

**PARUL UNIVERSITY**  
**FACULTY OF ENGINEERING & TECHNOLOGY**  
**B.TECH (2<sup>nd</sup> MID EXAMINATION)**  
**4<sup>th</sup> SEMESTER (SUMMER-2020-21)**

**SUBJECT NAME (CODE): SIGNAL & SYSTEM (203105257)**

**BRANCH: CSE-IT**

**DATE: 11.02.2021**

**TIME: 2.00 TO 3.30**

**TOTAL MARKS: 40**

Sr.No.

Marks

05

Q.1

**(A) Multiple Choice Questions**

(1) If  $x(-t) = -x(t)$  then the signal is said to be \_\_\_\_\_

- (a) Even signal
- (b) Odd signal
- (c) Periodic signal
- (d) Non periodic signal

(2) Noise generated by an amplifier of radio is an example for?

- (a) Discrete signal
- (b) Deterministic signal
- (c) Random signal
- (d) Periodic signal

(3) Determine the fundamental period of the following signal:  $\sin 60t$ .

- (a)  $1/60$  sec
- (b)  $1/30$  sec
- (c)  $1/20$  sec
- (d)  $1/10$  sec

(4)  $Y(t) = x(2t)$  is \_\_\_\_\_

- (a) Compressed signal
- (b) Expanded signal
- (c) Shifted signal
- (d) Amplitude scaled signal by a factor of 2

(5) Which of the following systems is stable?

- (a)  $y(t) = \log(x(t))$
- (b)  $y(t) = \exp(x(t))$
- (c)  $y(t) = \sin(x(t))$
- (d)  $y(t) = tx(t) + 1$

**(B) Do as directed**

05

(1) Define: Signal

(2) What is system?

(3) Derivative of step signal is \_\_\_\_\_

(4) Integral of impulse signal is \_\_\_\_\_

(5) Sketch the signal  $u(3-t)$

12

Q.2 Attempt any four (Short Questions)

(1) Give comparison between energy signal & power signal

(2) Determine the energy of given signal  $x(t) = e^{-a|t|}, a > 0$

(3) Determine the power of unit step signal.

(4) Check the linearity & time variance property of system  $y(t) = t x(t)$ .

(5) Explain any three properties of system.

Q.3 Attempt any two

08

(1) Compute convolution  $y(n) = x(n) * h(n)$  where,

$$x(n) = \{1, 1, 0, 1, 1\} \text{ and } h(n) = \{1, -2, -3, 4\}$$

(2) For discrete time signal is given by  $x(n) = \{1, 1, 1, 1, 2\}$ .

Sketch the following signals (a)  $x(n-2)$  (b)  $x(n+1)$  (c)  $x(3-n)$  (d)  $x(n) u(n-1)$

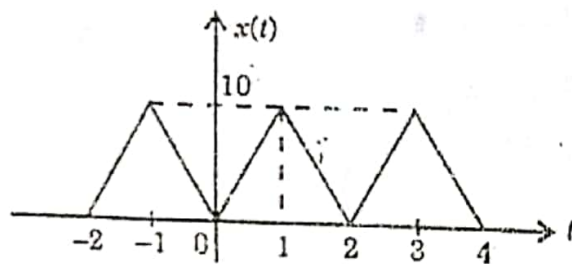
(3) List all the properties of fourier series.

Q.4 (A) Explain classification of signal with example.

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(B) Obtain trigonometric Fourier series representation the given periodic signal as shown in figure.

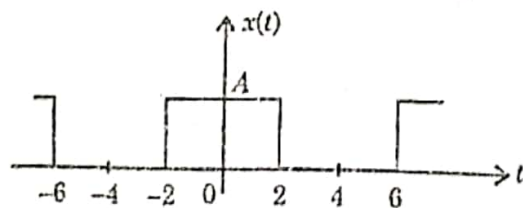
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OR

