

Roll No.....

Exam Code -21227

**Institute of Engineering & Technology, DAVV Indore**

**B.E. II<sup>nd</sup>, Year (CS, A&B)**

**Examination, June – July 2021**

**Subject Code – CER4G2, Subject Name –Digital Signal Processing**

**Time: 3 Hr.**

**Maximum Marks: 60**

**Note: There are five Questions in this paper, each Question has three sub parts a, b and c. Attempt any two parts from each Question and each Questions Carry equal marks.**

Q.(1) (a) Determine the output  $y(t)$  of linear time invariant system with impulse

response  $h(n) = \left\{ \begin{matrix} 5 \\ \uparrow \end{matrix}, 8, 3, 7, 2, 4 \right\}$

when the input is  $x(n) = \left\{ \begin{matrix} 2 \\ \uparrow \end{matrix}, 1, 2, 5 \right\}$

(b) (i) Determine the following system is linear or non linear

(I)  $y(n) = \log_{10} (|x(n)|)$  (II)  $y(n) = x(n) \cos(\omega_0 n)$

(ii) Determine the following system is causal or non causal

(I)  $y(n) = x^2(n) + x(n-4)$  (II)  $y(n) = x(2-n) + x(n-4)$

(iii) Determine the power and rms value of the following signals

(I)  $x(t) = 8\cos 4t \cos 6t$  (II)  $x(t) = e^{j2t} \cos 10t$

(c) (i) Find the even and odd components of the following signals

(I)  $x(t) = \left\{ \begin{matrix} 3+2j \\ \uparrow \end{matrix}, -2, 7+4j \right\}$  (II)  $x(n) = \left\{ \begin{matrix} -2 \\ \uparrow \end{matrix}, 4, 5, -3 \right\}$

(ii) Check whether the following systems are linear, causal, static, bounded, stable and time invariant

$$y(t) = 2x(t+3) + x^2(t)$$

Q.(2) (a) Find the Fourier transform of the following signals

(I)  $x(t) = e^{-3t} u(t-2)$  (II)  $x(t) = \sin(8t + 0.1\pi)$

(b) Find the Fourier series of  $f(x) = x \sin x$ , in the interval  $(0, 2\pi)$

(c) Consider a periodic signal with  $T=8$  sec and Fourier series coefficients given as

$a_2 = 2$ ,  $a_{-2} = 2$ ,  $a_3 = 8j$  and  $a_{-3} = -8j$ , Find the signal  $x(t)$

Q.(3) (a) (i) Find the Z Transform and ROC of  $X(Z)$  for  $x(n) = 3 \left( \frac{7}{9} \right)^n u(n) + 2 \left( \frac{-1}{5} \right)^n u(n)$

(ii) Find the Z Transform and ROC of the sequence

$$x(n) = \{ 2, 1, -3, 0, 4, 3, 2, 7, 1, 5 \}$$

(b) Find the inverse Z Transform of  $X(Z) = \frac{Z}{3Z^2 - 4Z + 1}$  where the ROC is (I)  $|Z| > 1$

(II)  $|Z| < \frac{1}{3}$  using the long division method,

(c) (i) Find the Z Transform of the following signals (I)  $x(n) = \{ 3, 5, 2, 2, 8, 4 \}$

(II)  $x(n) = 2^n u(n-2)$  (III)  $x(n) = -a^n u(-n-1)$

Q.(4) (a) Determine the DFT of the following sequences

$$X(n) = \{ 5, 2, 8, 3, 7, 4, 2, 9 \}$$

(b) Determine the Inverse DFT of the following sequence

$$X(N) = \{ 4, 7, 5, 8, 3, 9, 5, 2 \}$$

(c) Find the circular convolution of the following sequences

$$X(n) = \{ 2, 5, 3, 4, -7, -8, -5, 3 \} \text{ and } h(n) = \{ 3, 6, 8, 5, 2, 7, 9, 4 \}$$

Q.(5) (a) Compute DFT of  $x(n) = \{ 7, 4, 8, 4, 9, 5, 3, 8 \}$  using DIT FFT.

(b) Find the direct form I and direct form II realizations of discrete time system

Represented by the transfer function

$$H(z) = \frac{8z^3 - 4z^2 + 11z - 2}{\left(z - \frac{1}{8}\right)\left(z^2 - z + \frac{1}{4}\right)}$$

(c) Realize the system with the following transfer function in parallel form

$$H(Z) = \frac{Z(Z+1)}{(Z^2 + 2Z + 3)(Z^2 + 3Z + 4)}$$