Experiment-05

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AIM: To examine pulse amplitude modulation (PAM), pulse position modulation (PPM) and Pulse width modulation (PWM) and verify and draw the resultant waveforms.

APPARATUS: MATLAB software online.

THEORY

1. Pulse modulation is a type of modulation in which the signal is transmitted in the form of pulses. In pulse modulation, continuous signals are sampled at regular intervals. Pulse modulation is further divided into Analog and Digital modulation and further analog and digital modulation is subdivided in PAM, PWM, PPM (analog) and PCM, DM (digital).

2. Pulse Amplitude Modulation (PAM):

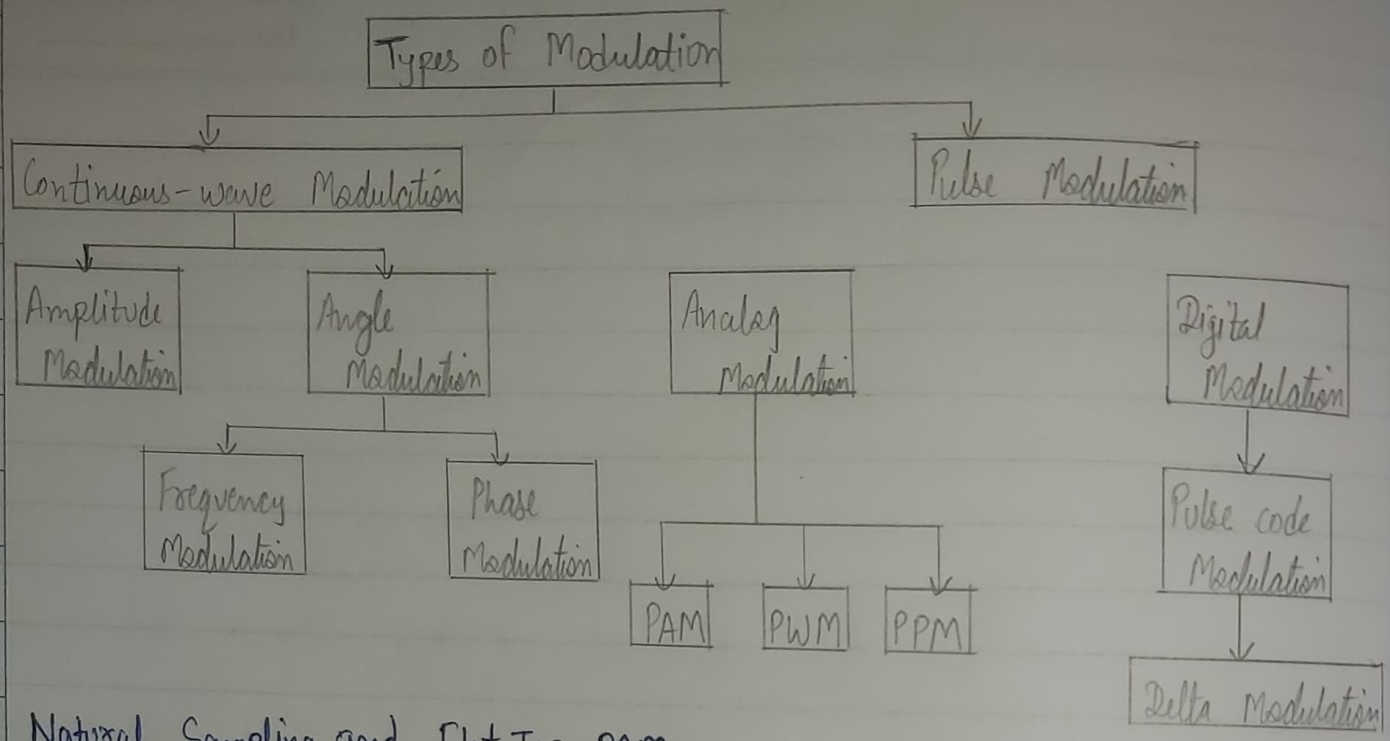
→ In PAM a pulse signal is used to sample an analog signal. The result is a train of constant-width pulses. The amplitude of each pulse is proportional to the amplitude of the message signal at the time of sampling. The PAM signal follows the amplitude of the original signal, as the signal traces on the path of the whole wave.

→ PAM signal generation: We can generate PAM signal by two types of sampling process.

