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"If you can think, you can Achieve"
So start thinking..

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M.Tech (VLSI Design)
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GATE 2024

प्रचण्ड Batch

COMMUNICATION

QUESTIONS FROM BASE BAND DATA COMMUNICATION

TIME- 9:00PM

RENU SIR

Chapter-2

Digital Communications

In today's lecture we will cover the following Topis :

1. *Questions from Base Band Data Communication*


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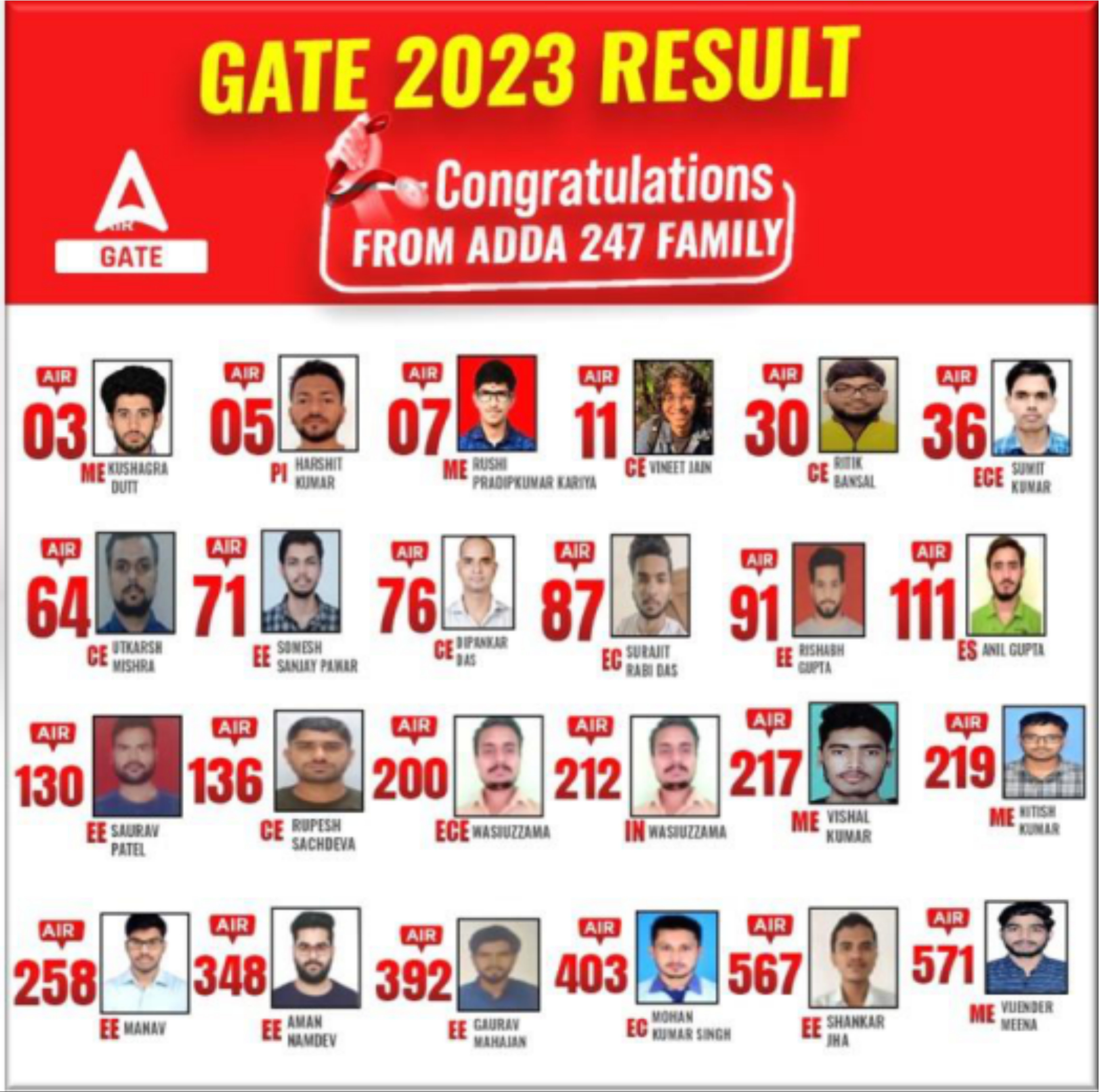
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AIR 571 ME VIJENDER MEENA

