Date 23/9/2020

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Experiment No: 06
ASK, PSK and FSK Generation

Objective: To study the amplitude shift keying (ASK), frequency shift keying (FSK) and phase shift keying (PSK) modulation technique and verify waveforms. Illustrate the schematic diagrams for ASK, FSK & PSK. Show and draw input/output waveforms using Matlab code / Simulink using virtual mode.

Software: Matlab/ Simulink

Theory:

ASK:

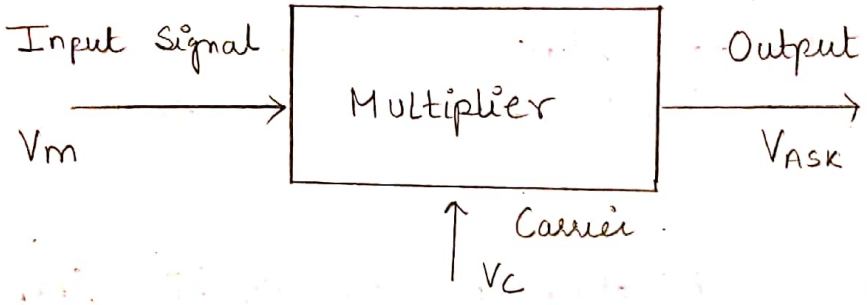
In case of amplitude shift keying the amplitude of the resultant output (modulated) depend upon the input data. This is also a type of Amplitude modulation which represent the binary data in form of the variation in amplitude of signal.

ASK is a digital modulation technique defined as the process of shifting the amplitude of the carrier signal between two levels, depending on whether 1 or 0 is to be transmitted.

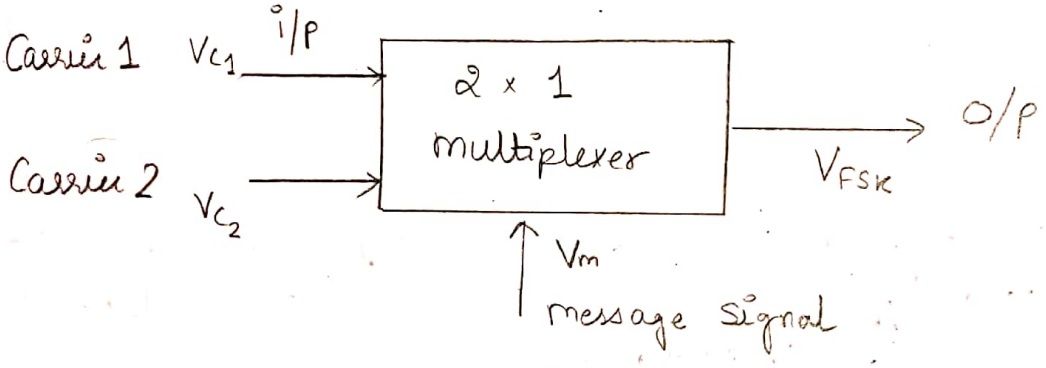
Let the message signal be binary sequence of 1's and 0's. It can be represented as function of time as follows.

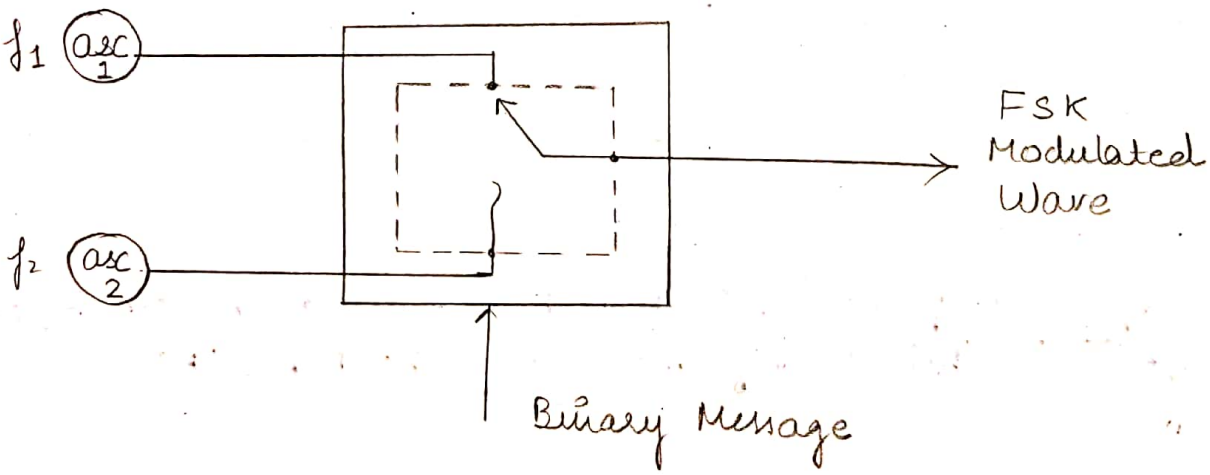
BLOCK DIAGRAM :

1) Block diagram of generation of ASK Signal →

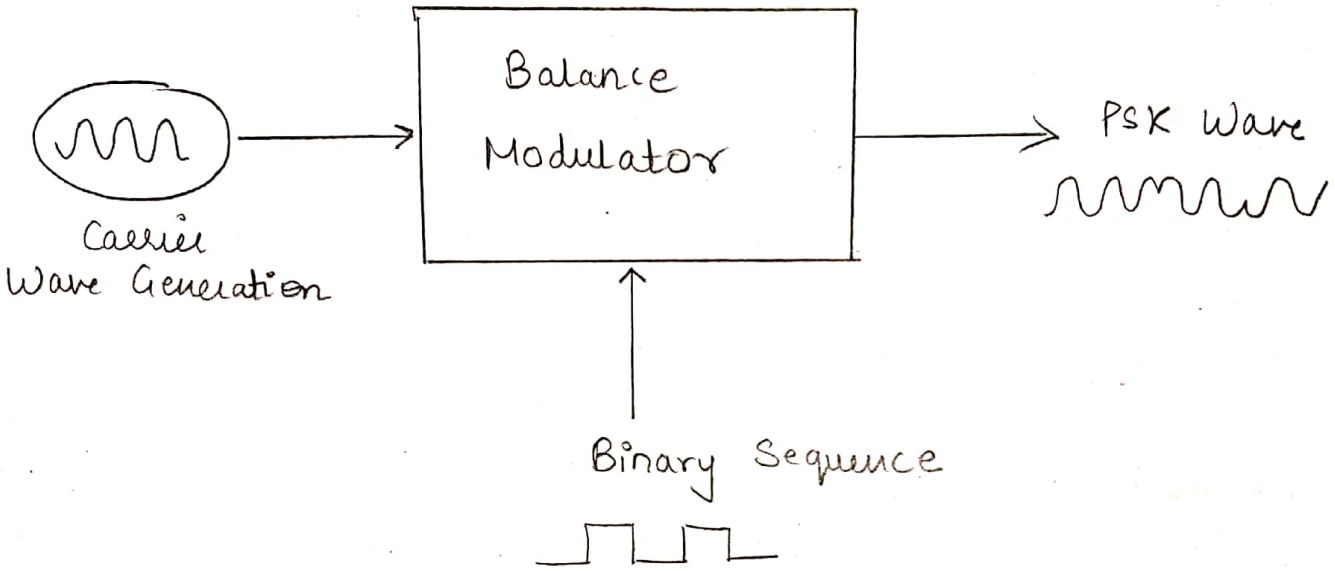


2) Block diagram of FSK Generator →





3) Block diagram showing generation of PSK



$V_m = \begin{cases} V_m, \text{ when symbol is 1} \\ 0, \text{ when symbol is 0} \end{cases}$

Let the carrier be defined as,

$V_c = V_c \cos \omega_c t$

Then corresponding ASK signal is given by product of V_m and V_c as,

$V_{ASK} = V_m V_c \cos \omega_c t$, when symbol is 1

$= 0$, when symbol is 0

FSK:

In case of frequency shift keying, output signal will be either high or low, depending upon the input data applied.

FSK is the digital modulation technique in which the frequency of the carrier signal varies according to discrete digital changes. FSK is a scheme of frequency modulation.

Let V_m be the message signal

$V_m(t) = V_m$

Let the two carries be defined as,

$V_{c_1} = V_c \cos \omega_{c_1} t$

$V_{c_2} = V_c \cos \omega_{c_2} t$

Then FSK corresponding signal is defined as,

$V_{FSK} = V_m V_c \cos \omega_{c_1} t$, when symbol is 1

$= V_m V_c \cos \omega_{c_2} t$, when symbol is 0

PSK:

Phase shift keying (PSK) is the digital modulation

technique, in which phase of carrier signal is changed by varying the sine and cosine input at a time. The phase of output signal get shifted depending upon the input.

