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

Renu Raj Garg
M.Tech (VLSI Design)
13 Year of Teaching Experience
Worked 10 Year in NTRO

GATE 2024

प्रचण्ड Batch

COMMUNICATION

QUESTIONS FROM BAND-PASS SAMPLING

TIME- 9:00PM

RENU SIR

Chapter-2

Digital Communications

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

1. *Band-Pass Sampling (Part-2)*

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GATE 2023 RESULT

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AIR 91 EE RISHABH GUPTA

AIR 111 ES ANIL GUPTA

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AIR 219 ME NITISH KUMAR

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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

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CLASS SCHEDULE

EE & ECE ENGINEERING

GATE

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

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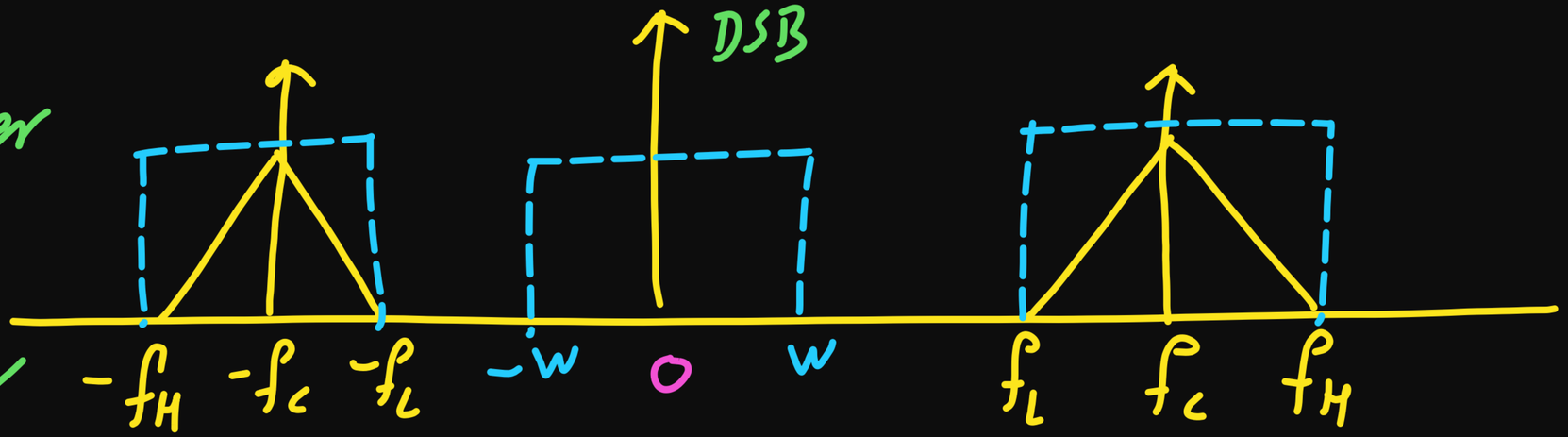
$\frac{2f_L}{2W}$ = Integer