Use Code Y505 | Communications for GATE 2024

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Free

YouTube Classes Schedule

ENGINEERS

EE & EC ENGINEERING

EXAM TARGET	SUBJECT	TIME	FACULTY
ALL PSUs	ENGINEERING MATHS	11:00 AM	ANANT SIR
GATE 2024-25	NETWORK THEORY	6:00 PM	RAVI SIR
GATE 2024-25	ELECTRICAL MACHINE	7:30 PM	SANTAN SIR
GATE 2024-25	COMMUNICATION	9:00 PM	RENU SIR

FREE APP CLASS SCHEDULE

EE & ECE ENGINEERING

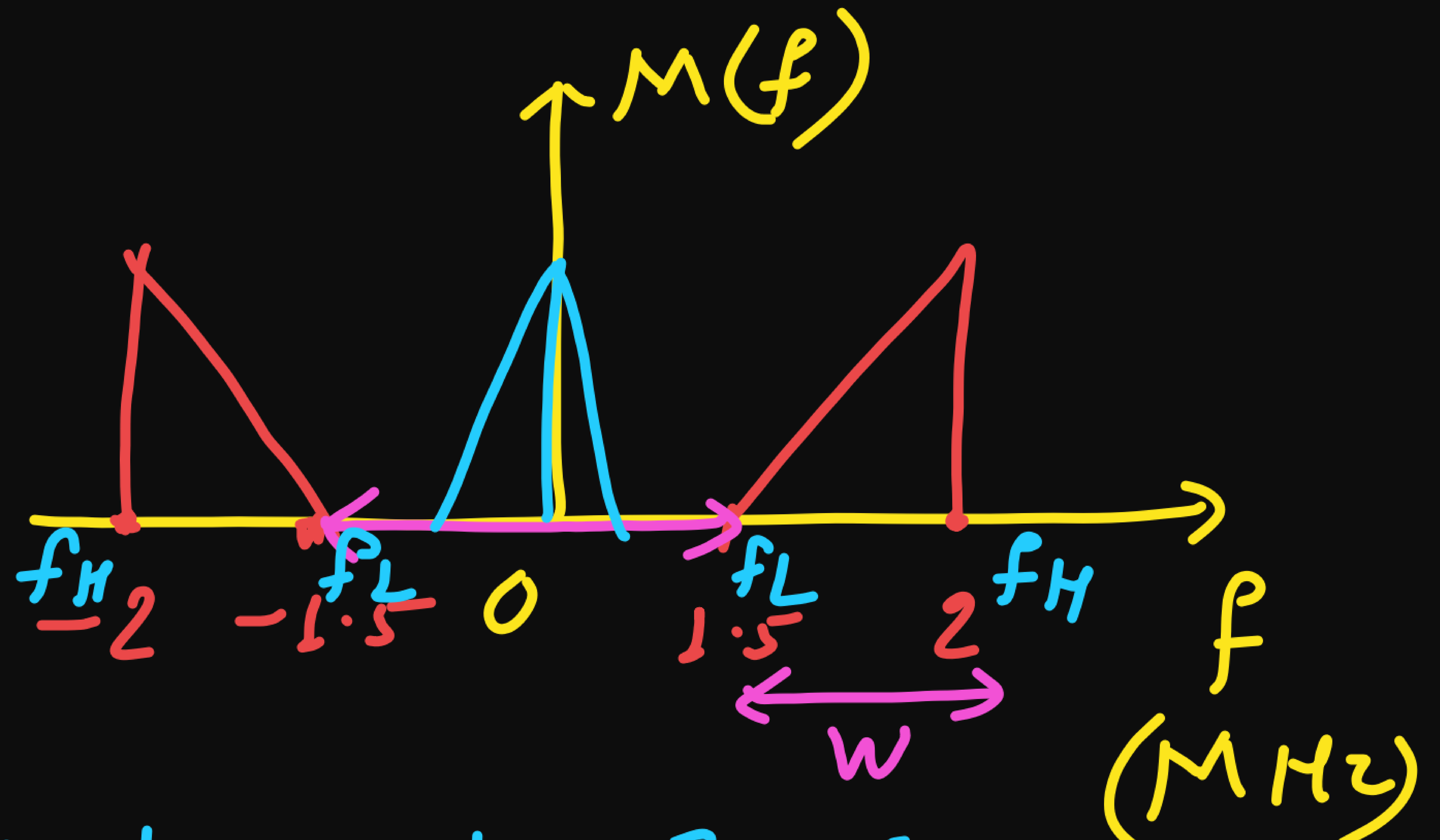
NETWORK THEORY	SATURDAY Live @11AM	RAVI SIR
COMMUNICATION	WEDNESDAY Live @8PM	RENU SIR
ANALOG ELECTRONICS	THURSDAY Live @8PM	LAWRENCE SIR
ENGINEERING MATHEMATICS	FRIDAY Live @11AM	ANANT SIR
ELECTRICAL MACHINE	MONDAY Live @8PM	SANTAN SIR

