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SECTION : B
SEMESTER : 5th
PAPER : COMMUNICATION SYSTEMS

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Q1. Differentiate Analog and Digital signal?

(Ans) Analog signals are the signals whose amplitude can have any value over a continuous range while a Digital signal is a signal whose amplitude can have only a finite number of values.

Q2. Briefly define the purpose of MODAM at transmitter and receiver.

(Ans) Purpose At Transmitter:
MODEM at the transmitter end takes a digital bit stream from a personal computer and converts it to analog signal.

Purpose At Receiver:
MODEM at the receiver end take the analog signal and convert it into digital signal.

Q3. Differentiate attenuation and distortion.

Attenuation	Distortion
The loss in the amplitude of a signal as it passes through a medium is called attenuation. The extent of attenuation is expressed in dBs	The alternation of the orignal signal is known as Distortion. Attenuation in different amounts for different parts of the signal results in distortion of that signal.

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Q4. What should be the sampling rate for the formation of the PCM signal?

(Ans) According to the Nyquist theorem/sampling theorem the sampling rate for the formation of the PCM signal should be greater than 2 time the highest signal frequency.

Mathematically: $f_{sample} > 2 f_{max}$

Q5. What is quantization error? And how it can be minimizeed?

(Ans) Quantization Error.

In the quantization process, the amplitude at each sample point is approximated by the mid point of the interval in which the sample value falls. The error occured due to this approximation is known as quantization error.

Quantization Error can be minimized by increasing the number L of levels.

$m = 2^{n}/L$

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Q6. How much signal power attenuated if its amplitude is 5V at the transmitter and the channel transfer function $h = 0.8$?

solution:

$x = 5V$

$h = 0.8$

we know that

$y = x_h + x_N$

$y = xh$ $(\because x_N = \text{noise})$

$y = 0.8x$

Power $= y^2 = (0.8x)^2$

$= 0.64x^2$

$P = 0.64(5)^2$

$= 0.64 \times 25$

$= 16$ watts.

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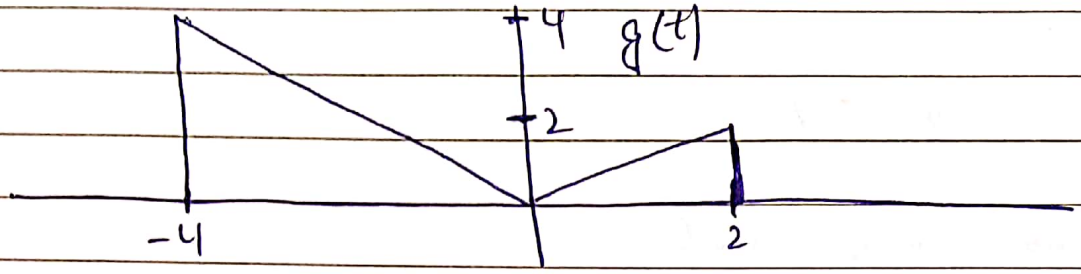
Q7. Sketch $g(0.5t-4)$, $g(3t/1.5)$, $g(2.5t-8)$ and $g(2-t)$ for figure given below.



Solution:

(1) $g(0.5t-4)$

$0.5t-4=2$

$0.5t=6$

$\boxed{t=12}$

$0.5t-4=0$

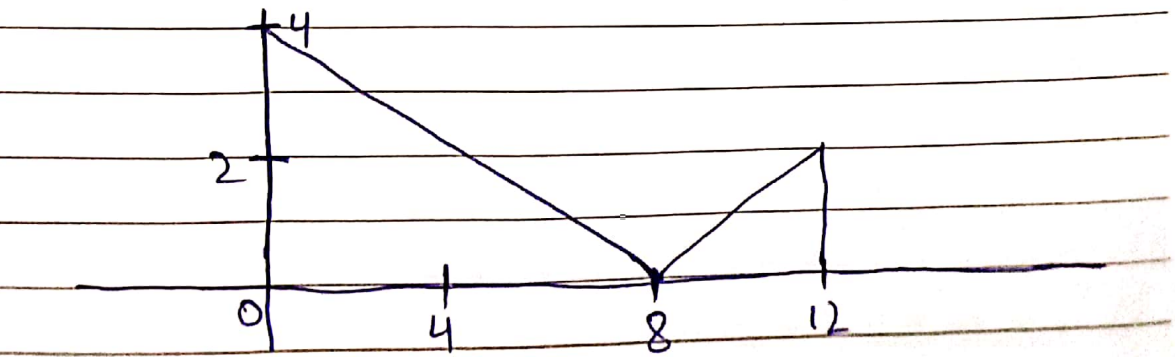
$0.5t=4$

$\boxed{t=8}$

$0.5t-4=-4$

$0.5t=0$

$t=0$



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(2) $g(3t/1.5)$

$3t/1.5 = 2$

$3t = 3$

$\boxed{t = 1}$

$3t/1.5 = 0$

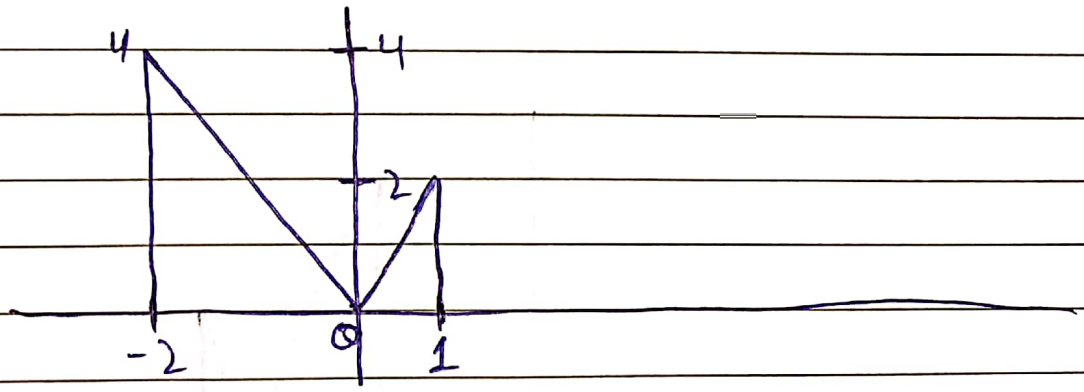
$3t = 0$

$\boxed{t = 0}$

$3t/1.5 = -4$

$3t = -6$

$\boxed{t = -2}$



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(3) $g(2.5t-8)$

$2.5t-8=2$

$2.5t=10$

$\boxed{t=4}$

$2.5t-8=0$

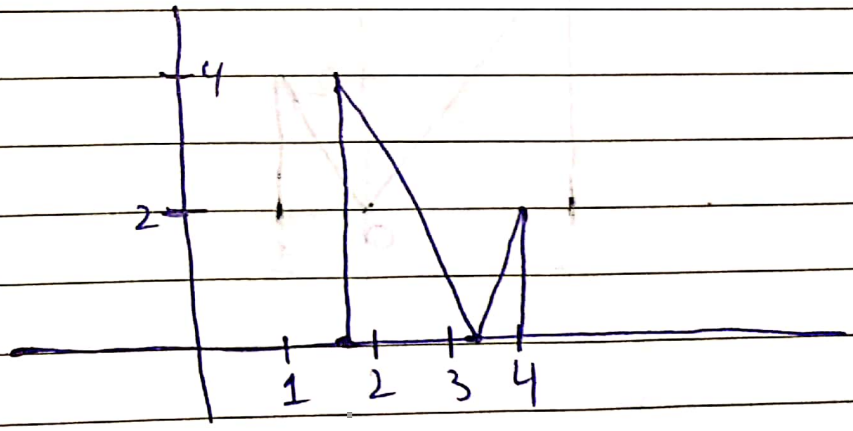
$2.5t=8$

$\boxed{t=3.2}$

$2.5t-8=-4$

$2.5t=4$

$\boxed{t=1.6}$



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(4) $g(2-t)$

$2-t = 2$

$\boxed{t = 0}$

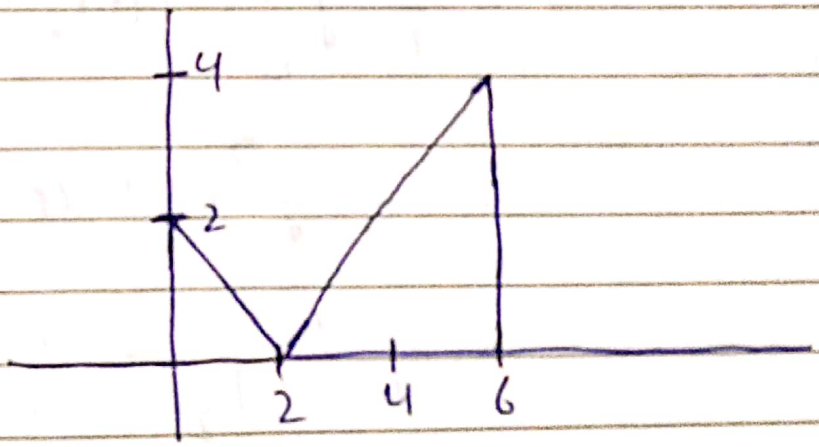
$2-t = 0$

$\boxed{t = 2}$

$2-t = -4$