$\frac{2f_H}{2W}$ = Integer



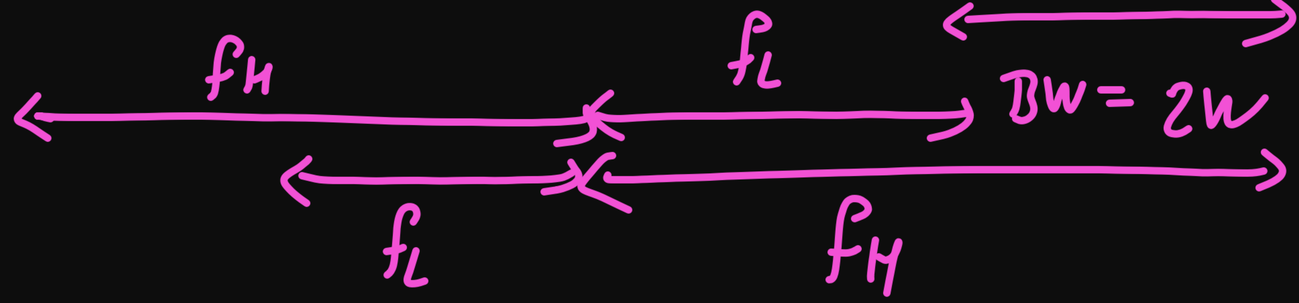
$f_H - f_L = 2W$

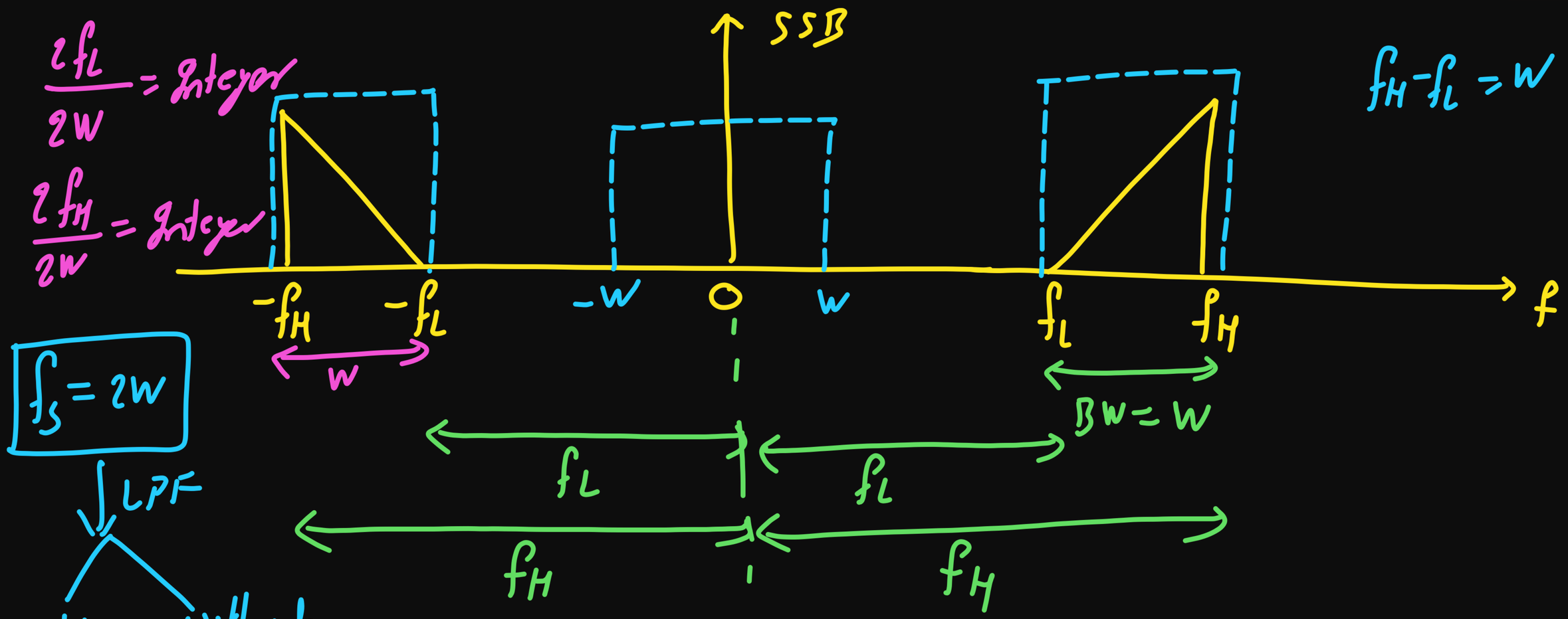
$f_s = 2W$

LPF

with Inversion

without Inversion





$f_{s_3} = 11.2, 14, 18.66, 28$ GHz

$f_{s_3} = 10 + 1.2$

$f_{s_3} = 11.2$ Hz

$\frac{2f_L}{2W} \neq$ Integer $\rightarrow$ $\frac{46}{10} = 4.6 = 4$ (lowest Integer)

$= 3, 2, 1, 0$

$\frac{6\text{Hz}}{5} = 1.2$ Hz

$\frac{2f_H}{2W} \neq$ Integer $\rightarrow$ $\frac{66}{10} = 6.6 = 6$

$= 5, 4, 3, 2$

$f_{s_1} = 11.2$ Hz

$f_{s_2} = 14$ Hz

$f_{s_3} = 18.66$ Hz

$f_{s_4} = 28$ Hz

$f_{s_5} = 66$ Hz

$\frac{16\text{Hz}}{4} = 4$Hz

$\frac{26}{3} = 8.66$Hz

If f_s = 1.5 times of MR

then what will be f_s ?

MR = 2W = 10Hz $\left.\begin{matrix}\\\\\end{matrix}\right\}$ $BW = f_H - f_L = 2W$

$f_s = 1.5 \times 10 = 15\,Hz \rightarrow$ Not possible $\neq f_{s1}, f_{s2}, f_{s3}, f_{s4}$

↓

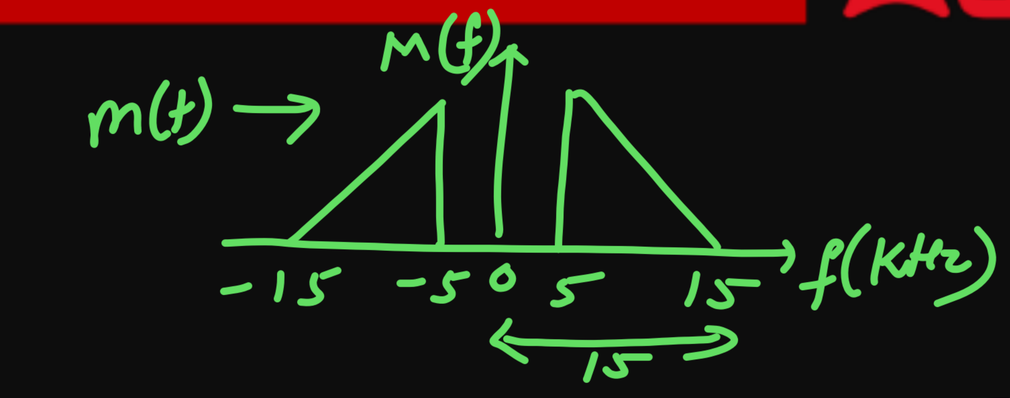
Assume Low Pass signal $\left.\begin{matrix}\\\\\\\\\end{matrix}\right\}$ $f_s = 1.5 \times 66$

