



Fourth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026  
**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. A continuous time signal  $x(t)$  and  $g(t)$  is shown in Fig.Q.1(a)(i) and (ii) respectively. Express  $x(t)$  in terms of  $g(t)$ . (10 Marks)

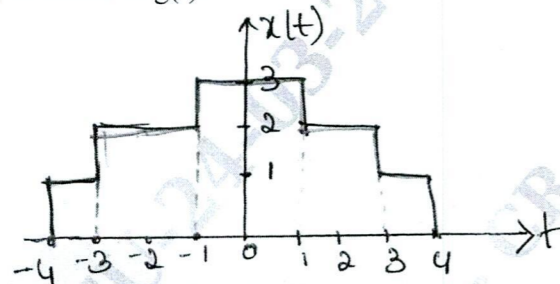


Fig.Q.1(a)(i)

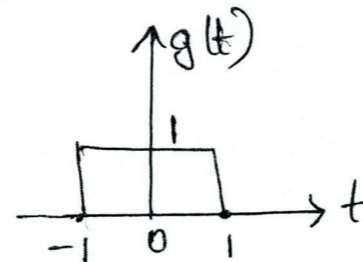


Fig.Q.1(a)(ii)

- b. Sketch the even and odd component of the signal  $x(t)$  shown in Fig.Q.1(b).

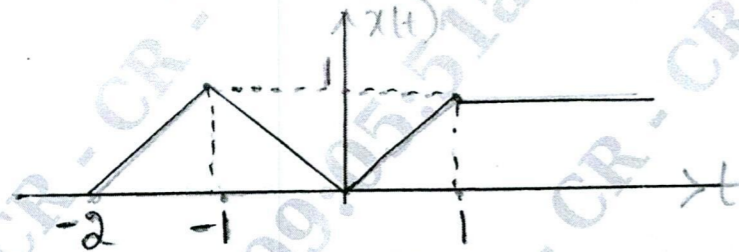


Fig.Q.1(b)

(10 Marks)

OR

- 2 a. i) Sketch the signal  $x(t) = -u(t+3) + 2u(t+1) - 2u(t-1) + u(t-3)$ . (05 Marks)  
 ii) Determine whether the signal is periodic or not, If periodic, find its fundamental period  $x(t) = \cos(5\pi t)$  (05 Marks)
- b. The trapezoidal pulse  $x(t)$  shown in Fig.Q.2(b) is applied to a differentiator defined by  $y(t) = \frac{dx(t)}{dt}$
- i) Find the resulting  $y(t)$  of the differentiator  
 ii) Find energy  $y(t)$

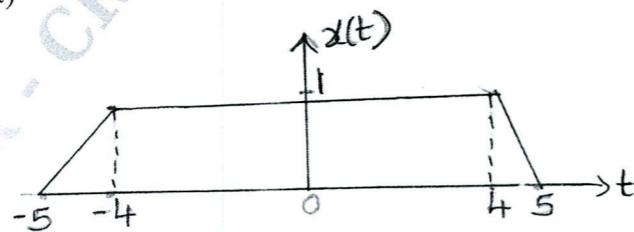


Fig.Q.2(b)

(10 Marks)

**Module-2**

- 3 a. For the given signal determine whether the system is i) Linear ii) Time-Invariant iii) Memoryless iv) Causal v) Stable
- I.  $y(t) = t x(t)$   
 II.  $y(n) = x^2(n)$  (10 Marks)
- b. A discrete time LTI system has impulse response  $h(n)$  as shown in Fig.Q.3(b). Using linearity and time invariance property determine the system output  $y(n)$  if the input  $x(n)$  is given by  $x(n) = 2\delta(n) - \delta(n-1)$

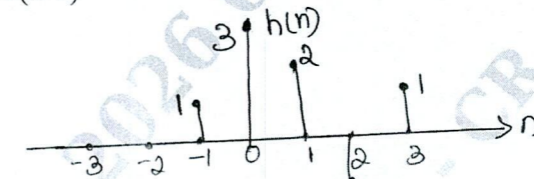


Fig.Q.3(b)

(10 Marks)

OR

- 4 a. State and prove the associative and commutative properties of convolution integral. (10 Marks)
- b. For the given signal determine whether the system is i) linear ii) Time invariant iii) Memoryless iv) causal v) stable
- I.  $y(t) = t^2 x(t-1)$   
 II.  $y(n) = \log_{10}|x(n)|$  (10 Marks)

**Module-3**

- 5 a. i) Find the overall impulse response  $h(t)$  in terms of the impulse response of each subsystem for the system shown in Fig.Q.5(a)(i).