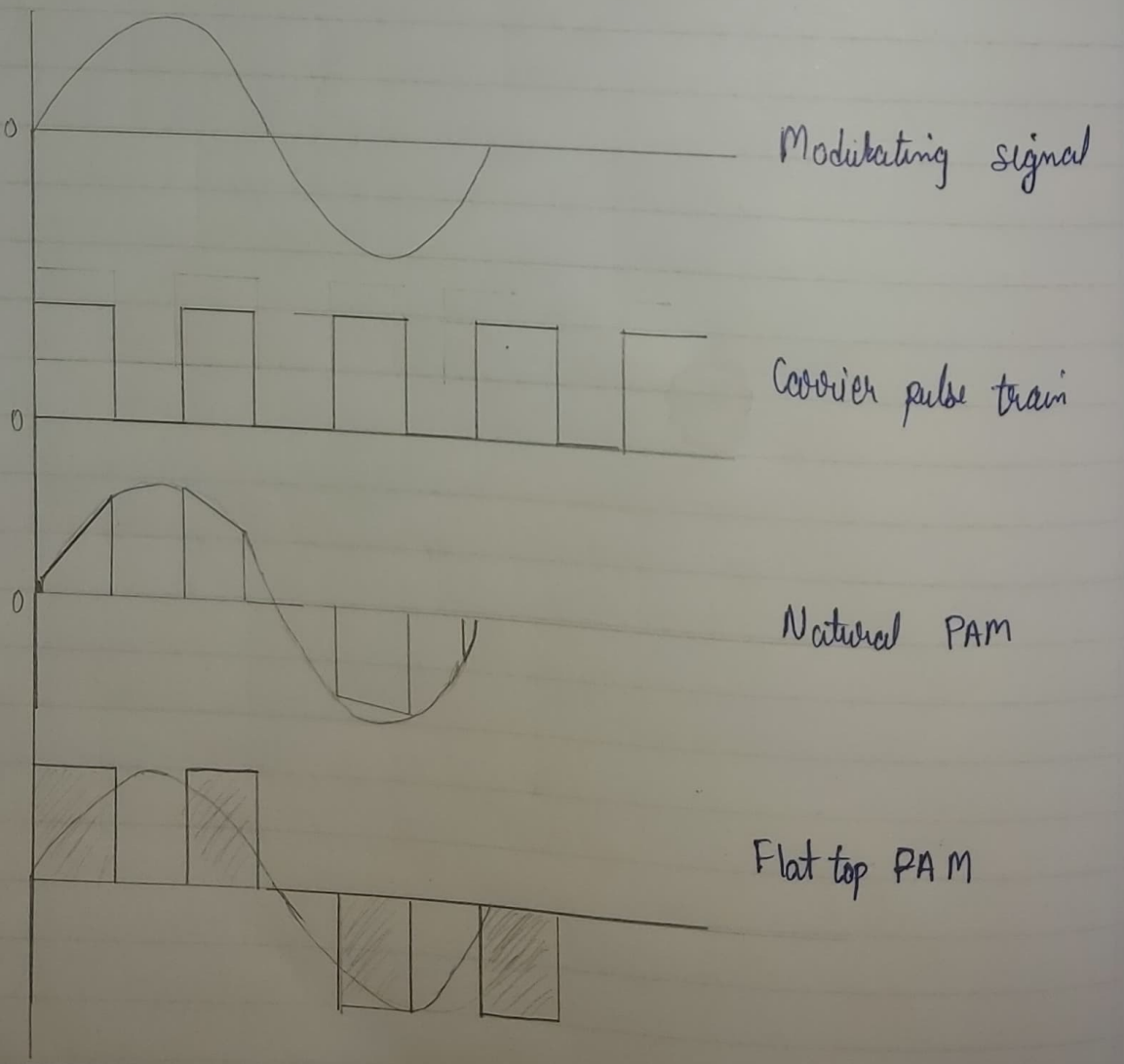
Natural sampling: For a PAM signal produced with natural sampling, the sampled signal follows the waveform of the input signal during the time that each sample is taken.

vision

Teacher's Signature :



Natural Sampling and Flat Top PAM



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Flat-top Sampling : In this type of sampling, a sample and hold circuit is used to hold the amplitude of each pulse at a constant level.

3. Pulse Width Modulation (PWM)