MATLAB Code:

For ASK →

```
clc;
clear all;
close all;
fc = input ('Enter value of carrier frequency');
fp = input ('Enter the value of frequency for binary
            message signal');
amp = input ('Enter the amplitude for Am & Ac');
t = 0: 0.001: 1
amp = amp/2;
m = amp.*square (2*pi * fp * t) + amp;
c = amp.* sin (2 * pi * fc * t);
ask = c.* m;
subplot (3,1,1)
plot (t, m);
xlabel ('time');
ylabel ('Amplitude');
title ('message signal');
subplot (3,1,2)
plot (t, c)
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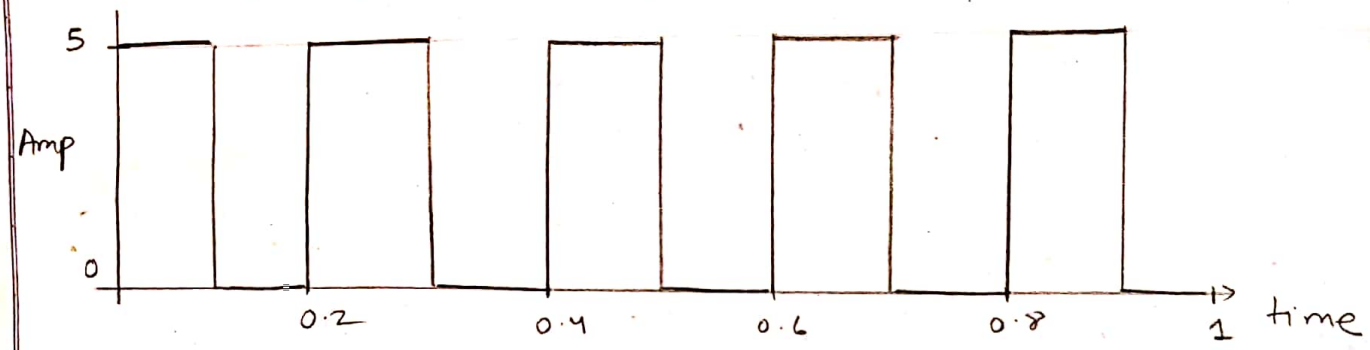
```
xlabel('time')
ylabel('Amplitude')
title('carrier')
subplot(3,1,3)
plot(t, ask);
xlabel('Time')
ylabel('Amplitude')
title('ASK modulated signal');
```