[IES – EC - 2000]

A band – pass signal has significant frequency components in the range of 1.5 MHz to 2 MHz. If the signals to be reconstructed from its sample, the minimum sampling frequency will be

(A) 1 MHz (B) 2MHz

(C) 3.5 MHz (D) 4 MHz



Student-I : Low Pass Signal

$W = 2\,MHz$ $NR = 2W = 4\,MHz$

$f_s \geq NR \Rightarrow (f_s)_{min} = 4\,MHz$

Student-II : Band-Pass Signal → $W = 0.5\,MHz$, $NR = 2W = 1\,MHz$

$\frac{2f_L}{2W} = \frac{3M}{1M} = 3 = m$, $\frac{2f_H}{2W} = \frac{4M}{1M} = 4 = m+1$

$f_s = 1\,MHz$

Ans: 20KHz

[IES – EC - 2010]

The spectrum of a band pass signal spans from 20 kHz to 30 kHz. The signal can be recovered ideally from the sampled values when the sampling rate is at least

$W = 10KHz$

$2W = 20KHz$

$NR = 20KHz$

$$\frac{2f_L}{2W} = \frac{40}{20} = 2 = m$$

$$\frac{2f_H}{2W} = \frac{60}{20} = 3 = m+1$$

$$\frac{2f_L}{m} = \frac{40K}{2} = 20KHz$$

$$\frac{2f_H}{m+1} = \frac{60K}{3} = 20KHz$$

$$(f_s)_{min} = 20KHz$$

[IES – EC - 2009]

A signal occupies a band 5 kHz to 10 kHz. For proper error free reconstruction at what rate it should be sampled?