(B) Find Fourier series coefficients of given wave form as shown in figure

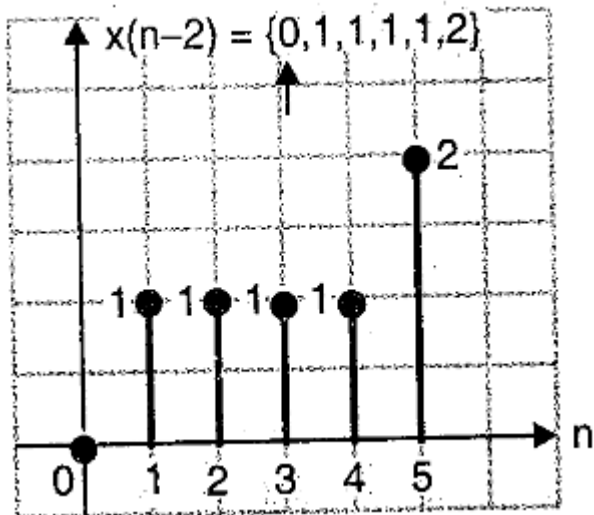
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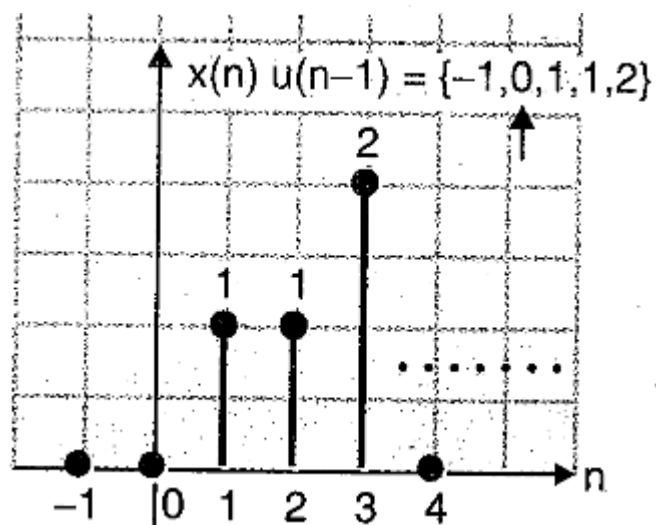
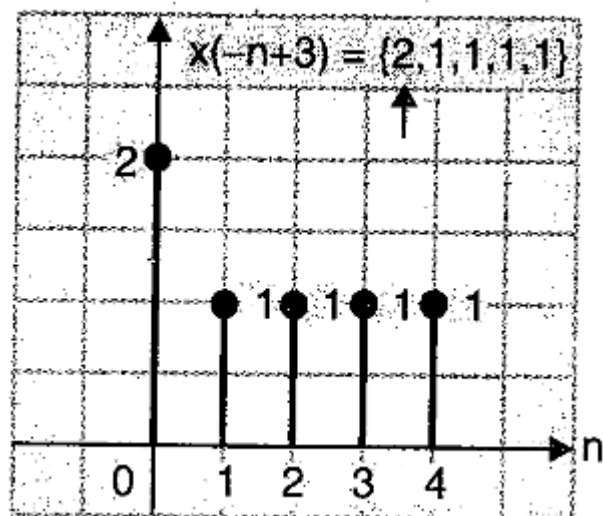
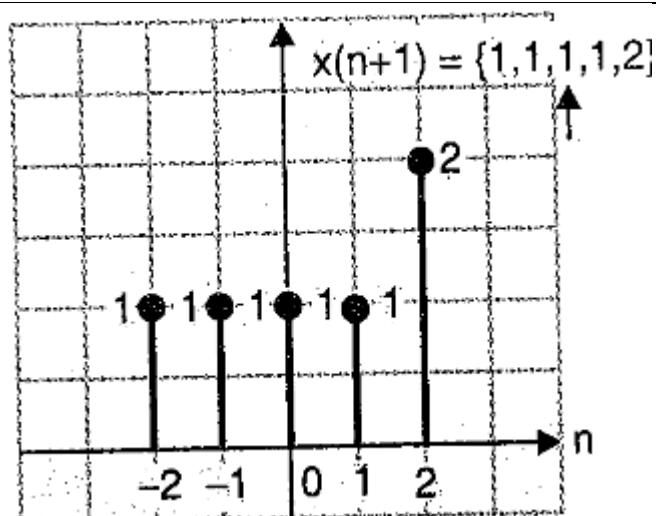


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Sr. No.		Marks
Q.1	<p>(A) Multiple Choice Questions</p> <p>(1) If <math>x(-t) = -x(t)</math> then the signal is said to be _____</p> <p>(a) Even signal</p> <p>(b) <b>Odd signal</b></p> <p>(c) Periodic signal</p> <p>(d) Non periodic signal</p> <p>(2) Noise generated by an amplifier of radio is an example for?</p> <p>(a) Discrete signal</p> <p>(b) Deterministic signal</p> <p>(c) <b>Random signal</b></p> <p>(d) Periodic signal</p> <p>(3) Determine the fundamental period of the following signal: <math>\sin 60t</math>.</p> <p>(a) 1/60 sec</p> <p>(b) <b>1/30 sec</b></p> <p>(c) 1/20 sec</p> <p>(d) 1/10 sec</p> <p>(4) <math>Y(t) = x(2t)</math> is _____</p> <p>(a) <b>Compressed signal</b></p> <p>(b) Expanded signal</p> <p>(c) Shifted signal</p> <p>(d) Amplitude scaled signal by a factor of 2</p> <p>(5) Which of the following systems is stable?</p> <p>(a) <math>y(t) = \log(x(t))</math></p> <p>(b) <math>y(t) = \exp(x(t))</math></p> <p>(c) <b><math>y(t) = \sin(x(t))</math></b></p> <p>(d) <math>y(t) = tx(t) + 1</math></p>	05
	<p>(B) Do as directed</p> <p>(1) Define: Signal</p> <p>(2) What is system?</p> <p>(3) Derivative of step signal is <b>impulse signal</b></p>	05