→ In this type, the amplitude is maintained constant but the duration or length or width of each pulse is varied in accordance with instantaneous value of the analog signal.

4. Pulse Position Modulation (PPM)

→ In this type of modulation, both the amplitude and width of the pulse are kept constant. We vary the position of each pulse according to the instantaneous sampled value of the message signal.

→ PPM is further modification of PWM.

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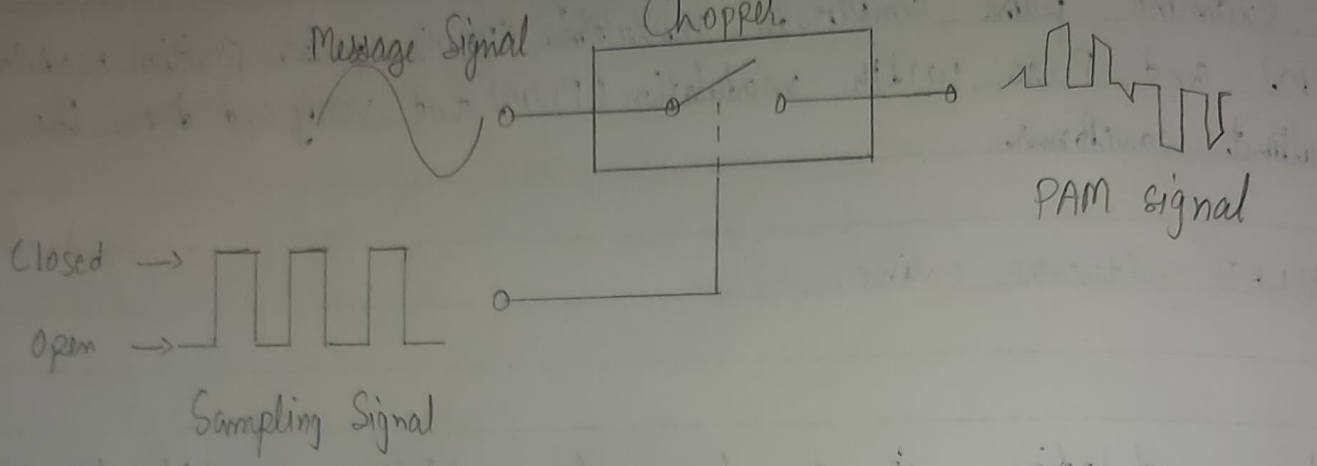
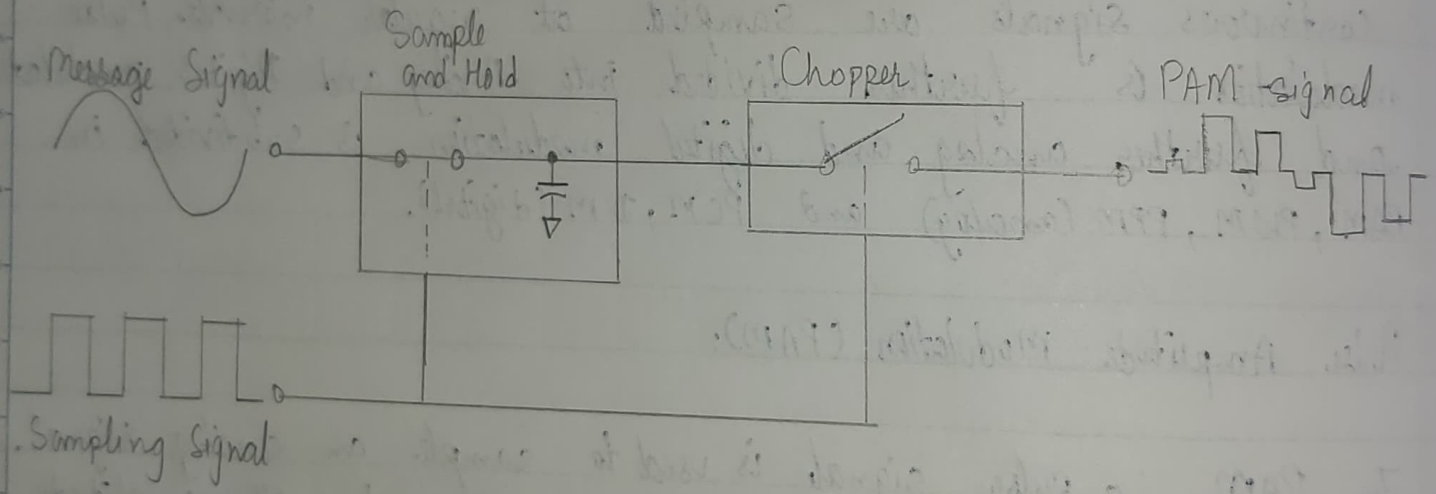
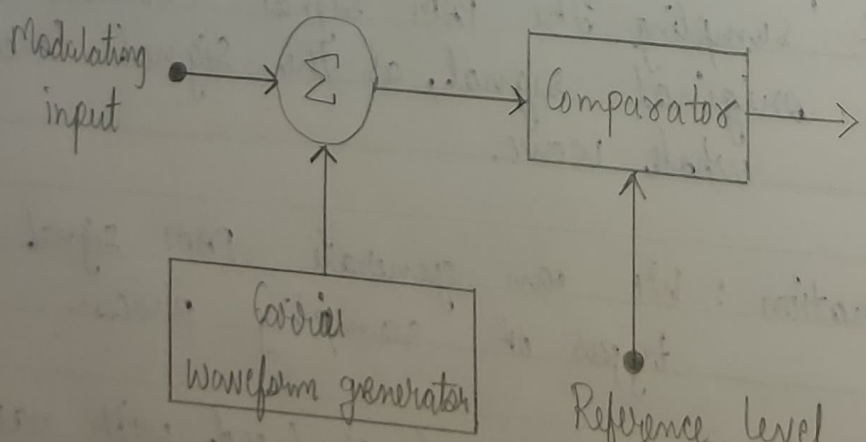
Generation of PAM signal by Natural Sampling:



Generation of PAM signal by Flat-top Sampling:



Generation of PWM signal



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5. Comparison of PAM, PWM and PPM:

S.No	Pulse Amplitude Modulation (PAM)	Pulse Width Modulation (PWM)	Pulse Position Modulation (PPM)
1.	Amplitude of the pulse proportional to amplitude of modulating signal.	Width of the pulse is proportional to amplitude of modulating signal	The relative position of the pulse is proportional to amplitude of modulating signal.
2.	Bandwidth of the transmission channel depends on the pulse width.	Here, it depends on the rise time of the pulse.	Here, it depends on the rising time of the pulse.
3.	Instantaneous power of the transmitter varies	Instantaneous power of the transmitter varies.	Instantaneous power of the transmitter is constant.
4.	Noise interference is high	Noise interference is minimum	Noise interference is minimum
5.	System is complex to implement	System is simple to implement	System is simple to implement
6.	Similar to amplitude modulation	Similar to frequency modulation	Similar to phase modulation

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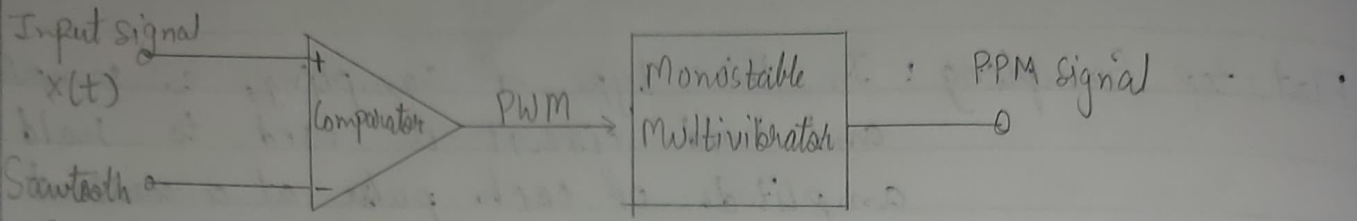
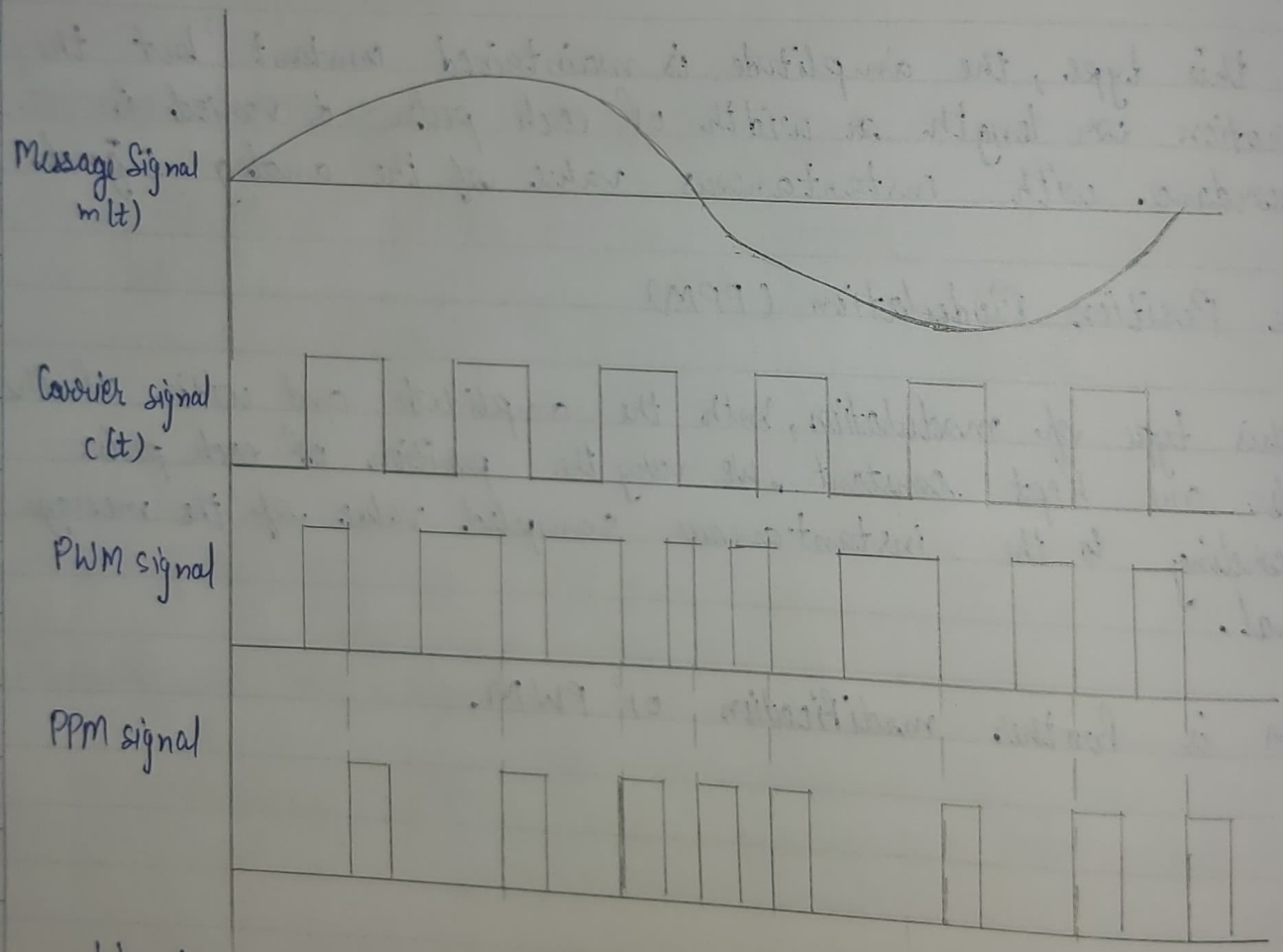
Generation of PPM signal

