

N.B. : (1) Question No. 1 is **compulsory**.

(2) Attempt any **four** questions from the remaining **five** questions.

1. (a) Derive the relationship between 2 transform, DTFT and DFT. 5
- (b) Find the step response of a system having difference equation. 5  

$$y(n) = x(n) - 0.4 y(n - 1) + 0.05 y(n - 2)$$
- (c) Show that if  $x(n]$  is odd signal then  $\sum_{n=-\infty}^{\infty} x(n) = 0$  5
- (d) Determine whether following signals are periodic 5  
 (i)  $\cos(0.3 \pi n + \pi/6)$  (ii)  $x(n) = \sin(0.01 \pi n)$
2. (a) Using DIF-FFT find DFT of the following sequence 10  
 $x(n) = \{1, 3, -2, 4, 1, 4, -2, 3\}$
- (b) Find the z transform of the following sequence and specify the ROC : 10  
 (i)  $x(n) = n \left(\frac{1}{4}\right)^n u(n)$  (ii)  $x(n) = n u(-n - 1)$
3. (a) Find initial and final value of  $x(n]$  for following causal system : 5  
 (i)  $x(z) = \frac{2z^2 + 1}{z^2 - 0.5z - 0.5}$  (ii)  $x(z) = \frac{z}{z^2 + z - 1}$
- (b) Sketch the pole-zero plot for the system with transfer function : 5  

$$H(z) = \frac{z^6 - 2^6}{z^5 (z - 2)}$$
 it the system stable.
- (c) Find the convolution and correlation of two sequences  $x_1(n]$  and  $x_2(n]$  10  
 $x_1(n) = [2, 1, 3]$   $x_2(n) = [-2, -1, 1]$
4. (a) Design a digital Butterworth filter satisfying the following constraints using bilinear transformation 10  
 transformation  
 Assume  $T = 1S$   

$$0.9 \leq |H(e^{jw})| \leq 1 \quad 0 \leq w \leq \pi/2$$

$$|H(e^{jw})| \leq 0.2 \quad 3\pi/4 \leq w \leq \pi$$
- (b) What is discrete hilbert transform ? Why it is used. 5
- (c) What are the conditions to be satisfied by LTI system. 5

5. (a) A low pass filter has desired response as given below

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$$H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega} & 0 \leq \omega \leq \pi/2 \\ 0 & \pi/2 \leq \omega \leq \pi \end{cases}$$

Determine the filter coefficient  $h(n)$  for  $M = 7$  using frequency sampling technique.

(b) Impulse response of LTI system is  $h(n) = \{1 \underset{\uparrow}{2} -1 \ 3\}$

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Determine the output response of the system to input  $x(n) = \{1 \underset{\uparrow}{2}, 3, 1\}$

6. Write short notes on :-

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- (a) Application of DSP in Telecommunication
  - (b) DSP processors
  - (c) Fetal ECG monitoring
  - (d) Chirp 2 Algorithm.
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