~~(A) 10 kHz~~

(B) 20 kHz

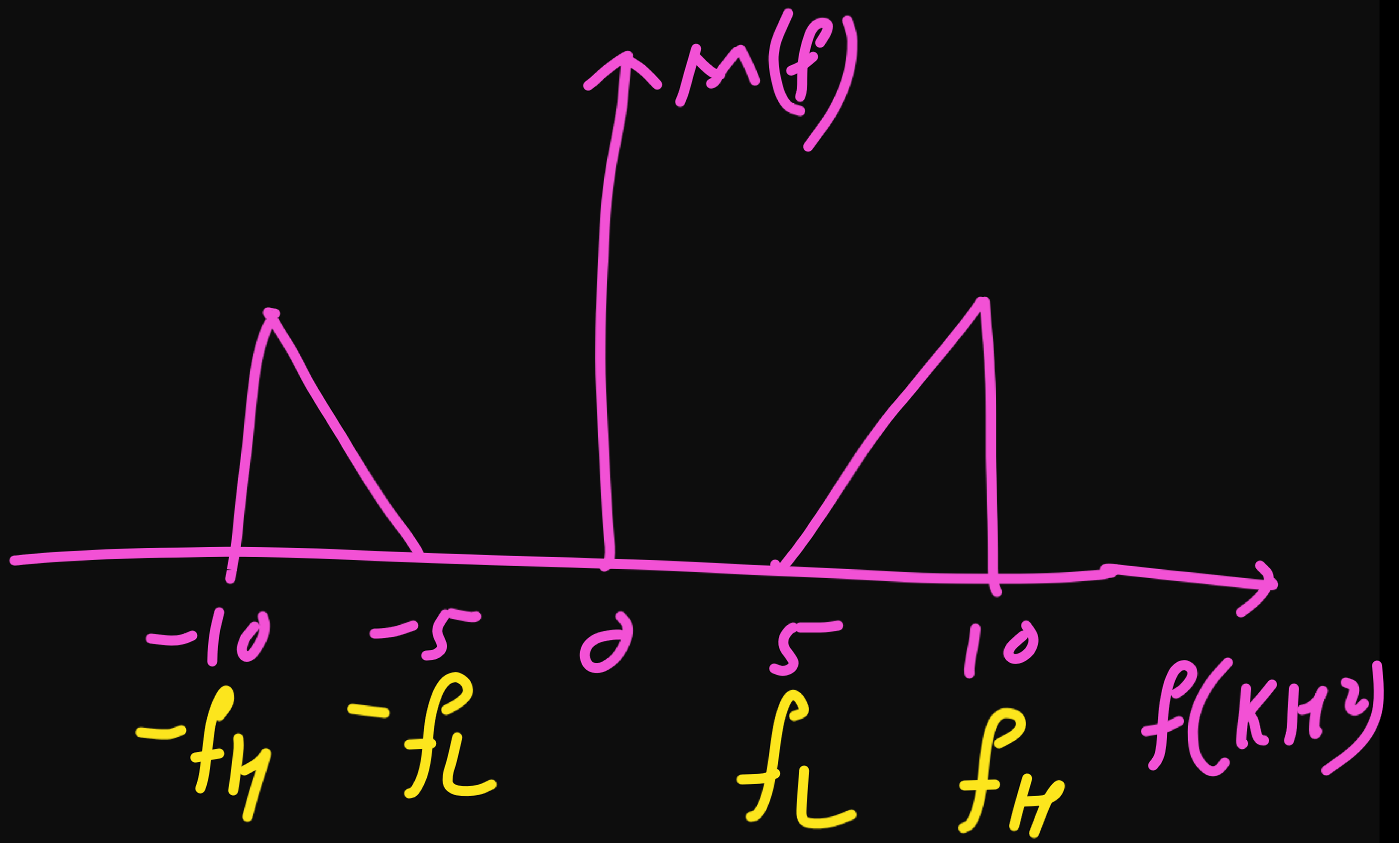
(C) 30 KHz

(D) 40 KHz

$$\frac{2f_L}{2W} = \frac{10}{10} = 1 = m$$

$$\frac{2f_H}{2W} = \frac{20}{10} = 2 = m+1$$

$$f_s = 10\,\text{KHz}$$



$W = 5\,\text{KHz}$

$2W = MR = 10\,\text{KHz}$

$f_s \geq 10\,\text{KHz}$

[GATE - EC - 2007]

In delta modulation, the slope overload distortion can be reduced by

(A) decreasing the step size ✗

(B) decreasing the granular noise ✗

(C) decreasing the sampling rate ✗

~~(D)~~ increasing the step size

D.M.