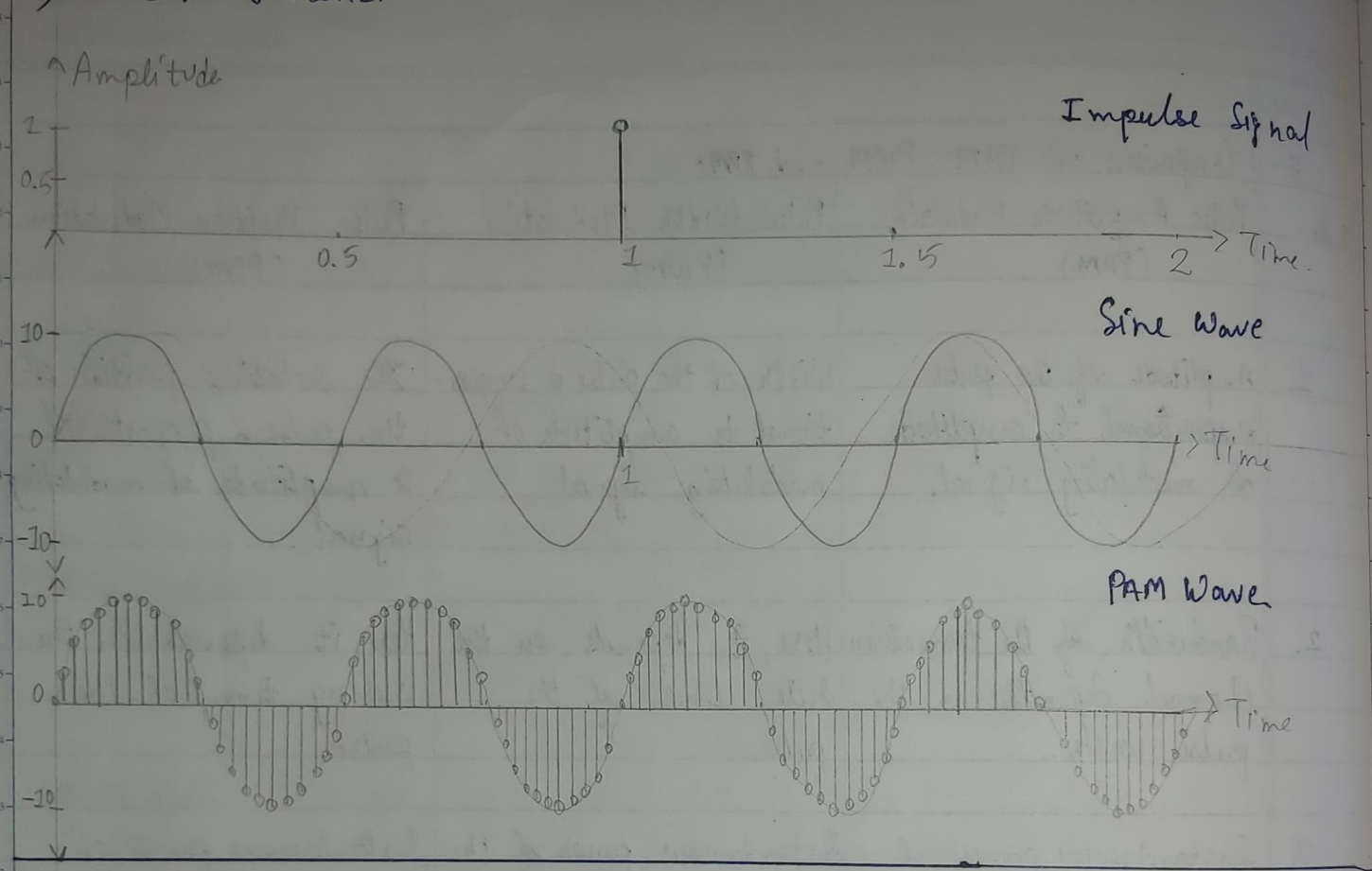




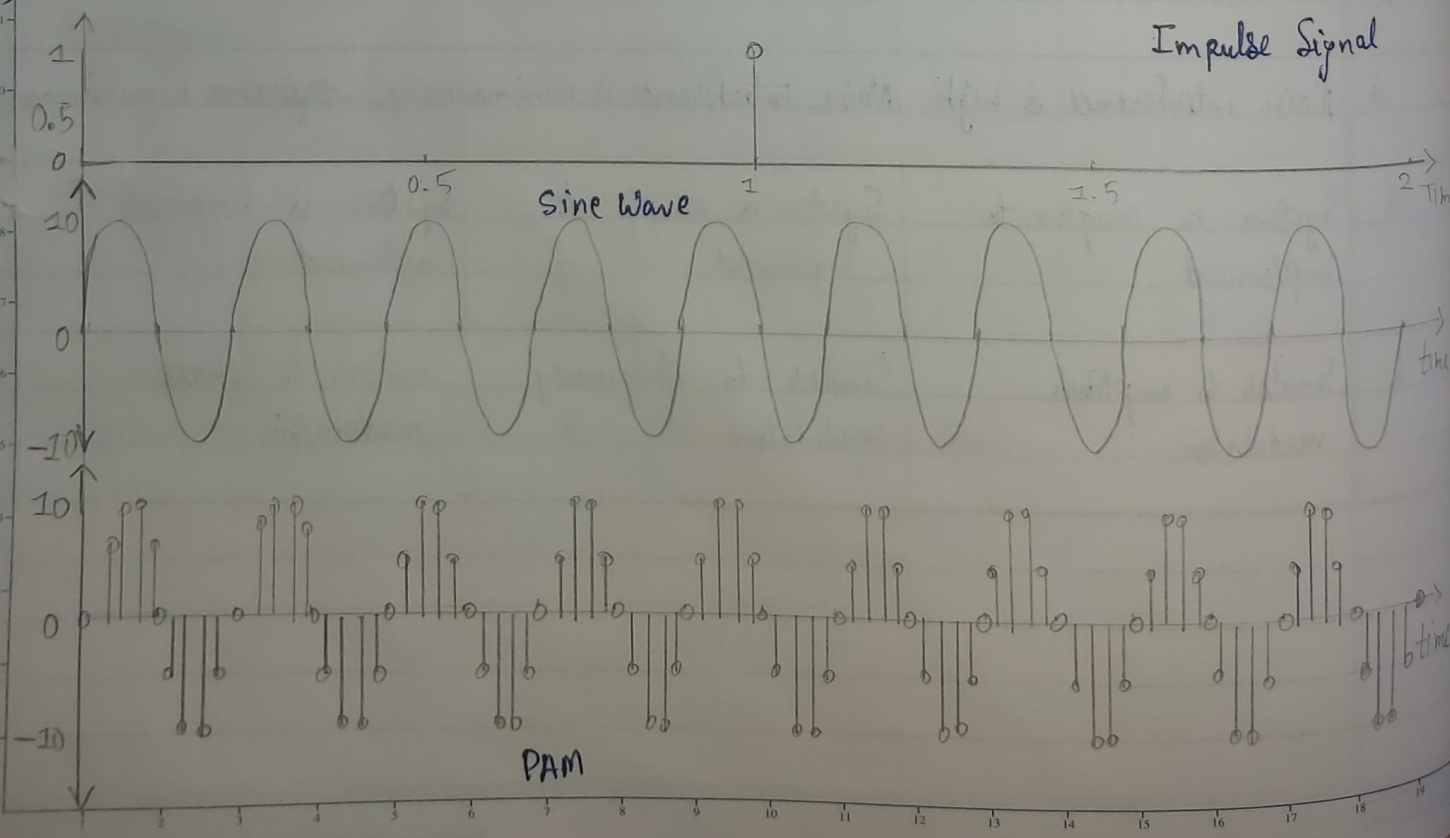
Waveform representation of PPM signal generation.

PAM with Ideal Sampling.

1) A = 1 V f = 2 Hz.

