1.5 Lab Procedure

1.5.1 Amplitude Modulation

1. The circuit connection is made as shown in the circuit.
2. The power supply is connected to the collector of the transistor.
3. Set the input signal f_m as 1 KHz and 8 volt sinusoidal signal in AFO
4. Set the carrier signal f_c as 500 KHz and 50 millivolt sinusoidal signal in AFO
5. The Amplitude Modulated Output is taken from the collector of the Transistor.
6. Note down E_{max} and E_{min} from the Output waveform.
7. Calculate modulation index using the formula.

   Modulation index $m = \frac{Emax - Emin}{Emax + Emin}$

   $E_{max} = 0.5$ $E_{min} = 0.5$ $m = 0.5$

   $m = \frac{E_{max} - E_{min}}{E_{max} + E_{min}} = 0.5$
8. Plot the input signals and obtained AM output waveforms in the graph sheet

1.5.2 Amplitude Demodulation

1. The circuit connections are made as shown in the circuit diagram.
2. The amplitude modulated signal from AM generator is given as input to the demodulator circuit.
3. The demodulated output is observed on the CRO
4. Plot the obtained AM demodulated output waveforms in the graph sheet

1.6 Observation - Hardware

Signal name	Amplitude	Frequency	Time period
Modulating signal	8V	1 kHz	1 ms
Carrier signal	100 mV	500 kHz	2 µs
Modulated signal	1.9 V	500 kHz	2 µs
Demodulated signal	0.5	1 kHz	1 ms

ANALOG AND DIGITAL COMMUNICATION LAB

EXPERIMENT-I : AMPLITUDE MODULATION & DEMODULATION

I Pre-Lab:

1. Define modulation?

Soln Modulation is defined as the process of superimposing a low frequency signal on a high frequency carrier signal.

2. Why modulation is necessary for communication system?

Soln The message signals have a very low frequency due to which these signals cannot be transmitted over long distances. Hence such low-frequency message signals are modulated over the higher frequency carrier signal due to several factors.

3. The maximum peak to peak voltage of an AM wave is 16mV and the minimum peak to peak voltage is 4mV. Calculate the modulation factor.

Soln Maximum Voltage $V_{max} = 16/2 = 8mV$

Minimum Voltage $V_{min} = 4/2 = 2mV$

Modulation factor $= \frac{V_{max} - V_{min}}{V_{max} + V_{min}} = \frac{8-2}{8+2} = 0.6$

4. The load current in the transmitting antenna of an unmodulated AM transmitter is 8A. What will be the antenna current when modulation is 40%?

Soln $P_s = \frac{1}{2} m^2 P_c$

$P_T = P_c + P_s = P_c \left(1 + \frac{m^2}{2}\right)$

$\frac{P_T}{P_c} = 1 + \frac{m^2}{2}$

$\left(\frac{I_T}{I_c}\right)^2 = 1 + \frac{m^2}{2}$; Given that $I_c = 8A$, $m = 0.4$