$\frac{\Delta}{T_s} = \frac{d}{dt} m(t)\Big|_{max}$ = No Error

$\frac{\Delta}{T_s} > \frac{d}{dt} m(t)\Big|_{max}$ = Granular Noise

$\frac{\Delta}{T_s} < \frac{d}{dt} m(t)\Big|_{max}$ = Slope over load Error

To reduce slope overload Error

$\frac{\Delta}{T_s}\uparrow \Rightarrow \Delta\uparrow, T_s\downarrow, f_s\uparrow$

[GATE – EC1 – 2015]

A sinusoidal signal of 2 kHz frequency is applied to a delta modulator. The sampling rate and step-size Δ of the delta modulator are 20,000 samples per second and 0.1 V, respectively. To prevent slope overload, the maximum amplitude of the sinusoidal signal (in Volts) is :

(A) $\frac{1}{2\pi}$ (B) $\frac{1}{\pi}$

(C) $\frac{2}{\pi}$ (D) π

$f_m = 2\,KHz$

$m(t) = A_m \sin 2\pi f_m t \rightarrow \frac{d}{dt}m(t)\Big|_{max} = A_m 2\pi f_m$

$f_s = \frac{1}{T_s} = 20000$ samples/sec

$\Delta = 0.1$ volt

for slope overload: $\frac{\Delta}{T_s} < \frac{d}{dt}m(t)\Big|_{max}$

To prevent slope overload: $\frac{\Delta}{T_s} \geq \frac{d}{dt}m(t)\Big|_{max}$

$0.1 \times 20000 \geq 2\pi f_m \cdot A_m$

$A_m \leq \frac{2000}{2\pi \times 2000} = \frac{1}{2\pi}$

[GATE - EC - 2006]

The minimum step-size required for a Delta-Modulator operating at 32K samples/sec to track the signal (here u(t) is the unit-step function) $x(t) = 125t(u(t) - u(t-1)) + (250 - 125t)(u(t-1) - u(t-2))$ so that slope – overload is avoided, would be