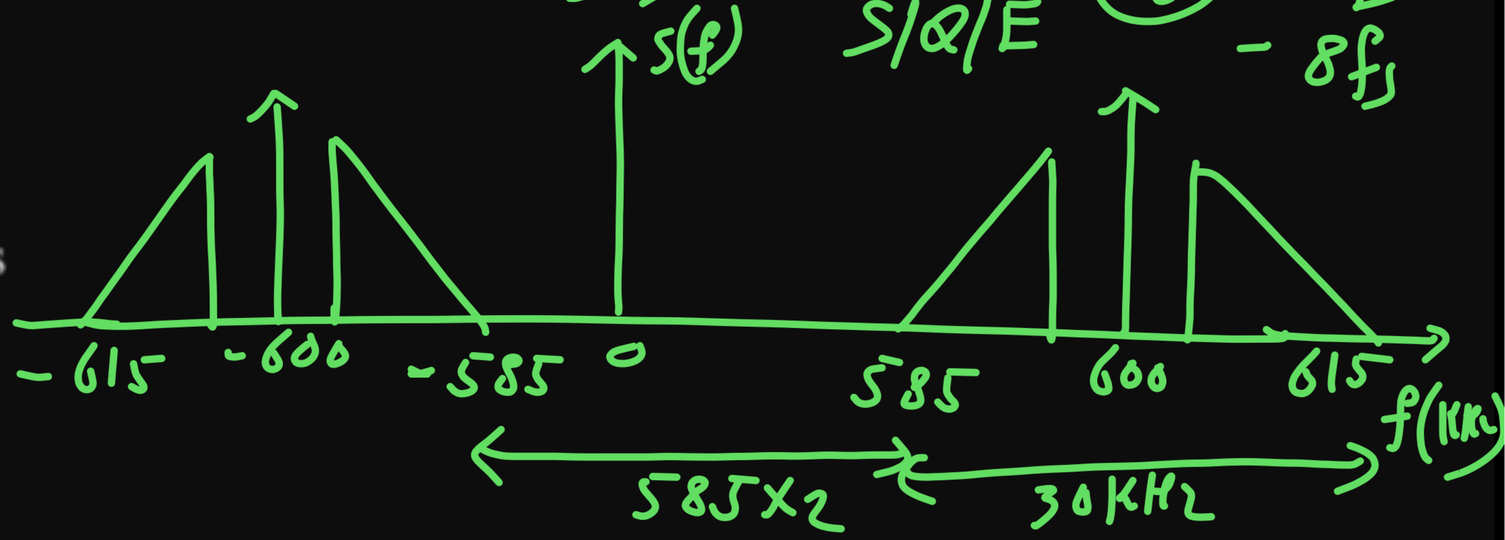
$BW = f_H - 0 = 33 = W$

$MR = 2W = 66\,Hz$

[GATE-EC-2019]

A voice signal $m(t)$ is in the frequency range 5 kHz to 15 kHz. The signal is amplitude-modulated to generate an AM signal $f(t) = A(1 + m(t))\cos 2\pi f_c t$, where $f_c = 600\,\text{kHz}$. The AM signal $f(t)$ is to be digitized and archived. This is done by first sampling $f(t)$ at 1.2 times the Nyquist frequency, and then quantizing each sample using a 256-level quantizer. Finally, each quantized sample is binary coded using K bits, where K is the minimum number of bits required for the encoding. The rate, in Megabits per second (rounded off to 2 decimal places), of the resulting stream of coded bits is 11.81 Mbps.





BPS

$MR = 2W = 30KHz$

$f_s = 1.2 \times MR = 1.2 \times 30 = 36KHz$

$\frac{585 \times 2}{36} = 32.5$ ≠ Min Integer } Aliasing

$\frac{585 \times 2}{30} = 39 =$ Integer

$f_{s1} = 30KHz$ f_{s2}, f_{s3} - - - ——— -

LPS

$W = 615KHz$

$MR = 2W = 2 \times 615 KHz$

$= 1230KHz$

$f_s = 1.2 \times MR$

$= 1.2 \times 1230 KHz$

$f_s = 1476KHz$

$f_s = 1.476MHz$

$R_s = nf_s = Kf_s = 8 \times 1.476 Mbps$

$= 11.808 Mbps$

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