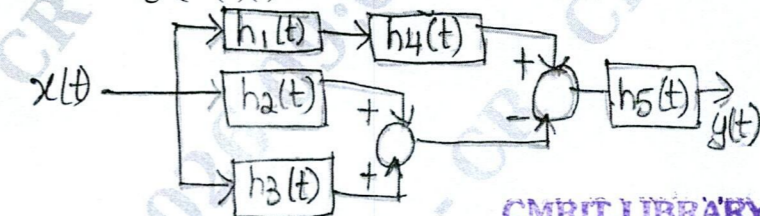


Fig.Q.5(a)(i)

CMRIT LIBRARY  
 BANGALORE - 560 037

(04 Marks)

- ii) A system consists of several subsystem connected as shown in Fig.Q.5(a)(ii). Find the operator  $T$  relating  $x(t)$  to  $y(t)$  for the subsystem operators given by:
- $T_1 : y_1(t) = x_1(t) x_1(t-1)$   
 $T_2 : y_2(t) = |x_2(t)|$   
 $T_3 : y_3(t) = 1 + 2x_3(t)$   
 $T_4 : y_4(t) = \cos(x_4(t))$

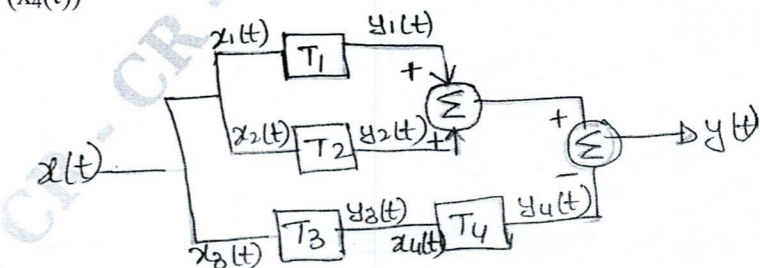


Fig.Q.5(a)(ii)

(06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42+8=50, will be treated as malpractice.

- b. For a given impulse response of continuous time LTI system. Determine whether system is  
 i) Memoryless ii) Causal iii) Stable. Justify your answer.  
 I.  $h(t) = e^{2t} u(t-1)$   
 II.  $h(n) = \cos n u(n)$  (10 Marks)

OR

- 6 a. State and prove the following properties of CTFS :  
 i) Frequency shift ii) Parseval's Theorem (10 Marks)  
 b. Find the FS coefficients for the signal  $x(t)$  shown in Fig.Q.6(b).

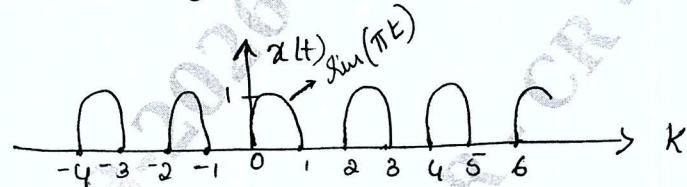


Fig.Q.6(b)

(10 Marks)

**Module-4**

- 7 a. State and prove the following DTFT properties :  
 i) Convolution ii) Linearity (10 Marks)  
 b. Show that the DTFT of  
 $x(n) = 1 : -\infty < n < \infty$   
 is given by  $X(e^{j\Omega}) = \sum_{k=-\infty}^{\infty} 2\pi\delta(\Omega + 2\pi k)$  (10 Marks)

OR

- 8 a. Using the appropriate properties, find the DTFT of the following signal :  
 $x(n) = \left(\frac{1}{2}\right)^n u(n-2)$  (10 Marks)  
 b. State and prove the following DTFT properties : i) Frequency shift ii) Time shift (10 Marks)

**Module-5**

- 9 a. i) Find the Z-transform of  $x(n) = \alpha^n u(n)$  (05 Marks)  
 ii) Find  $x(z)$  if  $x(n) = -\alpha^n u(n-1)$  and find the ROC. (05 Marks)  
 b. Find the inverse z-transform of the following using partial fraction expansion:

$$x(z) = \frac{1 - \frac{1}{2}z^{-1}}{1 + \frac{3}{4}z^{-1} + \frac{1}{8}z^{-2}} ; |z| > \frac{1}{2}$$

(10 Marks)

OR

- 10 a. Explain properties of ROC with example. (10 Marks)  
 b. A causal system has input  $x(n]$  and output  $y(n]$ . Find the impulse response of the system if  
 $x(n) = \delta(n) + \frac{1}{4}\delta(n-1) - \frac{1}{8}\delta(n-2)$   
 $y(n) = \delta(n) - \frac{3}{4}\delta(n-1)$  (10 Marks)

\*\*\*\*\*