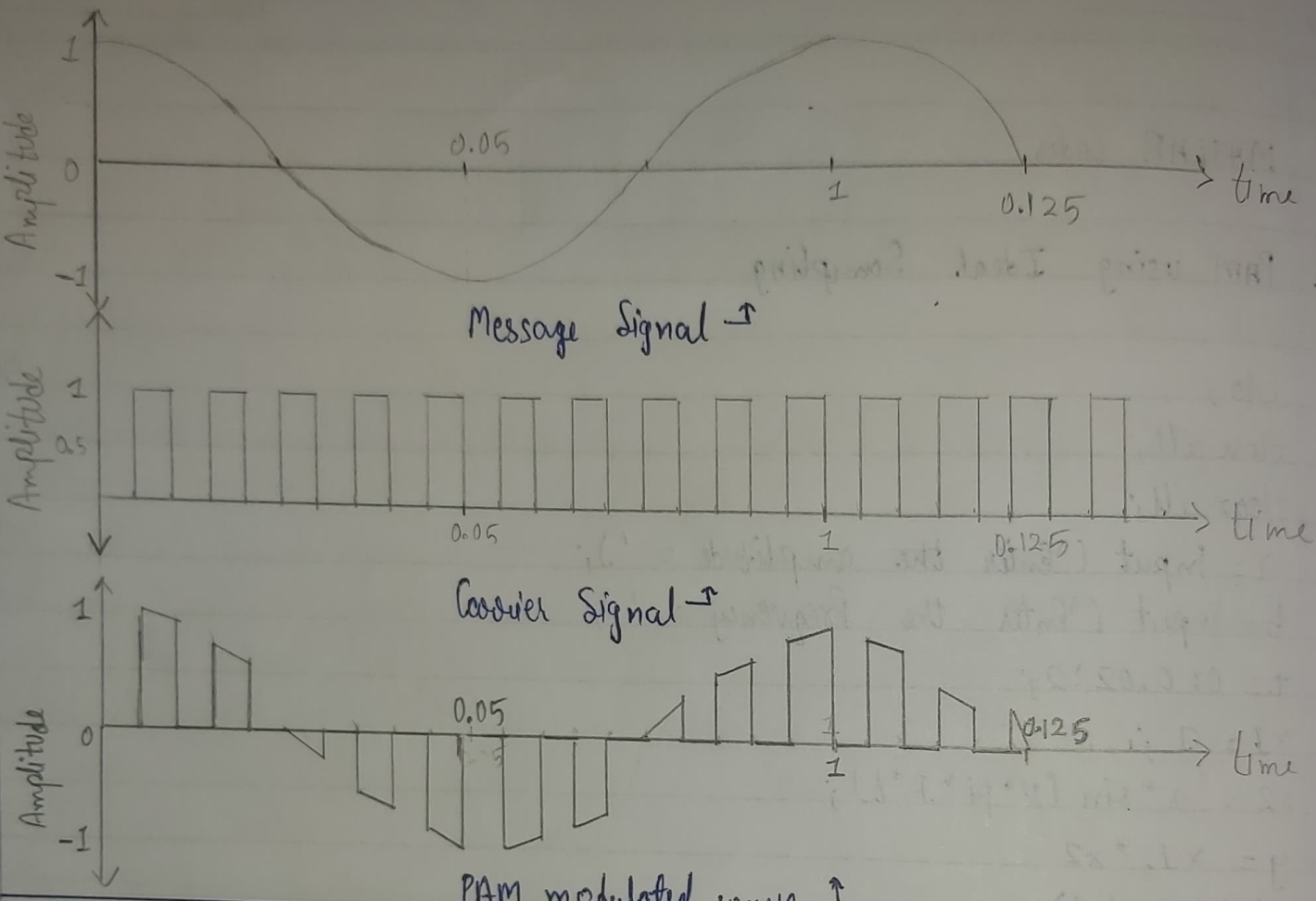


2) A = 10V f = 5Hz.

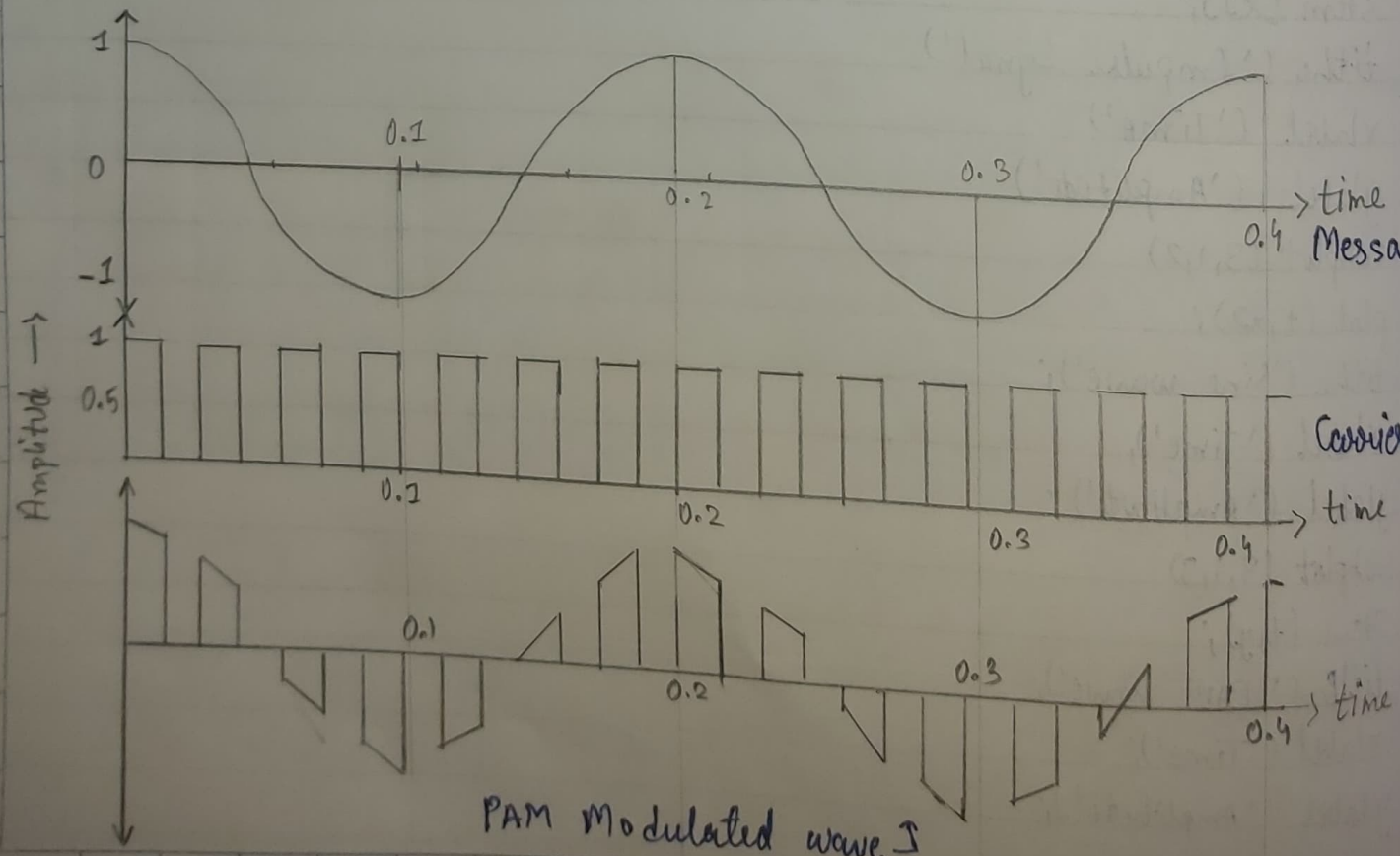


PAM using Square wave.

