

Experiment - 1

Aim: To study DSB-FC modulation and demodulation.

Apparatus required:- ST 2201 and ST 2202, with proper supply cord, CRO with connecting probes, connecting cords.

Theory: In the process of amplitude modulation the modulated signal wave consist of the carrier wave and two side bands. The modulated signal has the information in the whole band except at the carrier frequency.

A side band is a band of frequencies, containing power which are the lower and higher frequency. Both the band contains some information.

Depth of modulation: The amount by which the amplitude of carrier wave increases and decreases depend on the amplitude of information signal and is called the depth of modulation and

$$\text{Percentage Modulation} = \frac{V_{\text{max}} - V_{\text{min}}}{V_{\text{max}} + V_{\text{min}}} \times 100\%$$

DSB FC Expression:

$$V_m(t) = F_c \sin(2\pi f_c t) - \frac{M F_c}{2} \cos(2\pi(f_c + f_m)t) + \frac{M F_c}{2} \cos(2\pi(f_c - f_m)t)$$

Procedure:

1. The first the audio signal and find the amplitude and frequency by tracing off in the CRO.
2. Do the same for demodulated carrier signal and modulated signal.
3. Trace the final demodulated signal from the receiving kit.
4. From the traces calculate V_{max} & V_{min} from the above readings.

Result: Double side band full carrier (DSBFC) signal was modulated and demodulated successfully and waves are generated on CRO.

Precautions: 1. Connections should be tight.
2. Proper reading should be taken.

Viva - Voice

Q-1 Define amplitude modulation:-

Amplitude modulation is a type of modulation technique in which the amplitude of high frequency carrier wave is varied in accordance of modulating signal.

Q-2 What is modulation index?

Modulation Index is the measure of depth of modulating wave. It is number value between 0 and 1.

Q-3 What is the range of commercial and broadcast bands

535 kHz	-	1605 kHz	(Medium wave)
1.6 kHz	-	4.5 MHz	(Short wave I)
4.5 MHz	-	16 MHz	(Short wave II)
16 MHz	-	25 MHz	(Short wave - II)

Q-4 which kind of modulation is used in picture signal in television broadcast.
Vertical sideband (VSB)

Python code :-

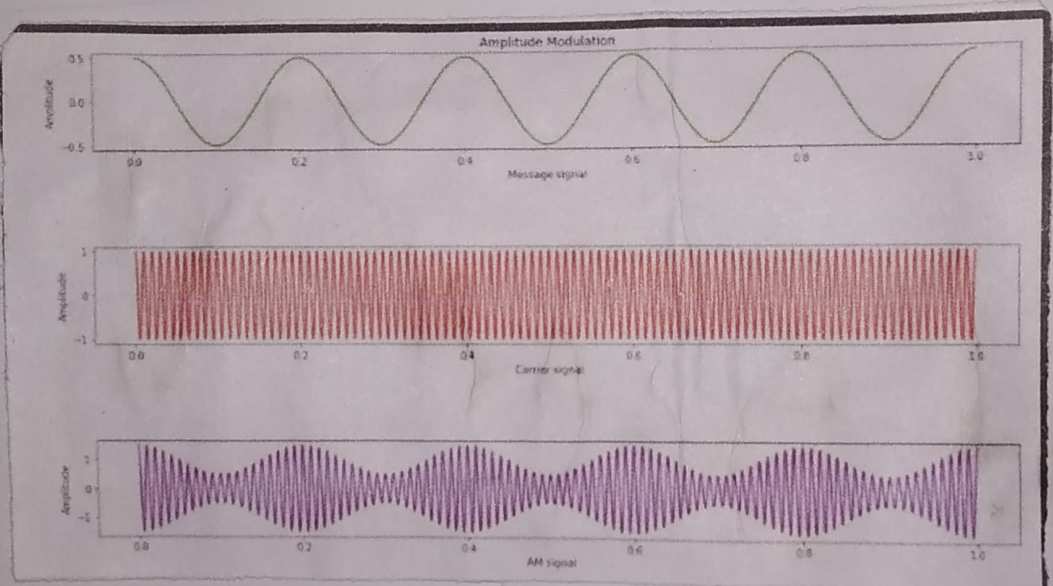
```
import numpy as np
import matplotlib.pyplot as plt
from math import pi
```

```
A_c = float(input('center carrier amplitude: '))
f_c = float(input('center carrier frequency: '))
A_m = float(input('center message amplitude: '))
f_m = float(input('center message frequency: '))
modulation_index = float(input('center modulation index: '))
```

```
fs = 5000
t = np.arange(0, 1, 1/fs)
```

```
carrier = A_c * np.cos(2 * np.pi * f_c * t)
modulation = A_m * np.cos(2 * np.pi * f_m * t)
product = A_c * (1 + modulation_index * np.cos(2 * np.pi * f_m * t)) * np.cos(2 * np.pi * f_c * t)
```

```
plt.subplot(3, 1, 1)
plt.plot(t, carrier, 'r')
plt.ylabel('Amplitude')
plt.xlabel('Carrier Signal')
```

```
plt.subplot ( 3,1,1)
plt.title ('Amplitude Modulation')
plt.plot ( +, modulator , 'g')
plt.ylabel ('Amplitude')
plt.xlabel ('Message Signal')
```

```
plt.subplot ( 3,1,3)
plt.plot ( +, product , color = "purple")
plt.ylabel ('Amplitude')
plt.xlabel ('Am Signal')
```

```
plt.subplots_adjust ( hspace = 1)
plt.rcParams ( 'font' , size = 15)
fig = plt.gcf()
fig.set_size_inches (16, 9)
```