$$\left(\frac{I_T}{8}\right)^2 = 1 + \frac{(0.4)^2}{2}$$

$$\left(\frac{I_T}{8}\right)^2 = 1.08$$

$$I_T = 8\sqrt{1.08}$$

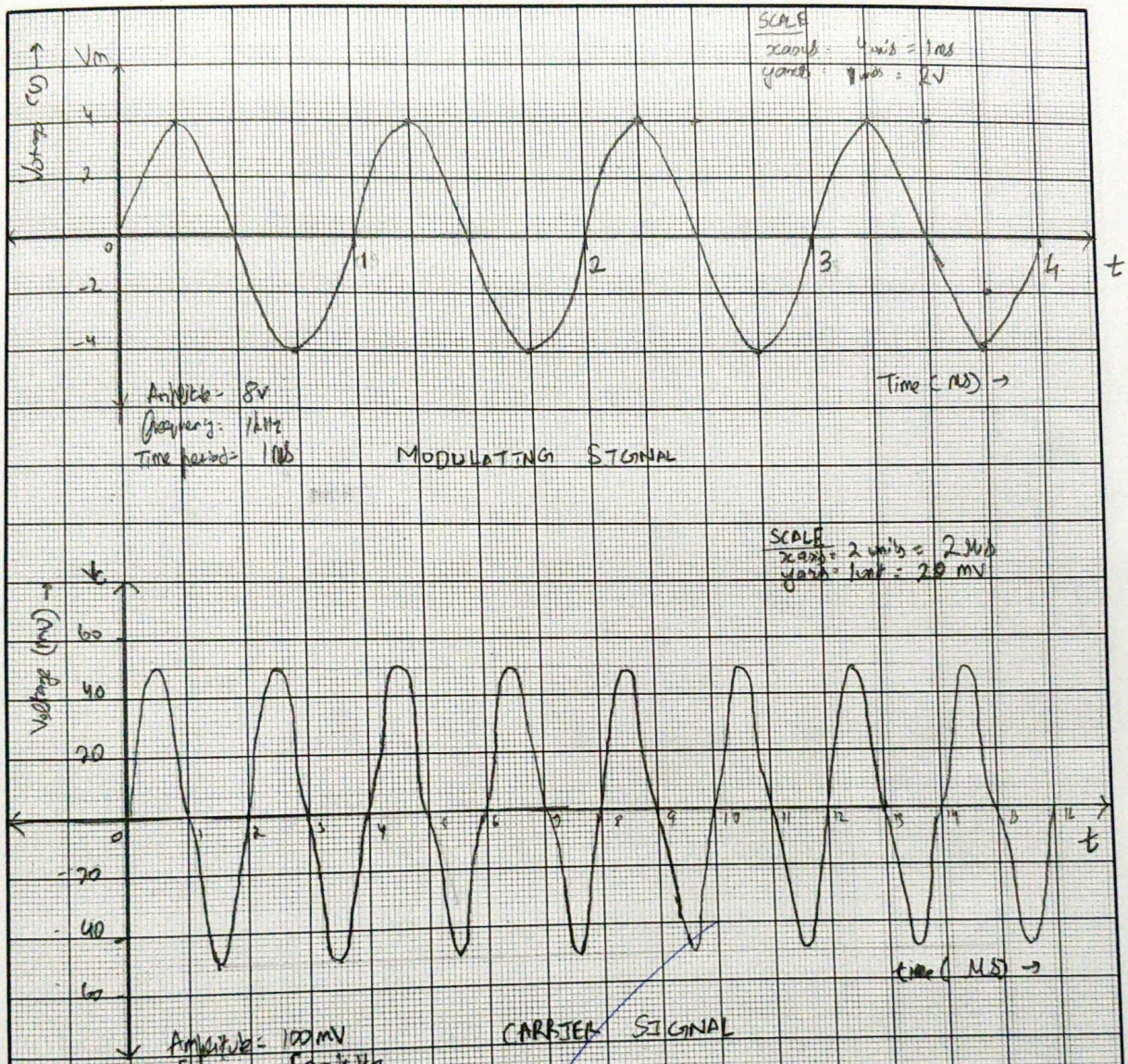
$$= 8.31\,A$$

5. Define Amplitude modulation and demodulation:

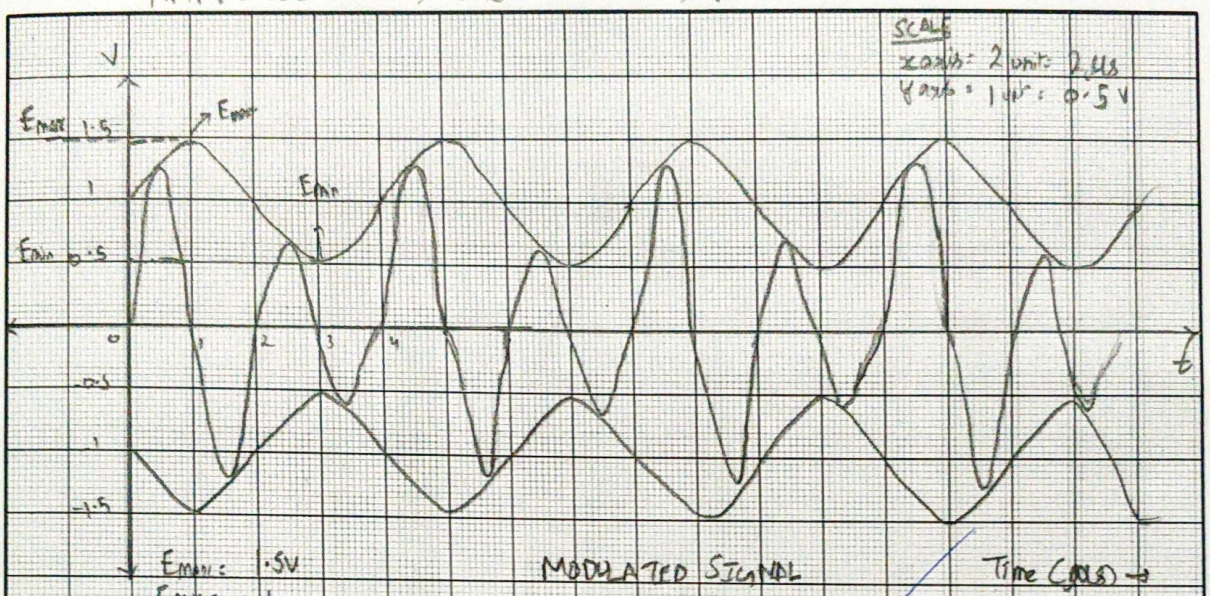
Soln. Amplitude Modulation: Its a kind of modulation where the amplitude of the Carrier signal is changed in proportion to the message signal while the phase and frequency are kept Constant.

