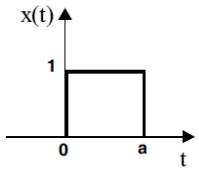
1T00836 - T.E.(Electiral Engineering)(SEM-VI)(Choice Base Credit Grading System) (R- 20-21) (C Scheme) / 89304 - Signals and Systems QP CODE: 10029616 DATE: 16/05/2023

Duration – 3 Hours **Total Marks- 80**

N.B.: - (1) Question No.**1** is compulsory.
(2) **Attempt** any **Three** questions out of the remaining **five** questions.
(3) Assume suitable data if necessary and justify the same.

Q 1. Answer **all questions**.

A) Sketch even and odd parts of the signal **05**



B) Determine the inverse Z transform of the following **05**

$$X(z) = \frac{z - 0.4}{z^2 + z + 2}$$

C) Determine the Fourier series representation of the following discrete time signals x(n)=2cos$\sqrt{3}\pi$n **05**

D) Write a note on bilinear transformation used in filter design **05**

Q 2 a) State whether the following system is linear, causal, time-invariant and stable **10**
y(n)=nx(n)+x(n+2)+y(n-2)

Q 2 b) (i) Determine the transfer function H(z) of the following system **10**

y(n)-0.5y(n-1)=x(n)

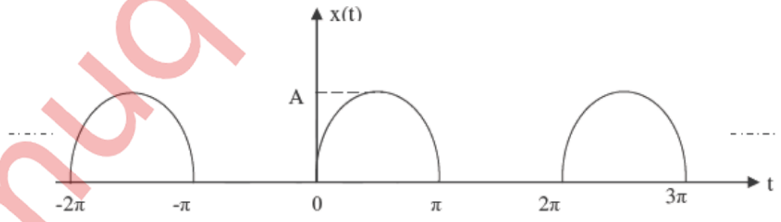
(ii) Determine whether the given signals are periodic or not, if periodic find the fundamental period.

A) $\sin(1.2\pi t)$

B) x (t) = 3 cos(4t) + 2 sin(πt)

Q 3 a) The length of an FIR filter is 9. If the filter has a linear phase-show that the following equation is satisfied, $\sum_0^{M-1} h(n)[\sin(\omega\tau - \omega n)] = 0$ **10**

Q 3 b) Calculate the trigonometric fourier series expansion of the waveform **10**



Q 4 a) An LTI system is described by the difference equation **10**

$$y(n) - \frac{9}{4}y(n-1) + \frac{1}{2}y(n-2) = x(n) - 3x(n-1)$$

Specify the ROC of H(z), and determine the h(n) for the following conditions

a)the system is stable

b)the system is causal

Q 4 b) Find the convolution of the sequences **10**

$$x_1(n) = \left(\frac{1}{3}\right)^n u(n) \text{ and } x_2(n) = \left(\frac{1}{5}\right)^n u(n)$$

Using the convolution property of Z transforms

Q 5 a) i. Perform IDFT using the matrix method to obtain x(n) of the following signal X(k) ={1,0,1,0} **10**

ii. In an LTI system i/p x(n)= {1,1,1} and the impulse response h(n)={-1,-1}. Determine Y(k) of the system by radix-2 DIT FFT

Q 5 b) An 8-point sequence is given by x(n) = { 1,2,3,4,4,3,2,}. Derive 8-point DFT of x(n) by radix-2 DIT-FFT **10**

Q 6 a) The desired response of a low-pass filter is **10**

$$H_d(e^{jw}) = \begin{cases} e^{-j3\omega}, & \frac{-3\pi}{4} \le |w| \le \frac{3\pi}{4} \\ 0, & \frac{3\pi}{4} < |w| \le \pi \end{cases}$$

Determine $H(e^{jw})$ for M=7 using a Hamming window.

Q 6 b) Design a digital Butterworth low pass filter satisfying the following equation **10**

$$0.7 \le \left|H(e^{jw})\right| \le 1 \qquad 0 \le \omega \le 0.2\pi$$

$$\left|H(e^{jw})\right| \le 0.3 \qquad 0.6\pi \le \omega \le \pi$$

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