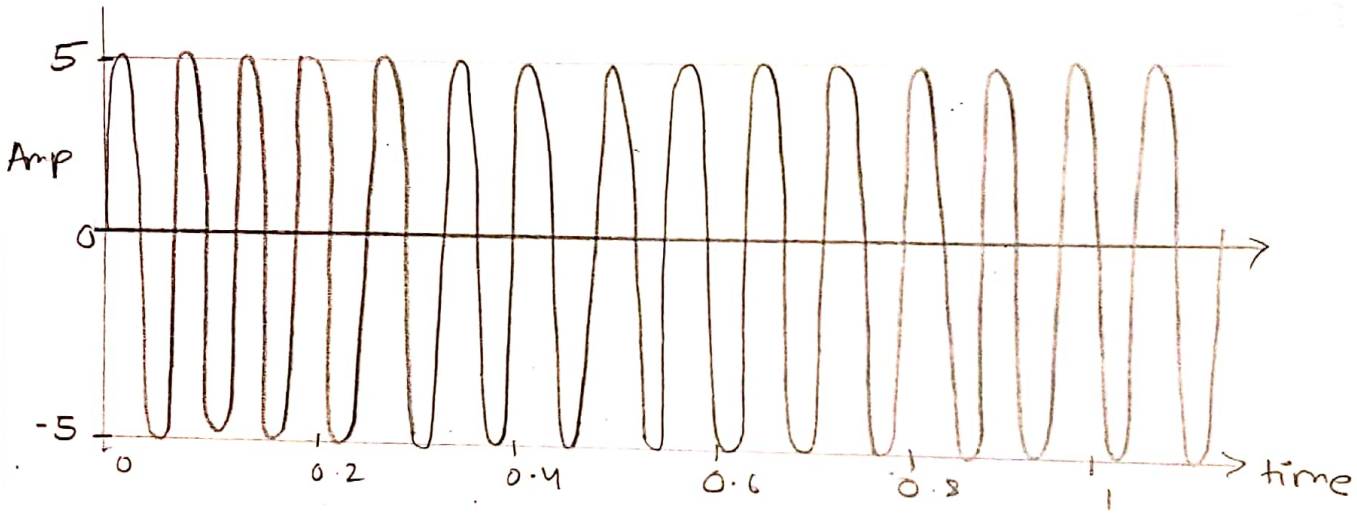
1) ASK

$f_c = 20Hz$ $f_p = 5Hz$
Amp = 5

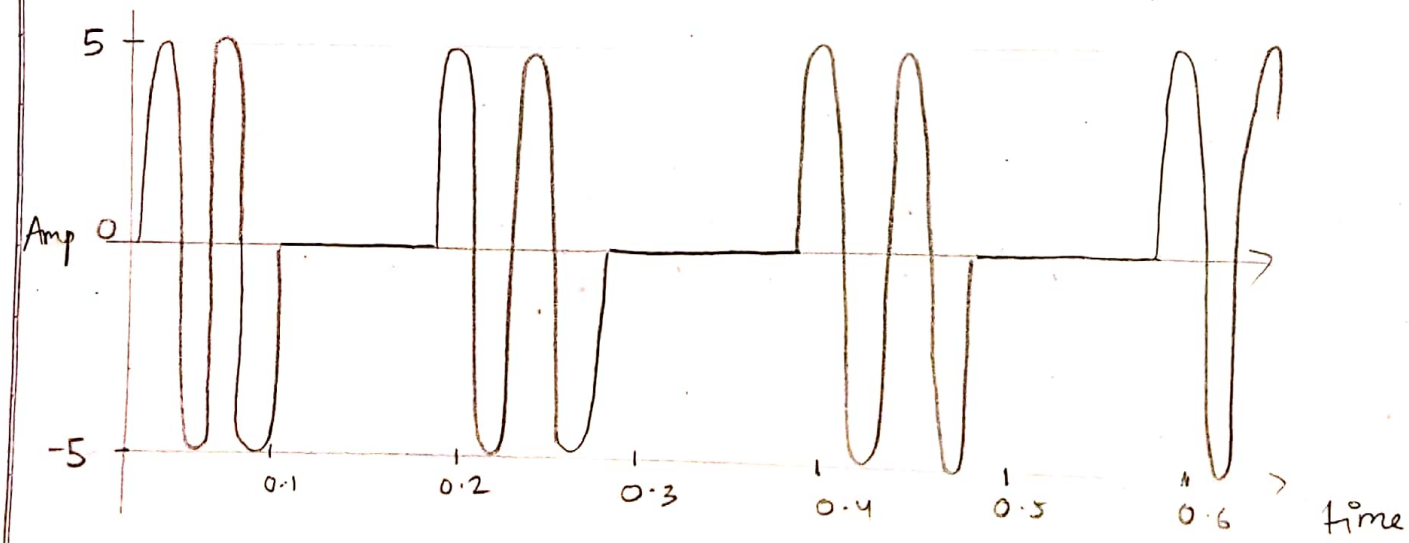
Message Signal →



Carrier Signal →



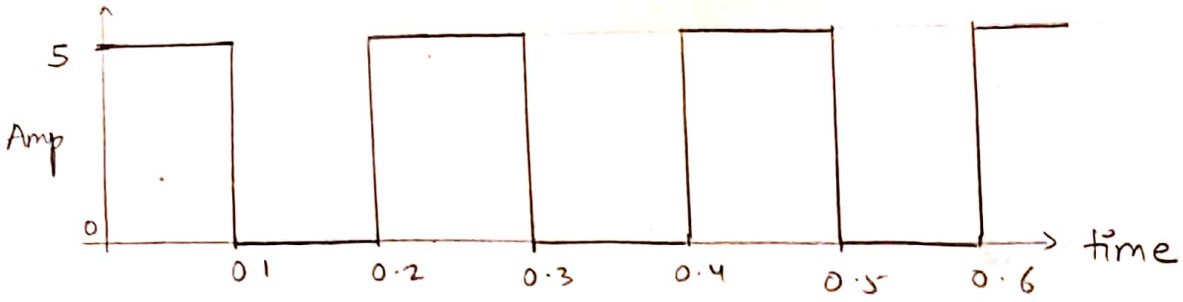
Amplitude Shift Keying Signal →



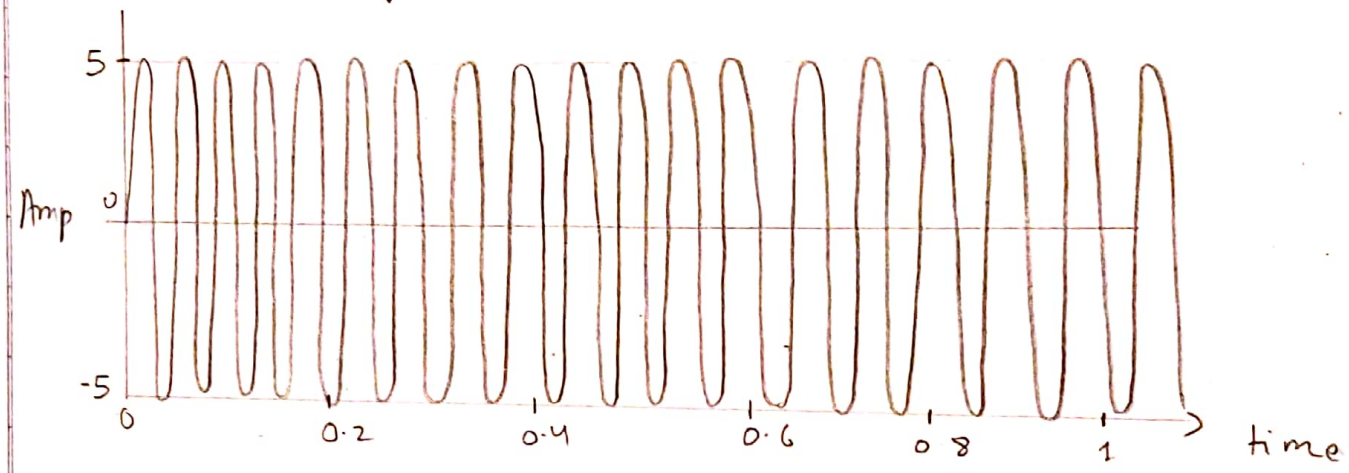
2) ASK

$f_c = 45Hz$, $f_p = 5Hz$
amp = 5

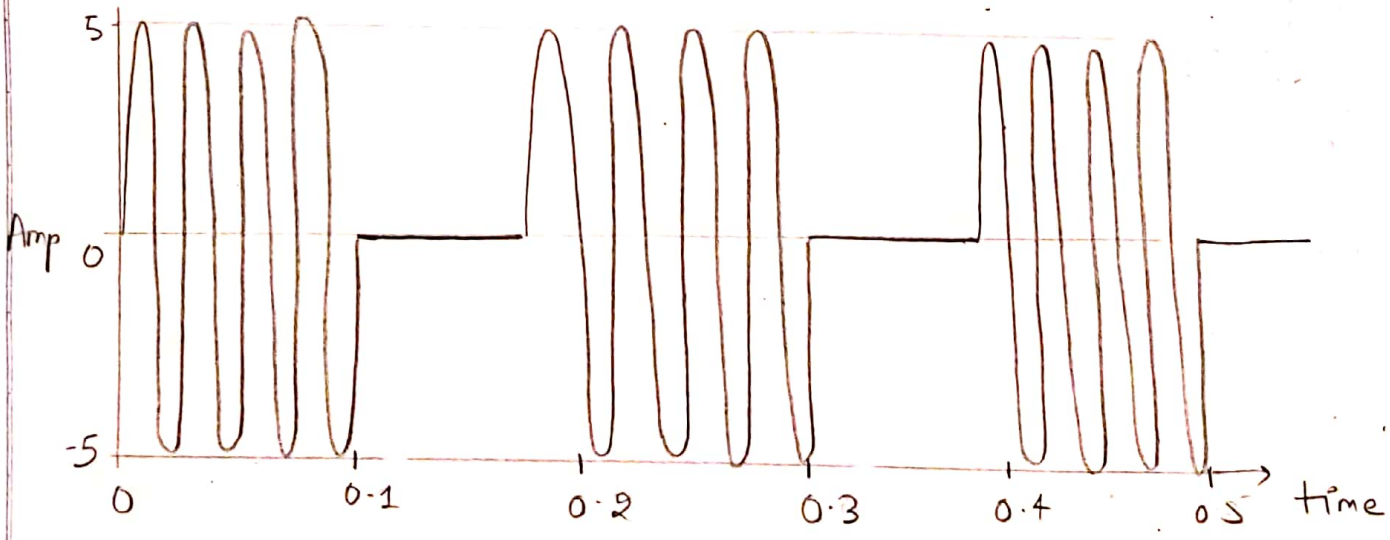
Message Signal →



Carrier Signal →

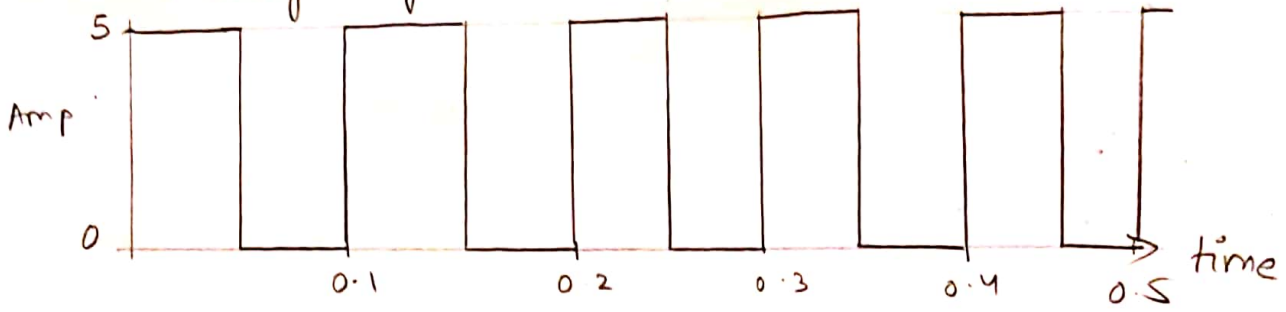


Amplitude Shift keying →

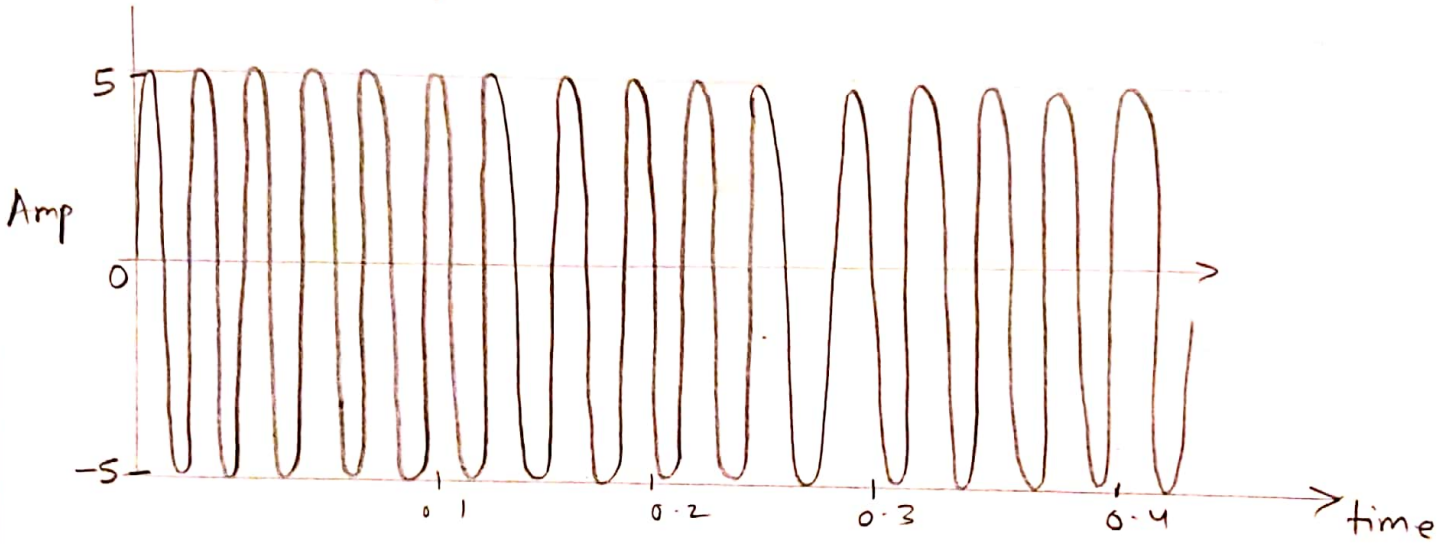


3) ASK $f_c = 50Hz$ $f_p = 10z$
amp = 5

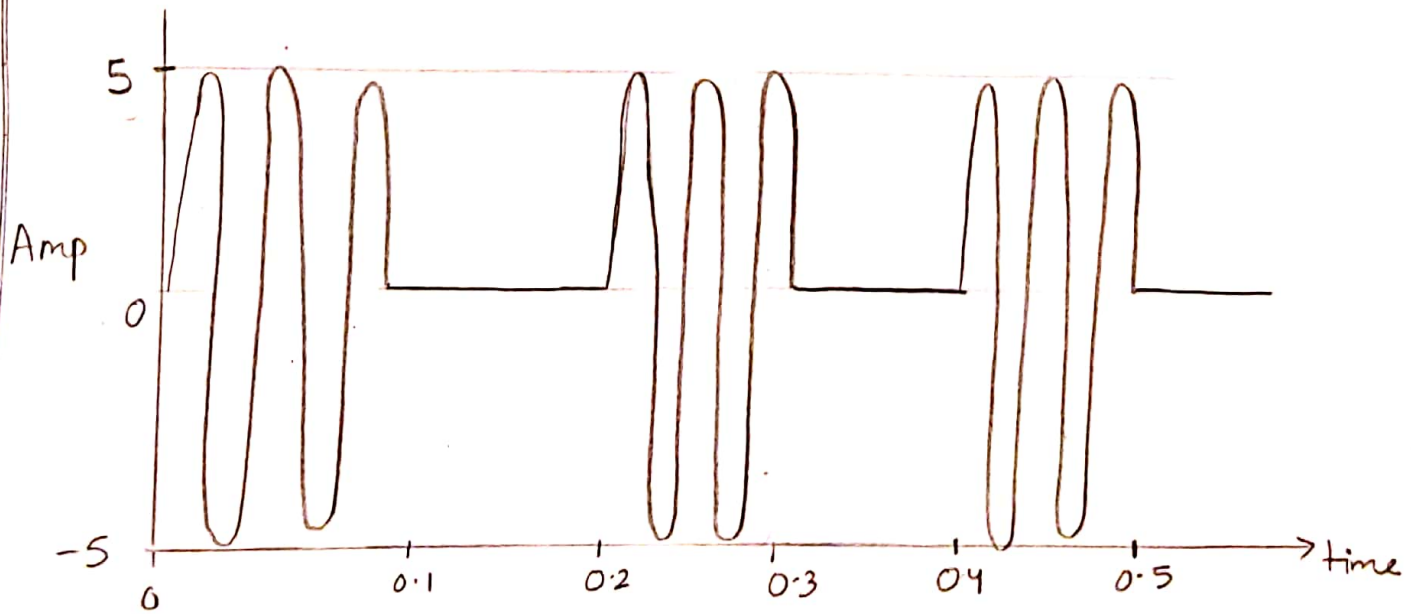
Message Signal →



Carrier Signal →



Amplitude Shift Keying Signal →



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For FSK:

```
clc;
clear all;
close all;
fc1 = input ('Enter the frequency for 1st carrier signal');
fc2 = input ('Enter the frequency for 2nd carrier signal');

fp = input ('Enter the frequency for binary message
            signal');
amp = input ('Enter the amplitude for message and
            carrier');

c1 = amp. * sin(2 * pi * fc1 * t);
c2 = amp. * sin(2 * pi * fc2 * t);

m = (amp/2). * square(2 * pi * fp * t) + (amp/2);

for i = 0:1000
    if m(i+1) == 0
        mm(i+1) = c2(i+1);

    else
        mm(i+1) = c1(i+1);
    end
end
subplot(4,1,1)
```

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```
plot (t, m)
xlabel ('Time')
ylabel ('Amplitude')
title ('Message Signal')
Subplot (4, 1, 2)
plot (t, c1)
xlabel ('time')
ylabel ('amplitude')
title ('1'st' Carrier signal')

subplot (4, 1, 3)
xplot (t, c2)
xlabel ('time')
ylabel ('Amplitude')
title ('2nd Carrier signal')

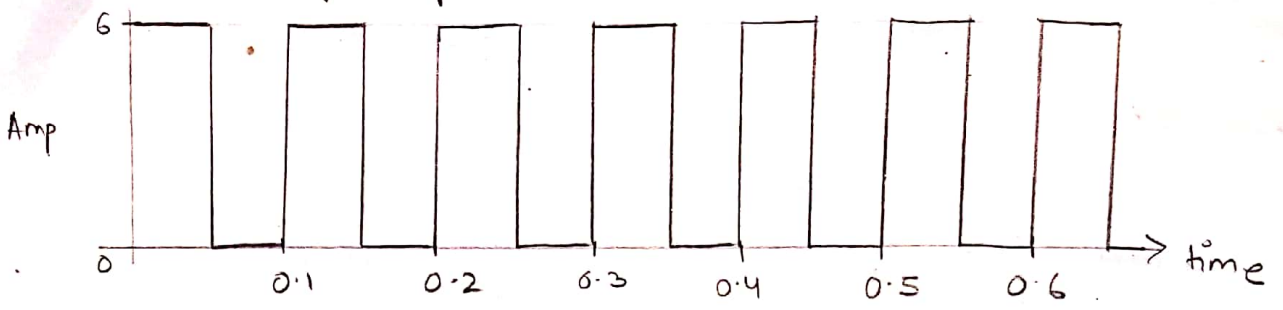
subplot (4, 1, 4)
plot (t, mm)
xlabel ('time')
ylabel ('Amplitude')
title ('FSK modulated Signal')
```