1) $f_c = 100$ $F_m = 10$ $f_s = 10,000$

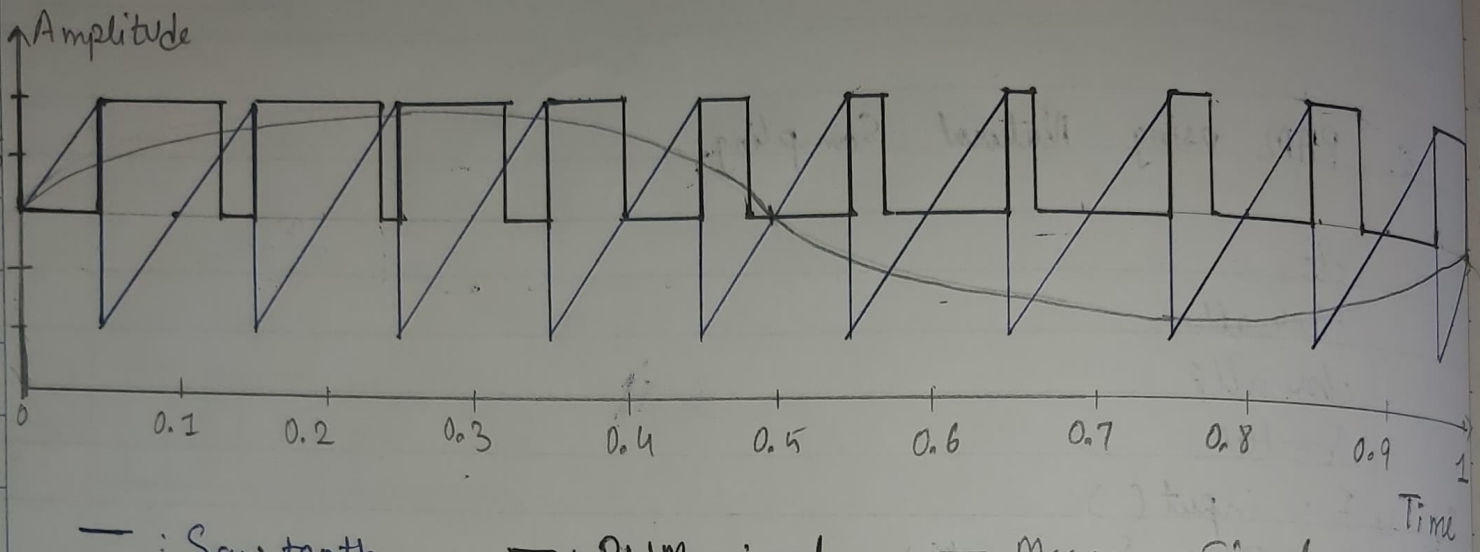


2) $f_c = 50$ $F_m = 5$ $f_s = 5000$



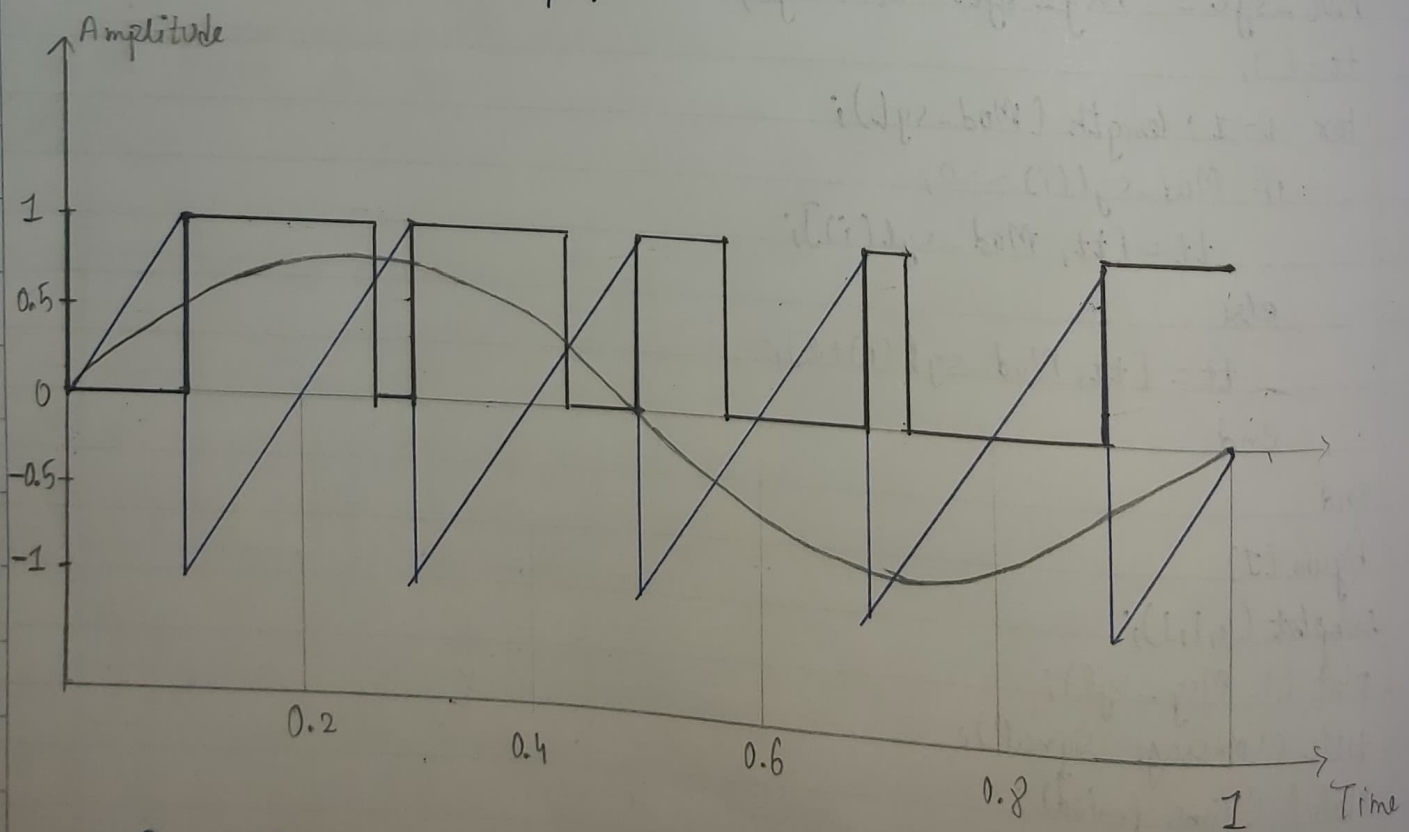
PWM

1) S = sawtooth(2*pi*10*t + pi);



— : Saw tooth — : PWM signal — Message Signal.