(A) 2^{-10}

(B) 2^{-8}

(C) 2^{-6}

(D) 2^{-4}

$f_s = \frac{1}{T_s} = 32000$ samples/sec

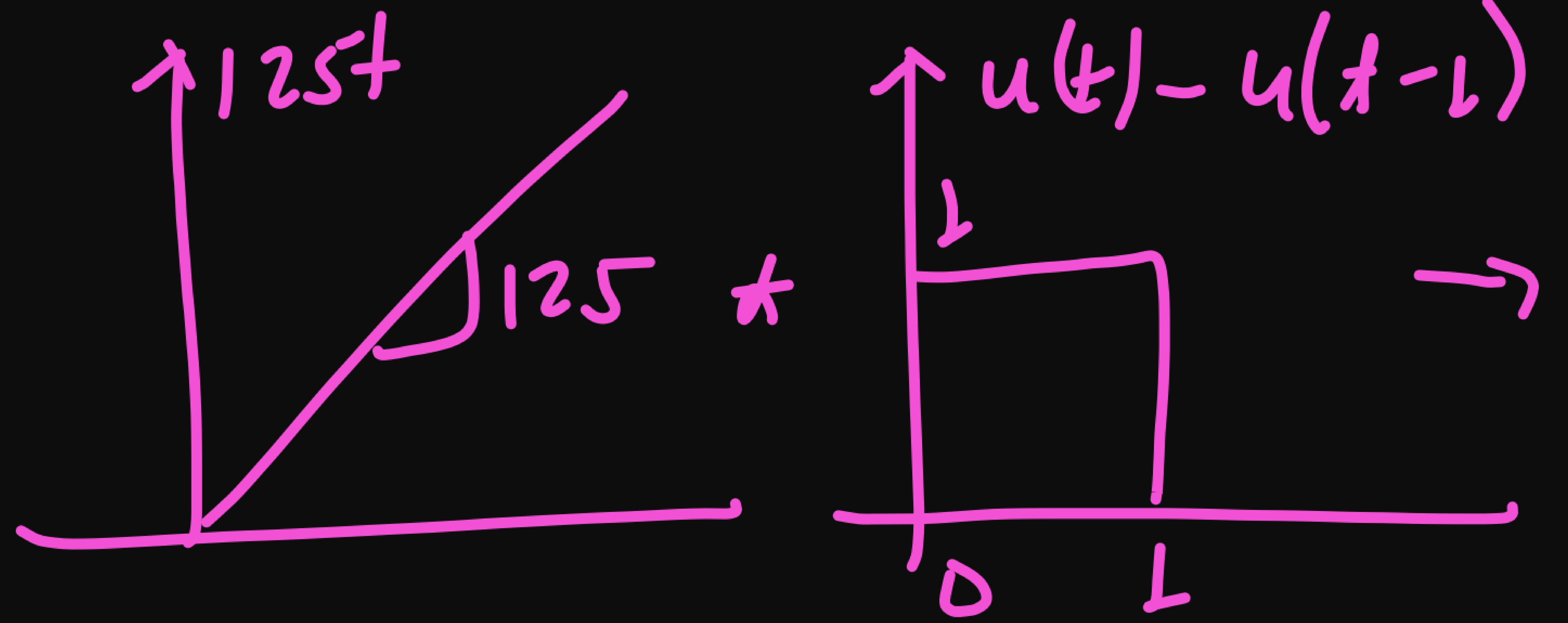
To avoid slope overload Error

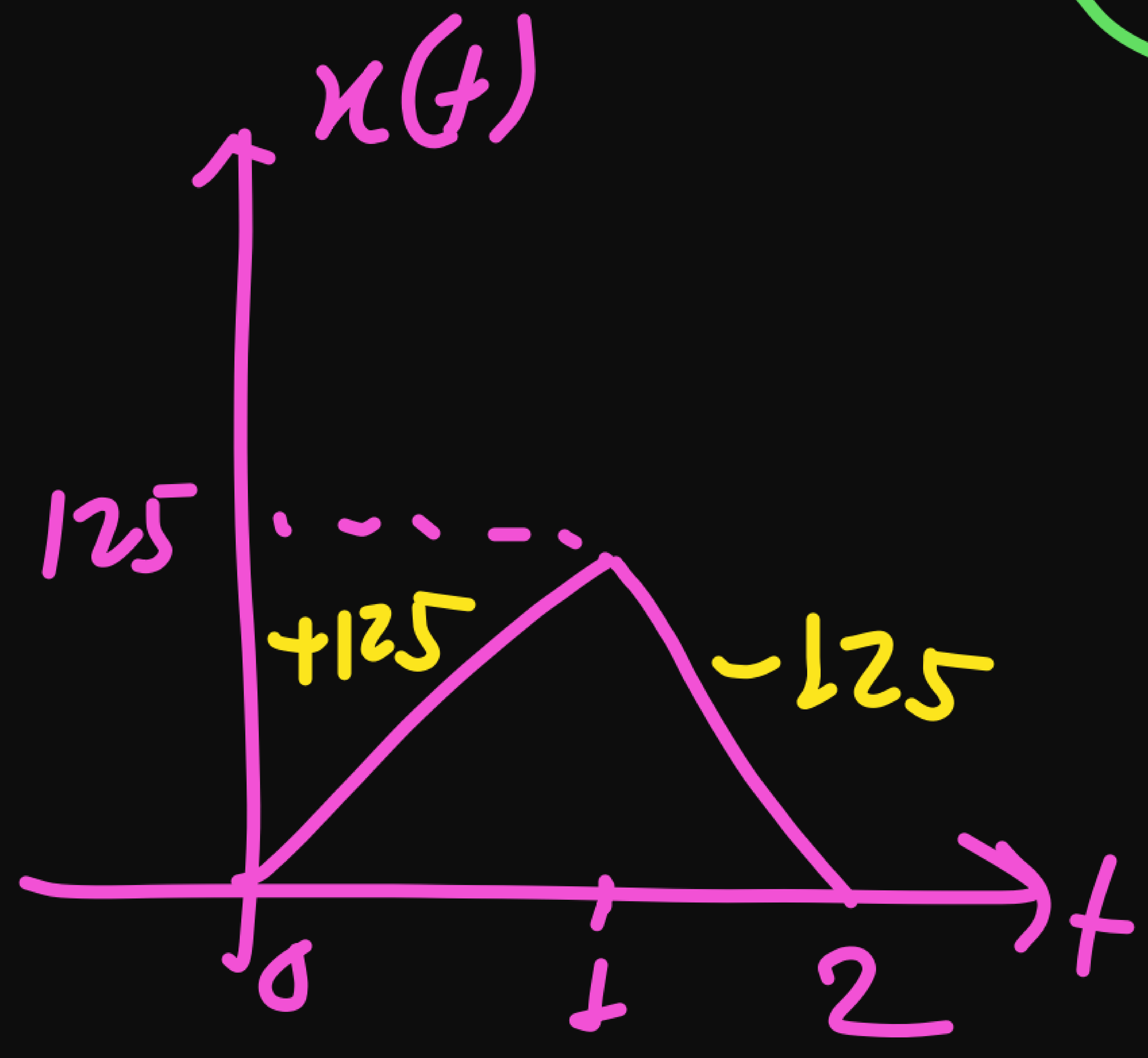
$$\frac{\Delta}{T_s} \geq \frac{d}{dt} m(t)\Big|_{max}$$

