1 sec.

b) Determine the order of the Chebyshev filter that satisfy the following constraints using bilinear transformation. Assume T = 1 sec. **05**

$0.707 \le |H(\omega)| \le 1.0 \qquad 0 \le |\omega| \le 0.2\pi$

$|H(\omega)| \le 0.1 \qquad 0.5\pi \le |\omega| \le \pi$

c) Find the frequency response of the filter given by **05**

$H(z) = \frac{1}{4} + \frac{1}{2}z^{-1} + \frac{1}{4}z^{-2}$ and check whether the system is linear phase filter or not find the group delay and phase delay of the system.

5. a) A linear phase FIR filter has desired frequency response **10**

$H_d(e^{j\omega}) = 0 \quad \text{for } \frac{-\pi}{4} \le \omega \le \pi/4$

$= e^{-j2\omega} \text{ for } \frac{\pi}{4} < |\omega| \le \pi$

Design the filter using Hamming window and also draw the realisation of the filter.

b) Realize the system using direct form –I, cascade form and parallel form. **10**

$$H(z) = \frac{3z(5z-2)}{\left(z+\frac{1}{2}\right)(3z-1)}$$

6. a) Explain the application of correlation in biomedical engineering. **05**

b) Explain with block diagram, the architecture of any one digital signal processor. **08**

c) Prove the Parseval's relation of DFT and using this property find energy of the signal x(n) = [1, 2, 3, 4]. **07**