$-t = -6$

$\boxed{t = 6}$



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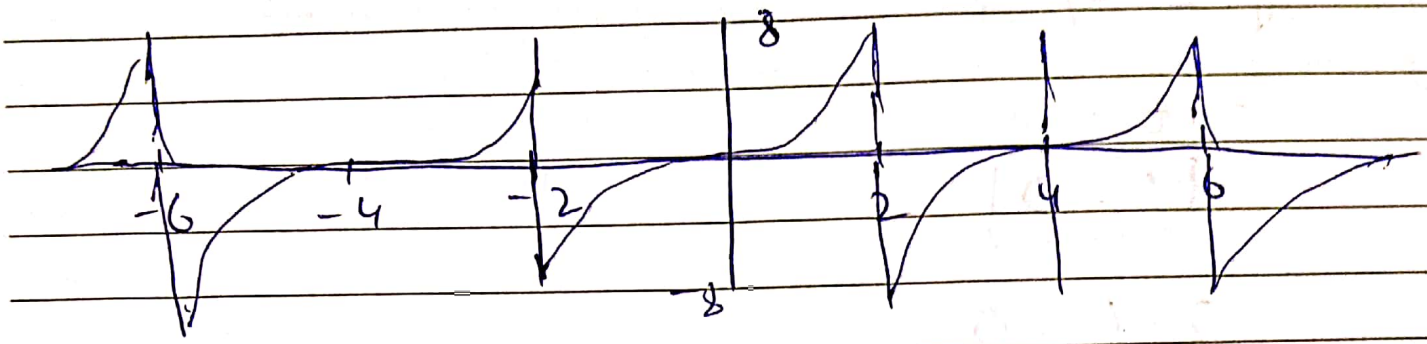
Q8. Find the power of the signal below.



Solution:

we know that

$$P = \lim_{T \to \infty} \frac{1}{T} \int_{-T/2}^{+T/2} |g(t)|^2 dt$$

For periodic signal

$$P = \frac{1}{T_0} \int_{-T_0/2}^{T_0/2} |x(t)|^2 dt$$

$$= \frac{1}{4} \int_{-2}^{0} |t^3|^2 dt + \frac{1}{4} \int_{0}^{2} |t^3|^2 dt$$

$$= \frac{1}{4} \frac{t^7}{7}\Big|_{-2}^{0} + \frac{1}{4} \frac{t^7}{7}\Big|_{0}^{2}$$

$$= \frac{1}{28} \left(-(-2)^7\right) + \frac{1}{28} \left((2)^7\right)$$

$$= \frac{128}{28} + \frac{128}{28}$$

$$\boxed{P = \frac{64}{7}}$$

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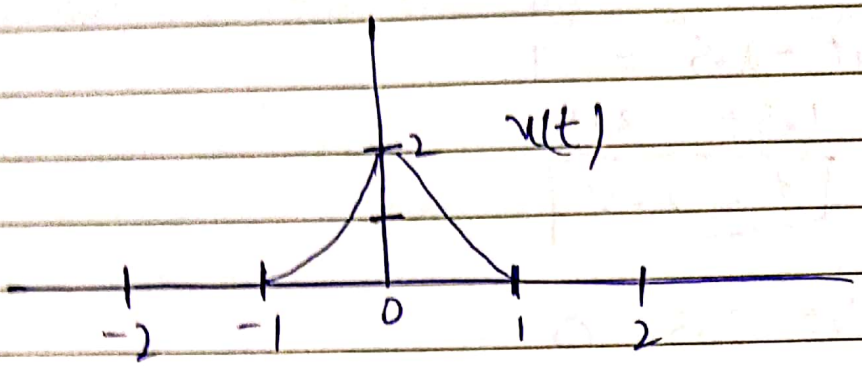
(Q4) Draw $x(0.5t-0.5)$ and $x(1.5t-2.5)$



Solution:

(1) $x(0.5t-0.5)$

$0.5t-0.5=1$

$0.5t=1.5$

$\boxed{t=3}$

$0.5t-0.5=0$

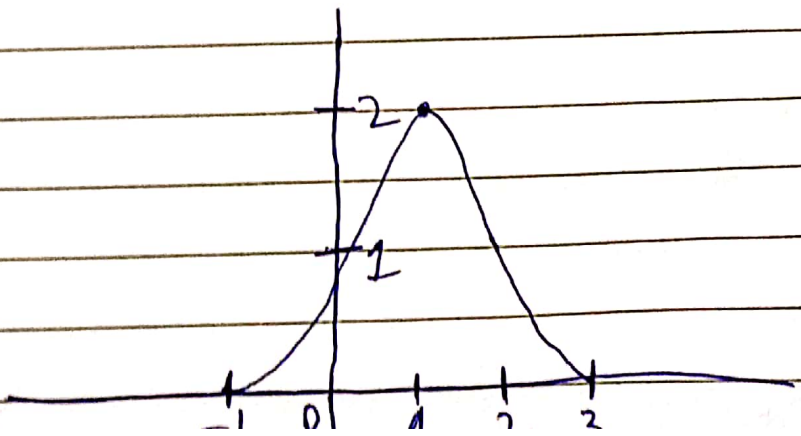
$0.5t=0.5$

$\boxed{t=1}$

$0.5t-0.5=-1$

$0.5t=-0.5$

$\boxed{t=-1}$



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(ii) $x(1.5t - 2.5)$

$1.5t - 2.5 = 1$

$1.5t = 3.5$

$\boxed{t = 2.34}$

$1.5t - 2.5 = 0$

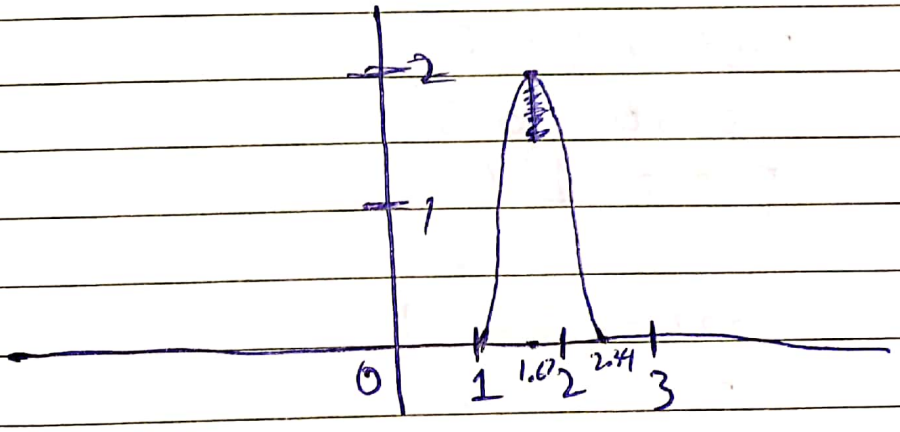
$1.5t = 2.5$

$\boxed{t = 1.67}$

$1.5t - 2.5 = -1$

$1.5t = 1.5$

$\boxed{t = 1}$



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(Q10) Briefly describe the needs of modulation.

(Ans) Needs of Modulation:

1. Frequency translation:

The transfer of the signals occupying a specified frequency band such as a channel or a group of channels, from one portion of the frequency to another in such a way that the arthematic frequency difference of signals within the band is unaltered we must have to seperate the signal so that they can't be mixed up.

2. Praeticality of Anteena:

For the efficient transmission and reception of the signals, the size of the Antenna needs to be practical. The antenna length "l" required in terms of wavelength is expressed as

$$\lambda = \frac{\text{speed of light km}}{\text{frequency}}$$

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(Q11) Describe how co-channel cells can be located in cellular systems if i=2 and j=1?

Solution:

$i = 2$

$j = 1$

$N = i^2 + ij + j^2$

$= (2)^2 + (2)(1) + (1)^2$

$= 4 + 2 + 1$

$= 7$

(Q12) How BW related to data rate? ---

(Ans) The basic relationship implies as by Nyquist theorem:

→ Doubling the data rate and keeping the number of signals levels the same, will halve the bandwidth used.

→ Squaring the number of signal levels and keeping the data rate same will halve the bandwidth.

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(Q13) Find SNR at the output ———

solution:

$$X_{Level} = 10^{\frac{0dB}{10}}$$

$$= 10^{0/10} = 10^{0} = 1$$

$$SNR = \frac{10}{1} = 10$$

(Q14) What will be offered capacity of GSM ———

$P_x = 10$ watts $\quad P_N = 0dB = 1$

GSM, $B = 200KHz$

$$C = B \log_2 (1 + P/N) \quad | \quad P/N = 10$$

$$C = 200 \times 10^3 \log_2 (1 + 10)$$

$$C = 200 \times 10^3 \log_2 (11)$$

$$C = 691800$$