$$\Delta \geq \frac{125}{32000}$$

$$\frac{d}{dt} m(t)\Big|_{max} = +125$$

$$\Delta_{min} = \frac{125}{32000} = \frac{125}{32 \times 1000} = \frac{1}{2^5 \times 2^3} = 2^{-8}$$





[GATE - EC - 2003]

The input to a linear delta modulator having a step size $\Delta = 0.628$ is a sine wave with frequency f_m and peak amplitude E_m. If the sampling frequency $f_s = 40KHz$, the combination of the sine-wave frequency and the amplitude, where slope overload will take place is

	E_m	f_m
(A)	0.3V	8 KHZ
(B)	1.5 V	4 KHZ
(C)	1.5 V	2 KHZ
(D)	3.0 V	1 KHZ

$\Delta = 0.628$, $f_s = \frac{1}{T_s} = 40KHz = 40000$ (samples/sec)

$m(t) = A_m \sin 2\pi f_m t$

$\frac{\Delta}{T_s} < \frac{d}{dt} m(t)\Big|_{max}$

$0.628 \times 40000 < 2\pi f_m A_m$

$f_m A_m > \frac{0.628 \times 4000}{2\pi} = \frac{0.628 \times 40K}{6.28}$

$f_m A_m > 4000$

(A) = 2.4 KHz = 2400 ✗

(B) = 6000 ✓

(C) = 3000 ✗

(D) = 3000 ✗

[IES – EC - 2004]

The sum of two signals

$$e_1 = 3\sin(4\pi\times10^3 t)$$

and $e_2 = 5\sin(2\pi\times256t)$

is sampled at 1024 Hz. The sampled signal is passed through a low pass filter with cut-off at 2048 Hz. The output of this filter will contain components at