	(4) Integral of impulse signal is <b>step signal</b> _____ (5) Sketch the signal $u(3-t)$	
Q.2	Attempt any four (Short Questions)	12
	(1) Give comparison between energy signal & power signal	
	(2) Determine the energy of given signal $x(t) = e^{-a t }, a > 0$  Ans: $E = \frac{1}{a}$	
	(3) Determine the power of unit step signal.  Ans: $P = \frac{1}{2}$	
	(4) Check the linearity & time variance property of system $y(t) = t x(t)$ .	
	(5) Explain any three properties of system.	
Q.3	Attempt any two	08
	(1) Compute convolution $y(n) = x(n) * h(n)$ where, $  \begin{array}{ccccccc}  x(n) = \{ & 1, & 1, & 0, & 1, & 1 \} & \text{and } h(n) = \{ 1, -2, -3, 4 \} \\  & \uparrow & & & & & \uparrow  \end{array}  $ $y(n) = \{ 1, -1, -5, 2, 3, -5, 1, 4, 0 \}$ Ans: $  \begin{array}{ccccccc}  & & & & \uparrow & & \\  & & & & & &   \end{array}  $	
	(2) For discrete time signal is given by $x(n) = \{ 1, 1, 1, 1, 2 \}$ . $  \begin{array}{c}  \uparrow \\  \text{Sketch the following signals (a) } x(n-2) \text{ (b) } x(n+1) \text{ (c) } x(3-n) \text{ (d) } x(n) u(n-1)  \end{array}  $ 	



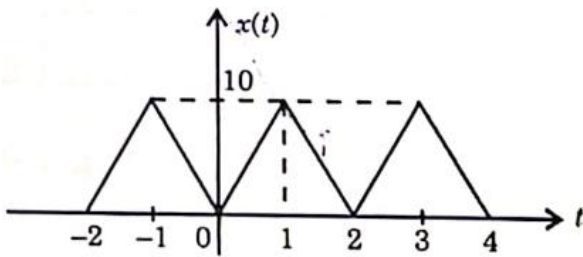
(3) List all the properties of fourier series.

Q.4 (A) Explain classification of signal with example.

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(B) Obtain trigonometric Fourier series representation the given periodic signal as shown in figure.

05



Ans:

(ii) Since given function is an even function,  
Therefore,  $B_k = 0$

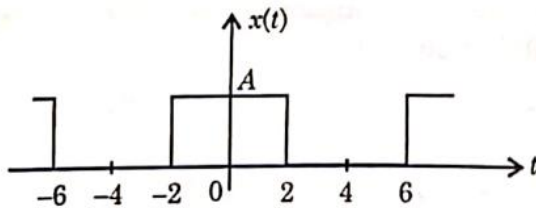
$$\begin{aligned}
 A_k &= \frac{20}{k^2 \pi^2} [(-1)^k - 1] \leftarrow \frac{2}{T} \int_T x(t) \cdot \cos \omega_0 kt dt \\
 &= \frac{4}{T} \int_{T/2} x(t) \cos \omega_0 kt dt = \frac{4}{2} \int_0^1 10 t \cos \pi kt dt \\
 &= 20 \int_0^1 t \cos \pi kt dt = 0 ; k \text{ is even} = -\frac{40}{k^2 \pi^2} ; k \text{ is odd} \\
 a_0 &= 5
 \end{aligned}$$

Therefore, 
$$x(t) = 5 - \frac{40}{\pi^2} \sum_{k=1}^{\infty} \left[ \frac{\cos k \pi t}{k^2} \right] ; k \text{ is odd}$$

or 
$$x(t) = 5 - \frac{40}{\pi^2} \sum_{k=1}^{\infty} \cos \left[ \frac{(2k-1) \pi t}{(2k-1)^2} \right]$$

OR

(B) Find Fourier series coefficients of given wave form as shown in figure



Ans:

05

**Solution :**

$$T = 8$$

$$\omega_0 = \frac{2\pi}{8} = \frac{\pi}{4}$$

$$x(t) = \sum_{k=-\infty}^{\infty} a_k e^{jk\omega_0 t}$$

where

$$a_k = \frac{1}{T} \int_T x(t) e^{-jk\omega_0 t} dt = \frac{1}{8} \int_{-2}^2 A e^{-jk\omega_0 t} dt = \frac{A}{8} \cdot \frac{e^{-jk\omega_0 t}}{-jk\omega_0} \Big|_{-2}^2$$
$$= \frac{A}{8} \cdot \frac{4}{-jk\pi} \cdot \left[ e^{-jk\frac{\pi}{2}} - e^{jk\frac{\pi}{2}} \right]$$

$$a_k = \frac{A}{8} \cdot \frac{4}{-jk\pi} \cdot (-2j \sin \frac{k\pi}{2}) = \frac{A}{2} \cdot \left( \frac{\sin k\pi/2}{k\pi/2} \right)$$

$$a_k = \frac{A}{2} \cdot \left( \frac{\sin k\pi/2}{k\pi/2} \right) = \frac{A}{2} \operatorname{sinc} \left( \frac{k\pi}{2} \right)$$