1) FSK

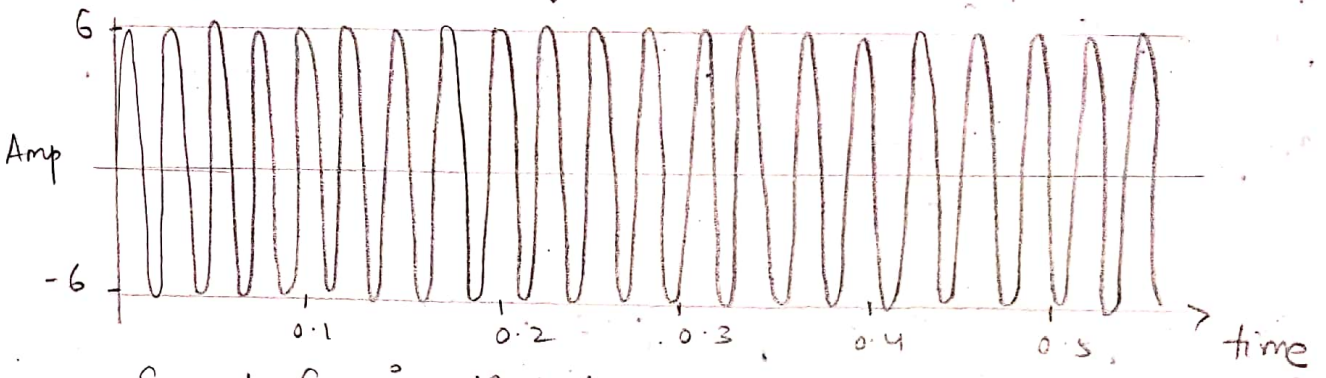
$f_{c1} = 50Hz$ $f_{c2} = 20Hz$

$f_p = 10Hz$ amp = 6

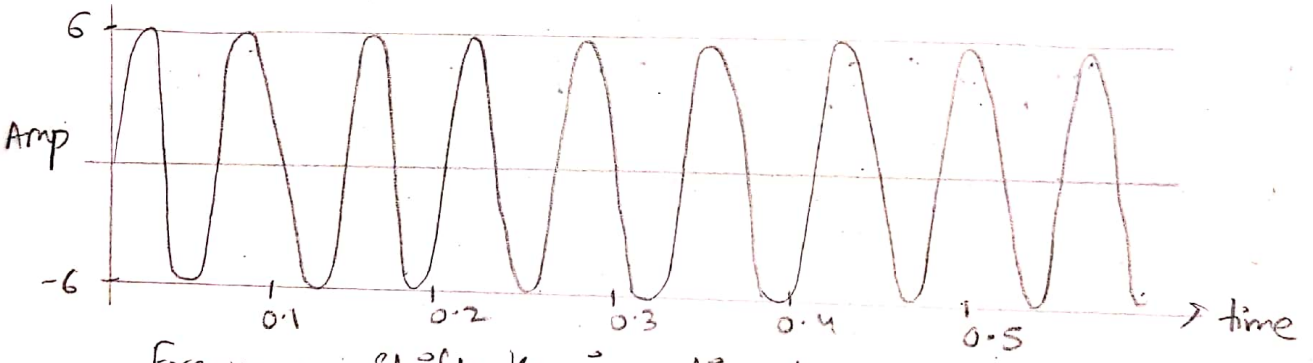
Message Signal →



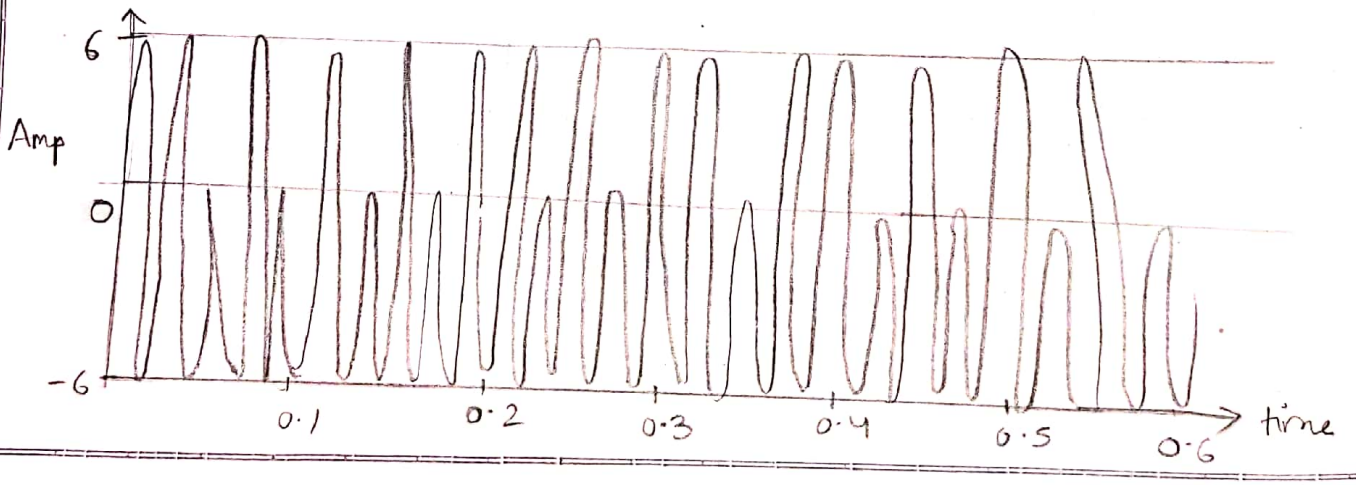
First Carrier Signal →



Second Carrier Signal →



Frequency Shift Keying Signal →

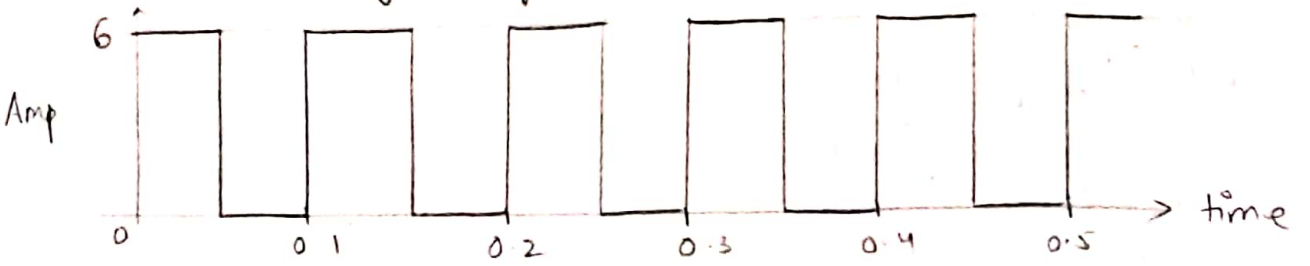


2) FSK

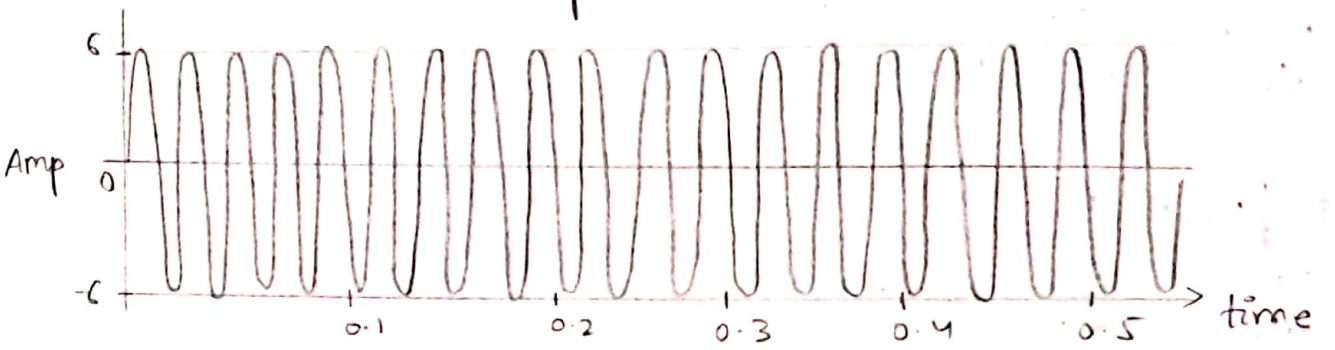
$f_{c1} = 50Hz$ $f_{c2} = 30Hz$

$f_p = 10Hz$ amp = 6

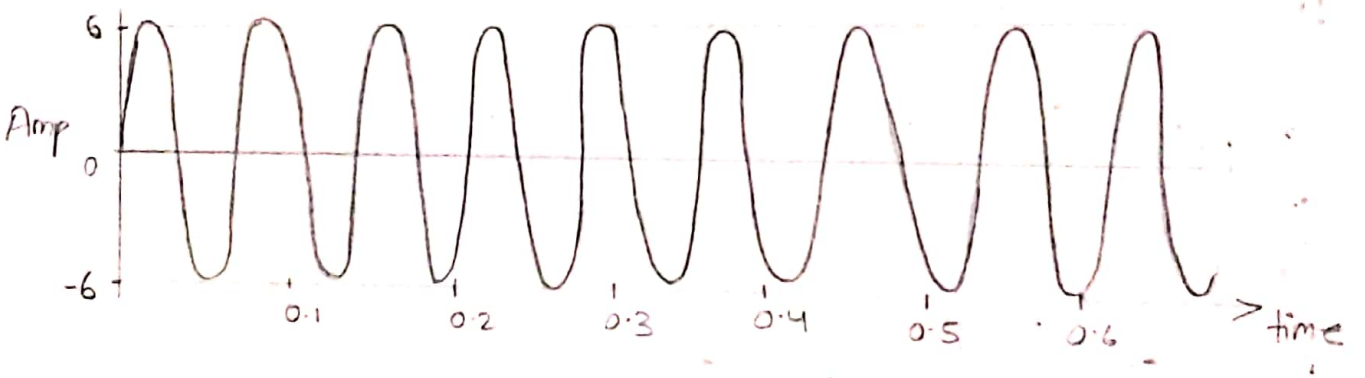
Message Signal →



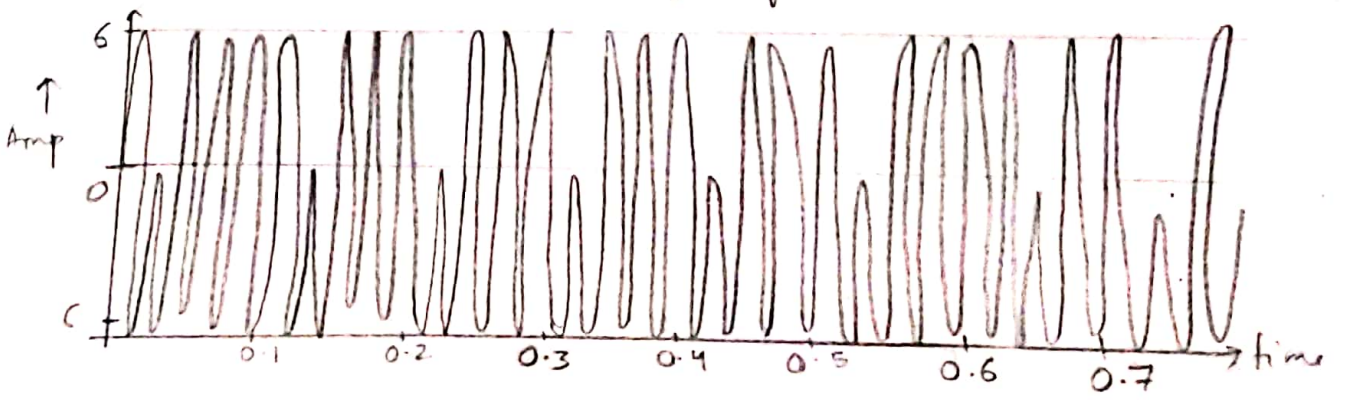
First Carrier Signal →



Second Carrier Signal →



Frequency Shift keying Signal →

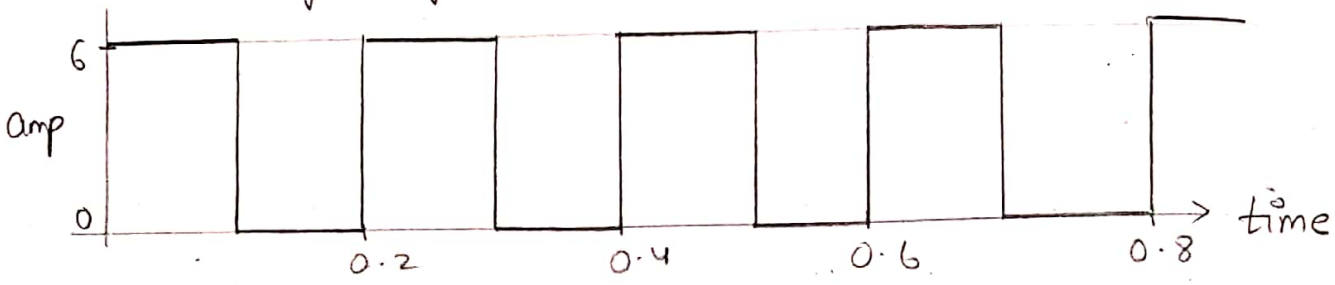


3) FSK

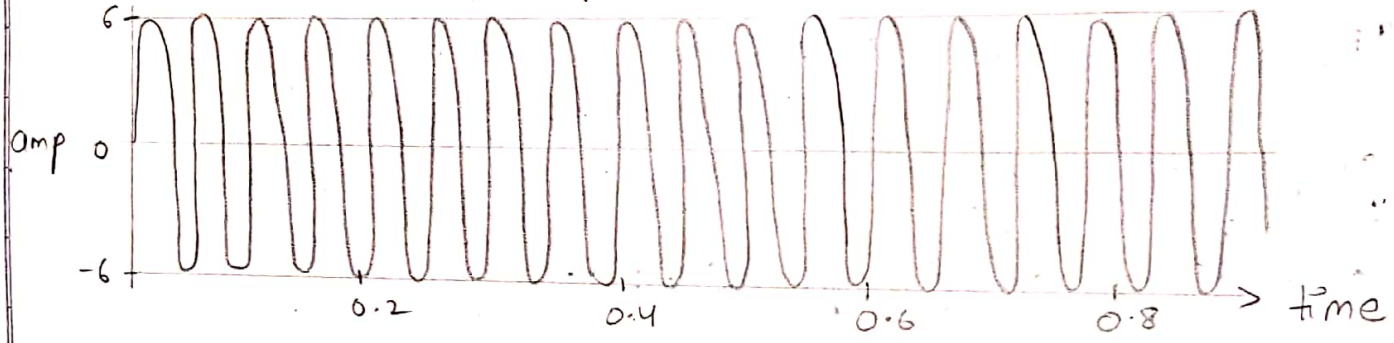
$f_{c_1} = 30Hz$, $f_{c_2} = 10Hz$

$f_p = 5Hz$, amp = 6

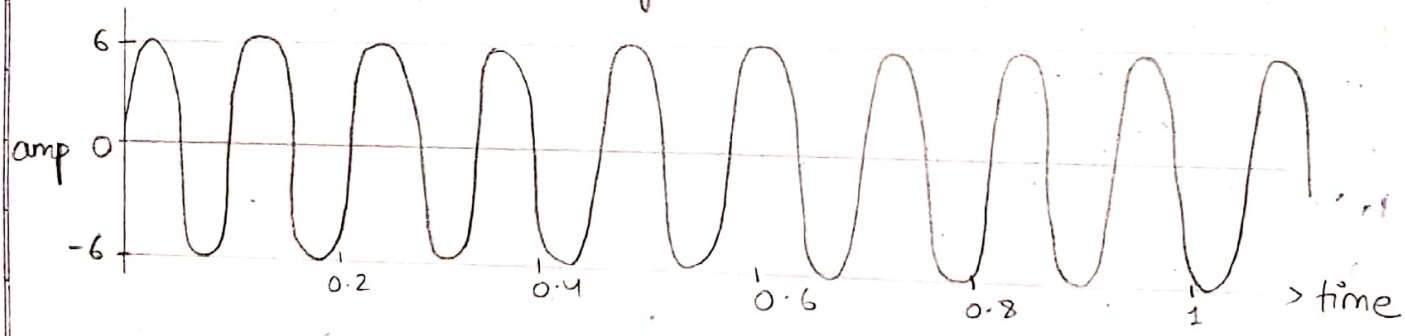
Message Signal →



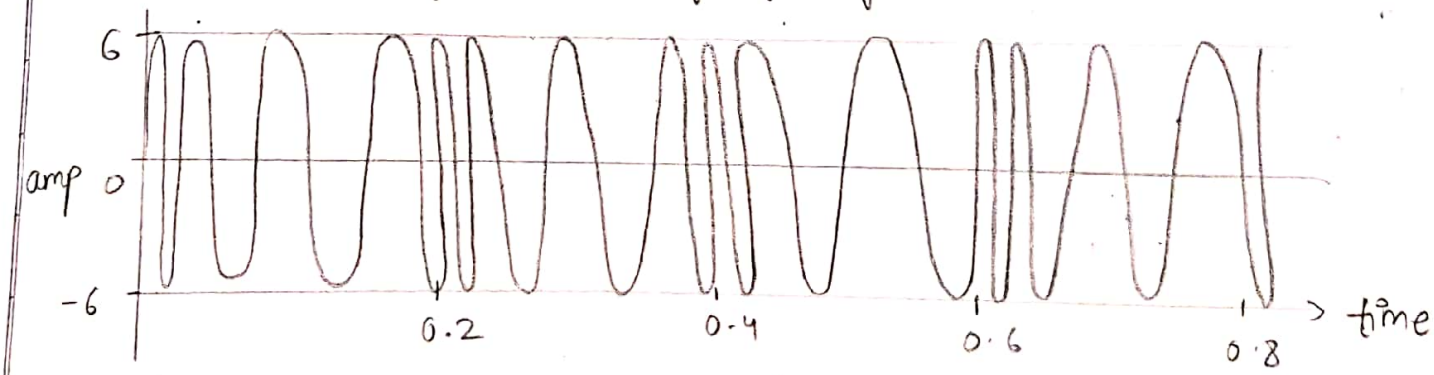