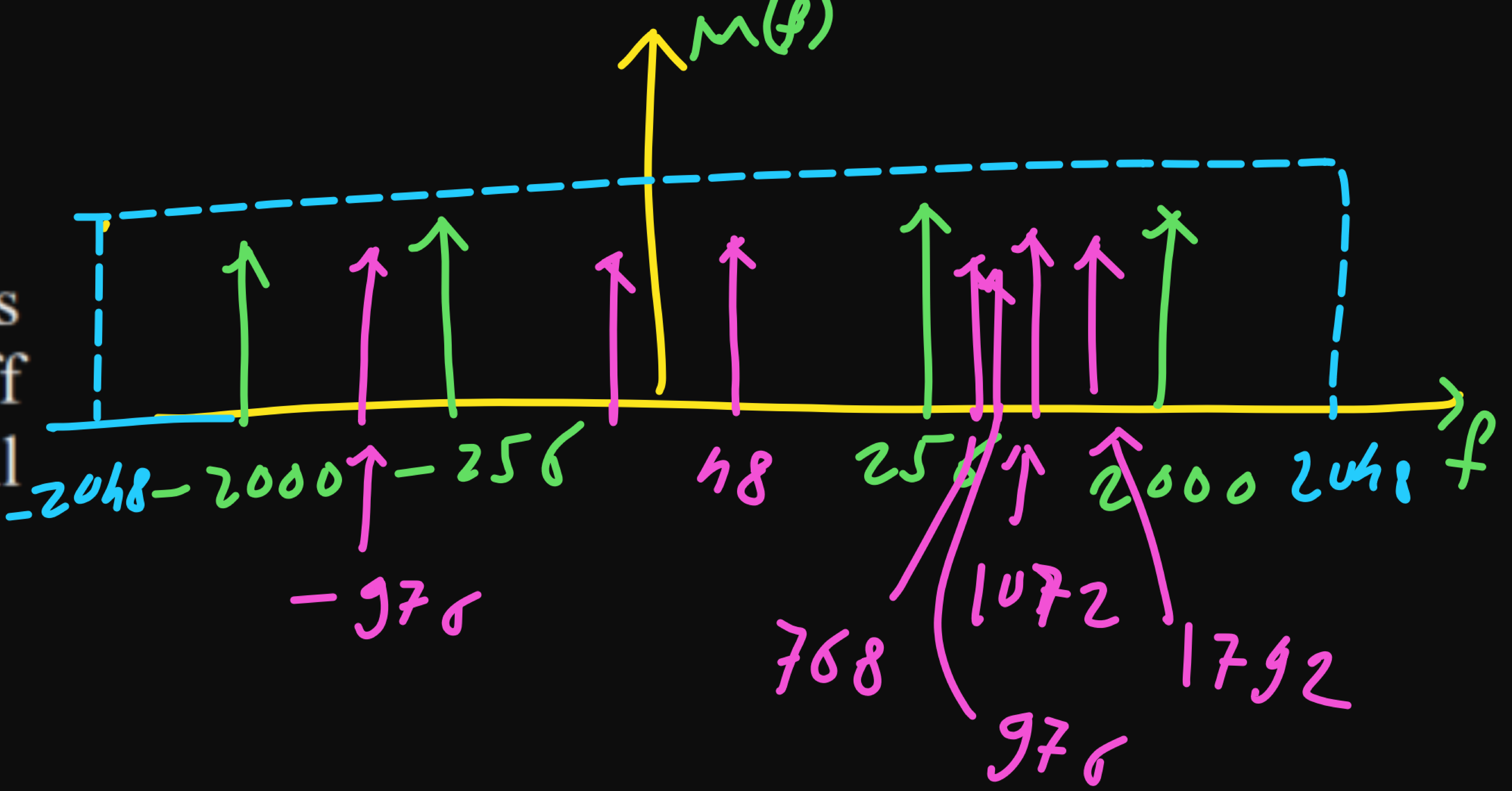
(A) 256 Hz and 10^3 Hz

(B) 256 Hz and 1024 Hz

(C) 256 Hz only

(D) 1024 Hz only

$m_1(t) = 3\sin 2\pi\cdot 2000t$
$m_2(t) = 5\sin 2\pi\cdot 256t$
Double tone Sinusoidal



THANKS FOR

Watching

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