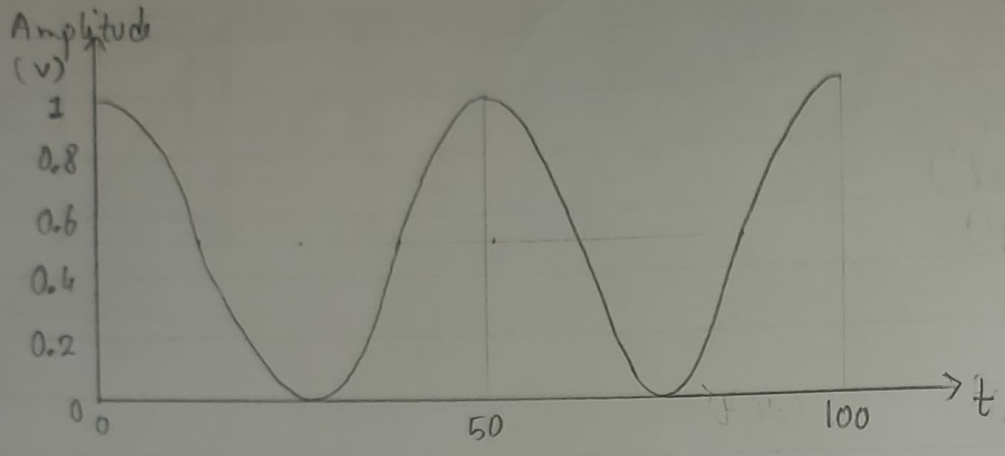
2) S = Sawtooth(2*pi*5*t + pi);



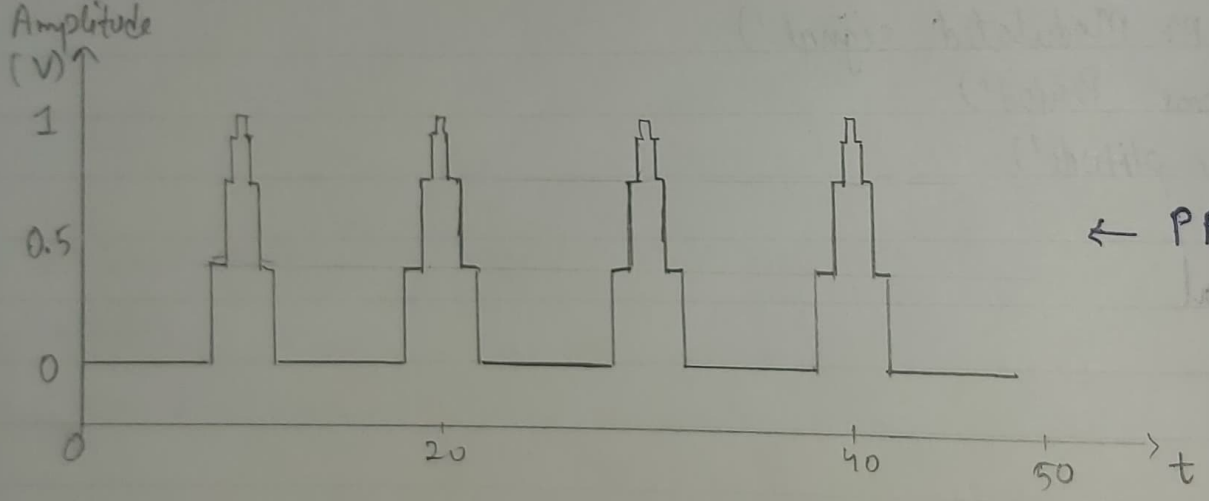
— Saw tooth — PWM Signal — Message Signal

PPM signal

1) $f_t = 1000$ $f_s = 10000$ $f_m = 200$

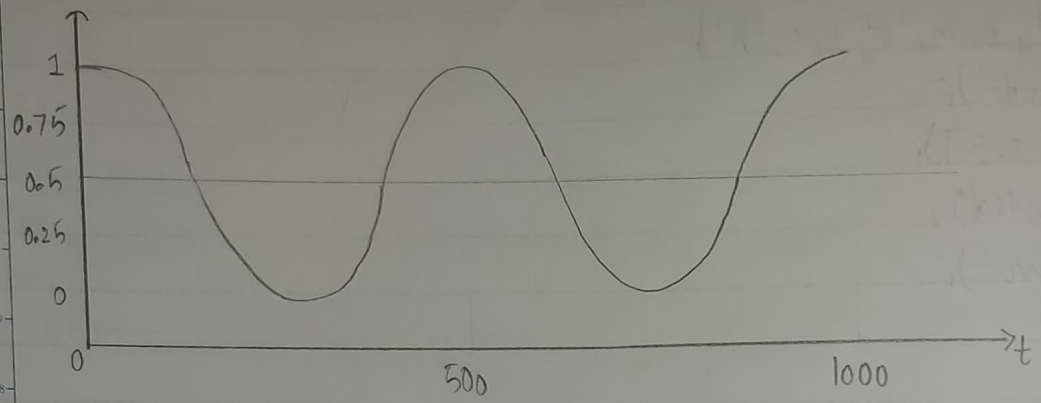


Message Signal

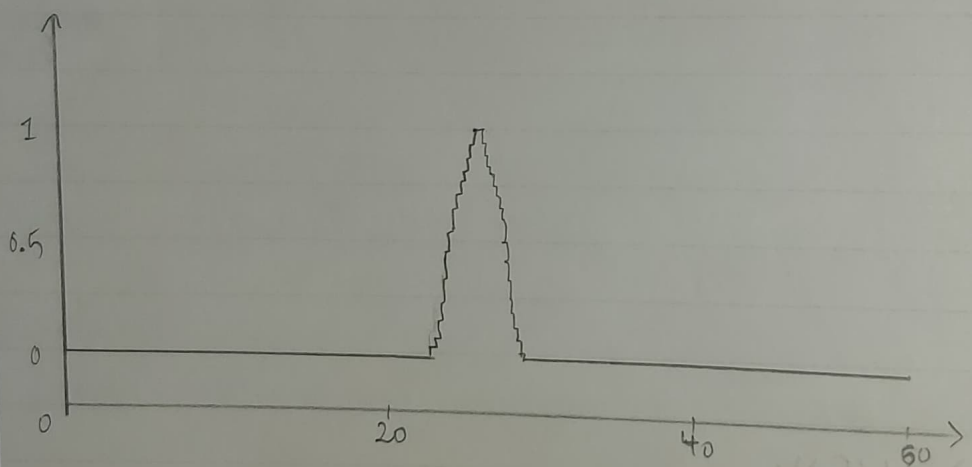


← PPM

2) $F_c = 40;$ $F_s = 1000;$ $F_m = 2;$



Message Signal



PPM

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AIM :

CONCLUSION: We successfully examined Pulse Amplitude Modulation, Pulse position Modulation, Pulse width modulation and also verified their waveforms. We also illustrated circuits for PAM and PWM. We performed our experiment successfully using MATLAB.