First Carrier Signal →



Second Carrier Signal →



Frequency Shift keying Signal →



For PSK:

```
clc;
close all;
clear all;
fc1 = input ('Enter the frequency of 1st sine wave carrier:');
fp = input ('Enter the frequency of periodic binary pulse (Message):');
amp = input ('Enter the amplitude (For Both Carrier and Binary Pulse Message):');
amp = amp/2;
t = 0:0.001:1;
c1 = amp.*sin(2*pi*fc1*t);

subplot (3,1,1);
plot (t, c1)
xlabel ('Time')
ylabel ('Amplitude')
title ('Carrier 1 Wave')
grid on;
m = square (2*pi*fp*t);

subplot (3,1,2)
plot (t, m)
xlabel ('Time')
ylabel ('Amplitude')
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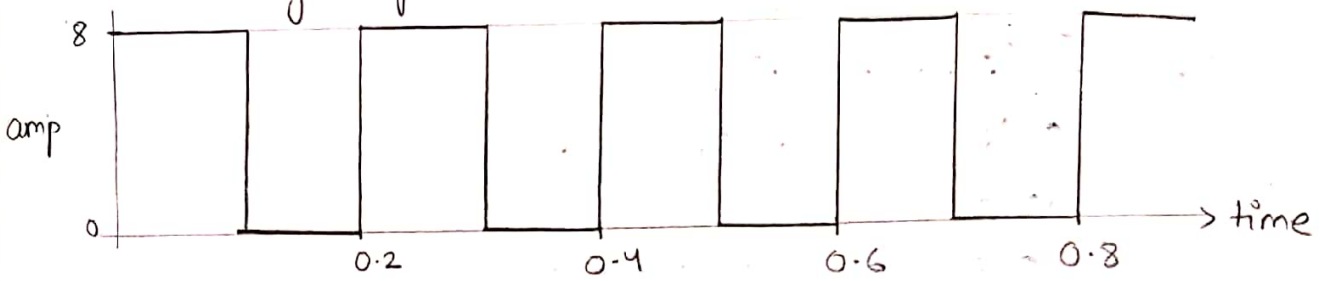
```
title('Binary Message Pulses')
grid on;
for i = 0:1000
    if (m(i+1) == 1)
        s(i+1) = c1(i+1);
        else
        s(i+1) = - c1(i+1);
    end
end