Demodulation: It is defined as extracting the original information Carrying signal from a modulated Carrier signal.

AMPLITUDE MODULATION AND DEMODULATION



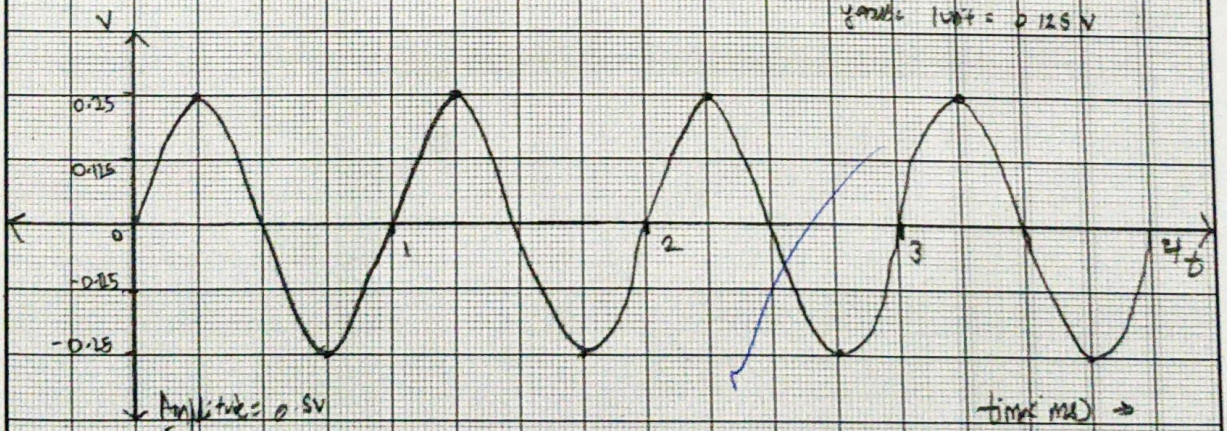
AMPLITUDE MODULATION AND DEMODULATION



Emax: 1.5V
Emin: 0.6V
Frequency: 500kHz
Time Period: 2μs

MODULATED SIGNAL

Time (μs) →



Amplitude: 0.5V
Frequency: 1kHz
Time Period: 1ms

DEMODULATED SIGNAL

time (ms) →