

# CBCS SCHEME

17EE54

## Fifth Semester B.E. Degree Examination, Feb./Mar. 2022 Signals and Systems

Time: 3 hrs.

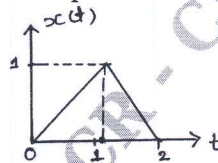
Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. Distinguish between :
  - i) Continuous and Discrete time signal
  - ii) Even and Odd signal
  - iii) Periodic and Non periodic signal
  - iv) Energy and Power signal. (08 Marks)
- b. Find the Even and Odd component of the signal.
  - i)  $x(t) = (1 + t^3) \cos^3 10t$
  - ii)  $x(t) = 1 + t + 3t^2 + 5t^3 + 9t^4$ . (06 Marks)
- c. Determine and sketch the Even and Odd part of the signal shown in Fig. Q1(c). (06 Marks)

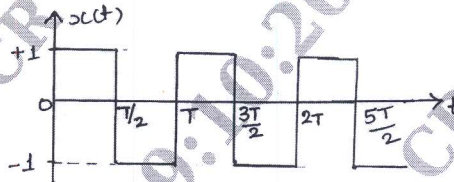
Fig. Q1(c)



OR

- 2 a. Determine whether the following Signals are periodic, if periodic determine fundamental period :
  - i)  $x(t) = \cos 2t + \sin 3t$
  - ii)  $x(n) = \cos(n\pi/5) \sin(n\pi/5)$ . (08 Marks)
- b. What is the Average power of Square wave shown in Fig. Q2(b)? (06 Marks)

Fig. Q2(b)



- c. Determine whether the system  $y(t) = e^{x(t)}$ .
  - i) Linear
  - ii) Time invariant
  - iii) Memory
  - iv) Causal
  - v) Stable. (06 Marks)

### Module-2

- 3 a. Consider the input signal  $x(n)$  and the impulse response  $h(n)$  given below :
 
$$x(n) = \begin{cases} 1 & 0 \leq n \leq 4 \\ 0 & \text{Elsewhere} \end{cases}; \quad h(n) = \begin{cases} \alpha^n & 0 \leq n \leq 6 \\ 0 & \text{Elsewhere} \end{cases}$$
 Compute the output signal  $y(n)$ . (08 Marks)
- b. Find the forced response for the system described by
 
$$d^2 \frac{y(t)}{dt^2} + 5 \frac{dy(t)}{dt} + 6y(t) = 2x(t) + \frac{dx(t)}{dt}$$
 with input  $x(t) = 2e^{-t} u(t)$ . (06 Marks)
- c. Sketch direct form I and direct form II implementation for the difference equation.
 
$$y(n) + \frac{1}{2} y(n-1) - y(n-3) = 3x(n-1) + 2x(n-2)$$
. (06 Marks)

OR

- 4 a. Evaluate the Continuous time convolution integral given below :
 
$$y(t) = e^{-2t} u(t) \times u(t+2)$$
. (08 Marks)
- b. Find the natural response for the system describe by the following Difference equation.
 
$$y(n) - \frac{9}{16} y(n-2) = x(n-1)$$
 with  $y(-1) = 1$  and  $y(-2) = -1$ . (08 Marks)

- c. Explain the following properties of Impulse response representation of LTI system :  
 i) Distributive ii) Associative iii) Causal. (04 Marks)

**Module-3**

- 5 a. Describe the following properties of C T F T :  
 i) Frequency shift ii) Time shift iii) Linearity. (06 Marks)  
 b. Obtain the Fourier transform of the signal  $x(t) = e^{-at} u(t)$   $a > 0$ .  
 Draw its Magnitude and Phase spectrum. (08 Marks)  
 c. Find the Fourier transform of the signal  $x(t) = e^{-3|t|} \sin 2t$  using Appropriate properties. (06 Marks)

**OR**

- 6 a. Find the Inverse Fourier transform  

$$X(j\omega) = \frac{-j\omega}{(j\omega)^2 + 3j\omega + 2}$$
 (06 Marks)  
 b. Find the Impulse response of continuous time LTI system given by  
 $h(t) = \frac{1}{RC} e^{-\gamma RC} u(t)$ . Find the Frequency response and plot magnitude and phase response. (08 Marks)  
 c. Find the frequency response and the impulse response of the system describe by Differential equation.  

$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6y(t) = -\frac{dx(t)}{dt}$$
 (06 Marks)

**Module-4**

- 7 a. Discuss the properties of DTFT : i) Linearity ii) Time shift iii) Convolution. (06 Marks)  
 b. Find the DTFT of the signal : i)  $x(n) = \alpha^n u(n)$   $|\alpha| < 1$ . Draw the Magnitude Spectrum. (08 Marks)  
 ii)  $x(n) = (-1)^n u(n)$ . (08 Marks)  
 c. Find the DTFT of the signal  $x(n) = a^{|n|}$   $|a| < 1$ . (06 Marks)

**OR**

- 8 a. State and prove the following properties of Discrete Time Fourier transform :  
 i) Parseval's theorem ii) Scaling. (08 Marks)  
 b. Using the Appropriate properties, find the DTFT of the following signal :  
 i)  $x(n) = (\frac{1}{2})^n u(n-2)$  ii)  $x(n) = \sin(\frac{\pi}{4}n) (\frac{1}{2})^n u(n-1)$ . (12 Marks)

**Module-5**

- 9 a. Describe the following properties of Z transform :  
 i) Linearity ii) Differentiation in the Z Domain iii) Time shift. (06 Marks)  
 b. Find the Z transform of  $x(n) = \alpha^n u(n)$ . (08 Marks)  
 c. Find the Z transform of the signal  $x(n) = 3.2^n u(-n)$  using Appropriate properties. (06 Marks)

**OR**

- 10 a. Explain the properties of Region of Convergence. (06 Marks)  
 b. Find the Discrete Time Sequence  $x(n)$  which has Z transform :  

$$X(z) = \frac{-1 + 5z^{-1}}{(1 - \frac{3}{2}z^{-1} + \frac{1}{2}z^{-2})}$$
 with ROC  $|z| > 1$ . (08 Marks)  
 c. A causal system has input  $x(n]$  and output  $y(n]$ . Find the Impulse Response of the system , if  
 $x(n) = \delta(n) + \frac{1}{4} \delta(n-1) - \frac{1}{8} \delta(n-2)$  ;  $y(n) = \delta(n) - \frac{3}{4} \delta(n-1)$ . (06 Marks)

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