subplot(3, 1, 3)
plot(t, s)
xlabel('Time')
ylabel('Amplitude')
title('Modulated Wave')
grid on;
```

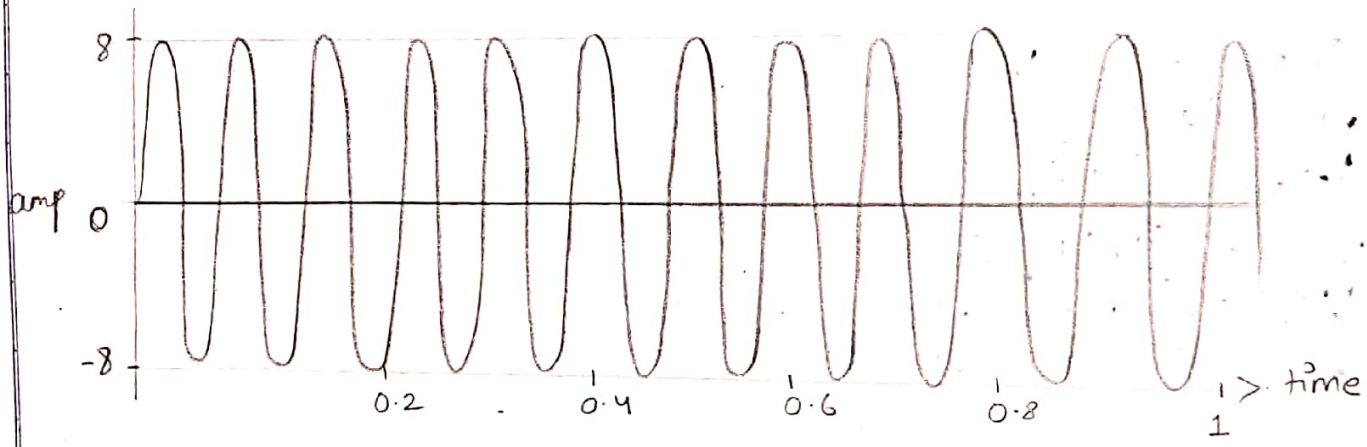
1) PSK

$f_c = 15Hz$ $f_p = 5Hz$
amp = 8

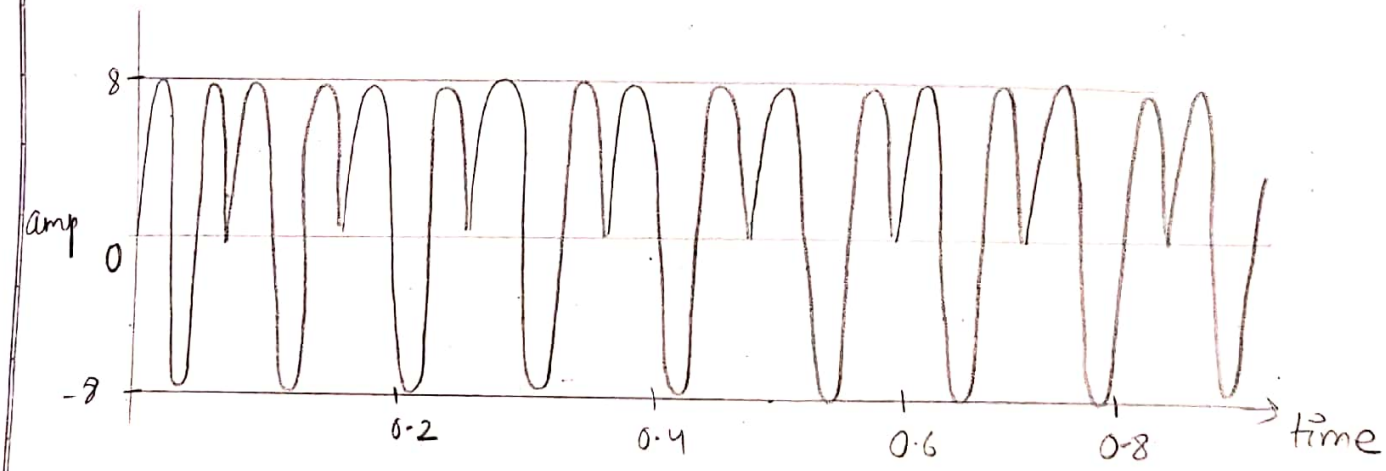
Message Signal →



Carrier Signal →



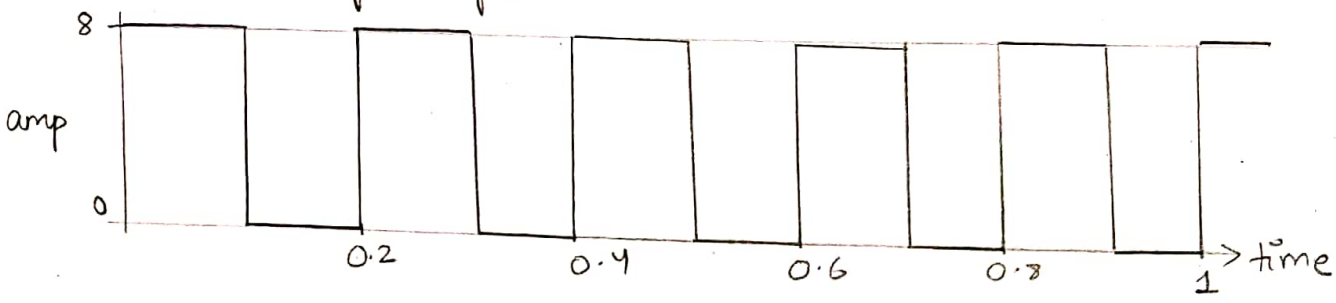
- Phase Shift Keying Signal →



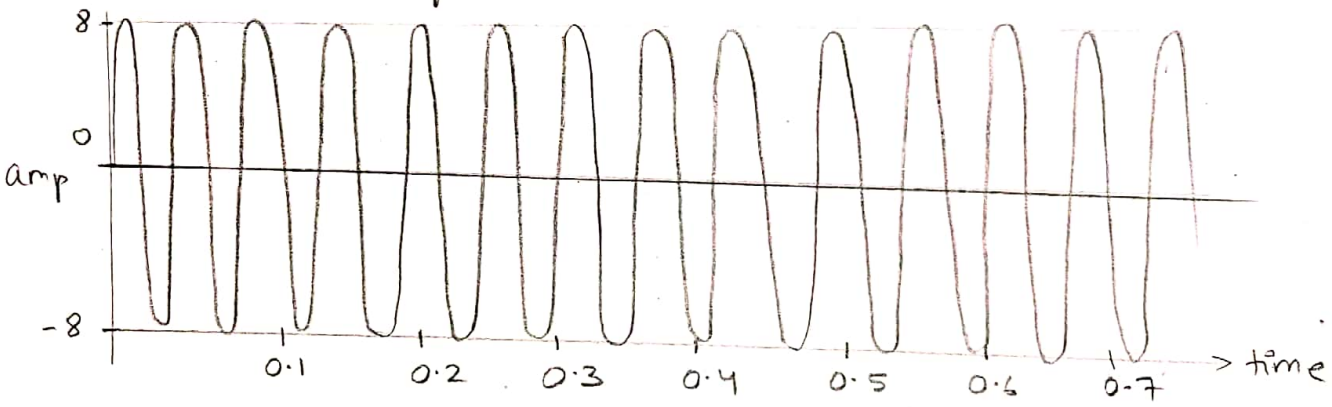
2) PSK

$f_c = 25Hz$, $f_p = 5Hz$
amp = 8

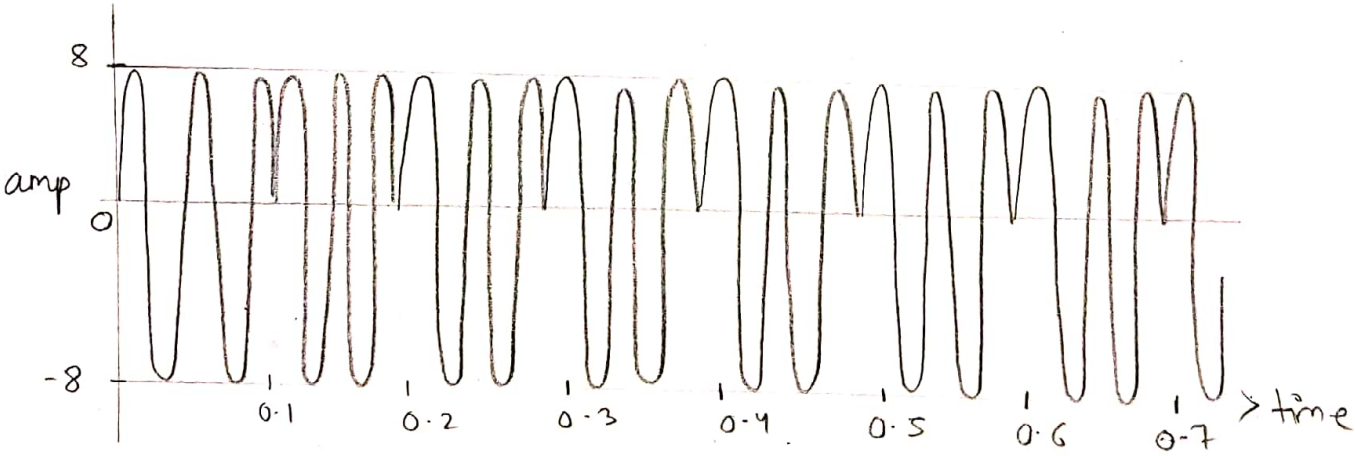
Message Signal →



Carrier Signal →



Phase Shift keying Signal →

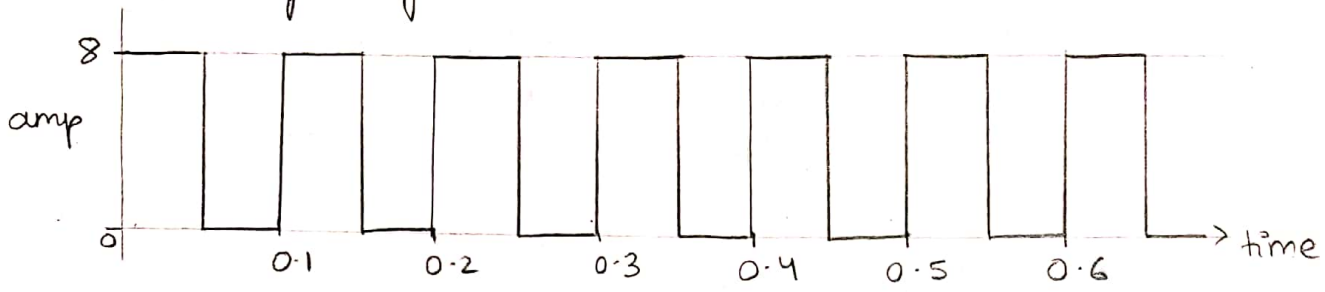


3) PSK

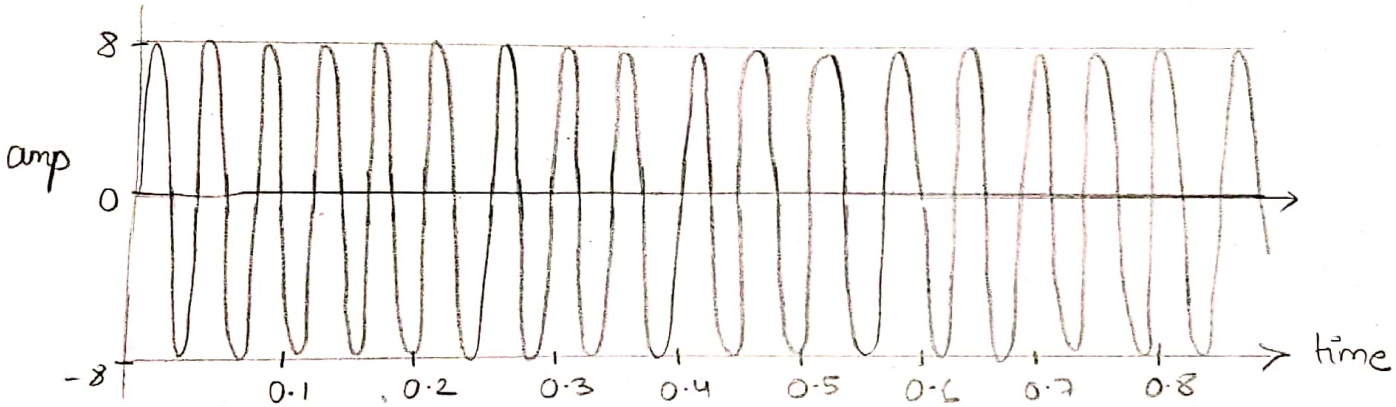
$f_c = 40Hz$, $f_p = 10Hz$

amp = 8

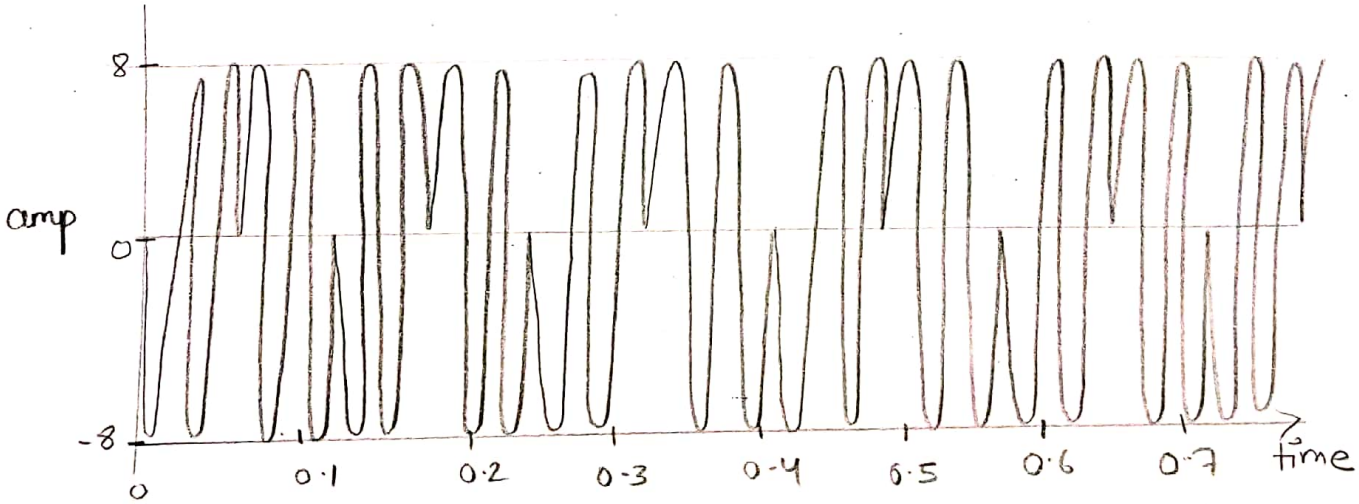
Message signal →



Carrier signal →



Phase Shift keying →



Advantages:

ASK →

- It offers high bandwidth efficiency
- Has simple receiver design.
- ASK modulation and demodulation is comparitively inexpensive.
- Can be used to transmit digital data over optical fiber.

FSK →

- Easy to implement, high data rate, provides high SNR
- Used for long distance communication
- Power requirement is constant and FSK has good sensitivity
- It has better immunity than ASK method, so the probability of error-free reception of data is high.

PSK →

- It carries data over RF signal more effiiently compared to the other modulation types. Hence it is more power efficient mod-ulation compared to ASK and FSK.
- It is less susceptible to errors compared to ASK and occupies same bandwidth as ASK
- It allows information to be transmitted in the radio commun-ication in a way more effiiently as compared to that of FSK.

Conclusion:

Successfully performed ASK, FSK, PSK modulation techniques and verified their waveforms using the MATLAB Software.