AMPLITUDE MODULATION,

AIM: To design and setup and AM generator and measure the Modulation Index from the observed output waveform

COMPONENTS REQUIRED:

SL. No.	Components	Specification	Quantity
1	BF194	Transistor	1
2	Resistor	69kΩ, 1.2kΩ, 12kΩ	1 each
3	Capacitor	10µF	3

THEORY:

Modulation is defined as the process by which some characteristics of a carrier signal is varied in accordance with a modulating signal. The base band signal is referred to as the modulating signal and the output of the modulation process is called as the modulation signal.

Amplitude modulation is defined as the process in which is the amplitude of the carrier wave is varied about a means values linearly with the base band signal. The envelope of the modulating wave has the same shape as the base band signal provided the following two requirements are satisfied

1. The carrier frequency fc must be much greater than the highest frequency components f_m of the message signal m (t) i.e. $f_c >> f_m$

2. The modulation index must be less than unity. If the modulation index is greater than unity, the carrier wave becomes over modulated.

DESIGN:

Assume: $V_{CC} = 12V$

I_C=1mA

$hF_e = 67$

Design of R_E

V_{RE} = 10% OF V_{CC} = 1.2V

$I_B = \frac{Ic}{hFe} = \frac{1mA}{67} = 15\mu A$

$R_E = \frac{VRE}{Ic} = 1.2k\Omega$

Design of R_1 and R_2

$10I_B$ flows through R_1 and $9I_B$ flows through R_2

By applying KVL to the base loop, we get,

$V_{R2} = V_{RE} + V_{BE(SAT)} = 1.2 + 0.6 = 1.8V$

$V_{R1} = V_{CC} - V_{R2} = 12 - 1.8 = 10.2V$

$R1 = \frac{VR1}{10IB} = \frac{10.2}{10 \text{ x } 15\mu} = 68k\Omega$ (std)

$R2 = \frac{VR2}{9IB} = 13.3k\Omega = 12k\Omega$ (std)

Design of Bypass Capacitor C_E

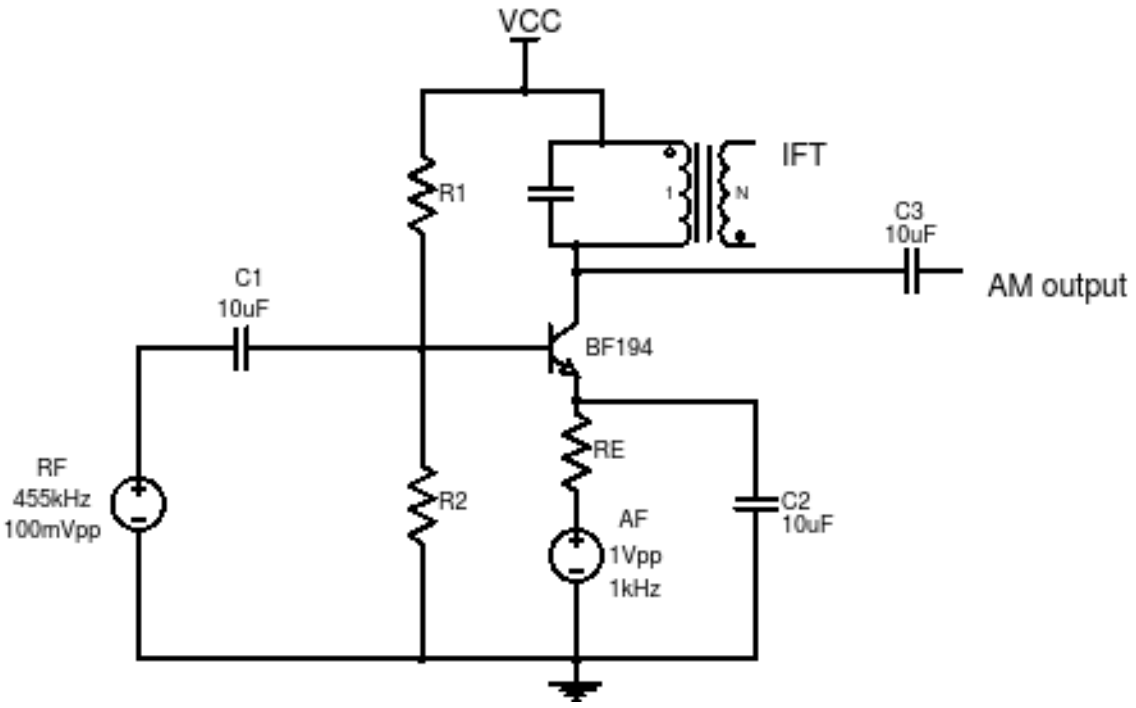
Operating frequency = 455kHz

$X_{CC} \leq \frac{RE}{10} = \frac{1.2k}{10} = 120\Omega$

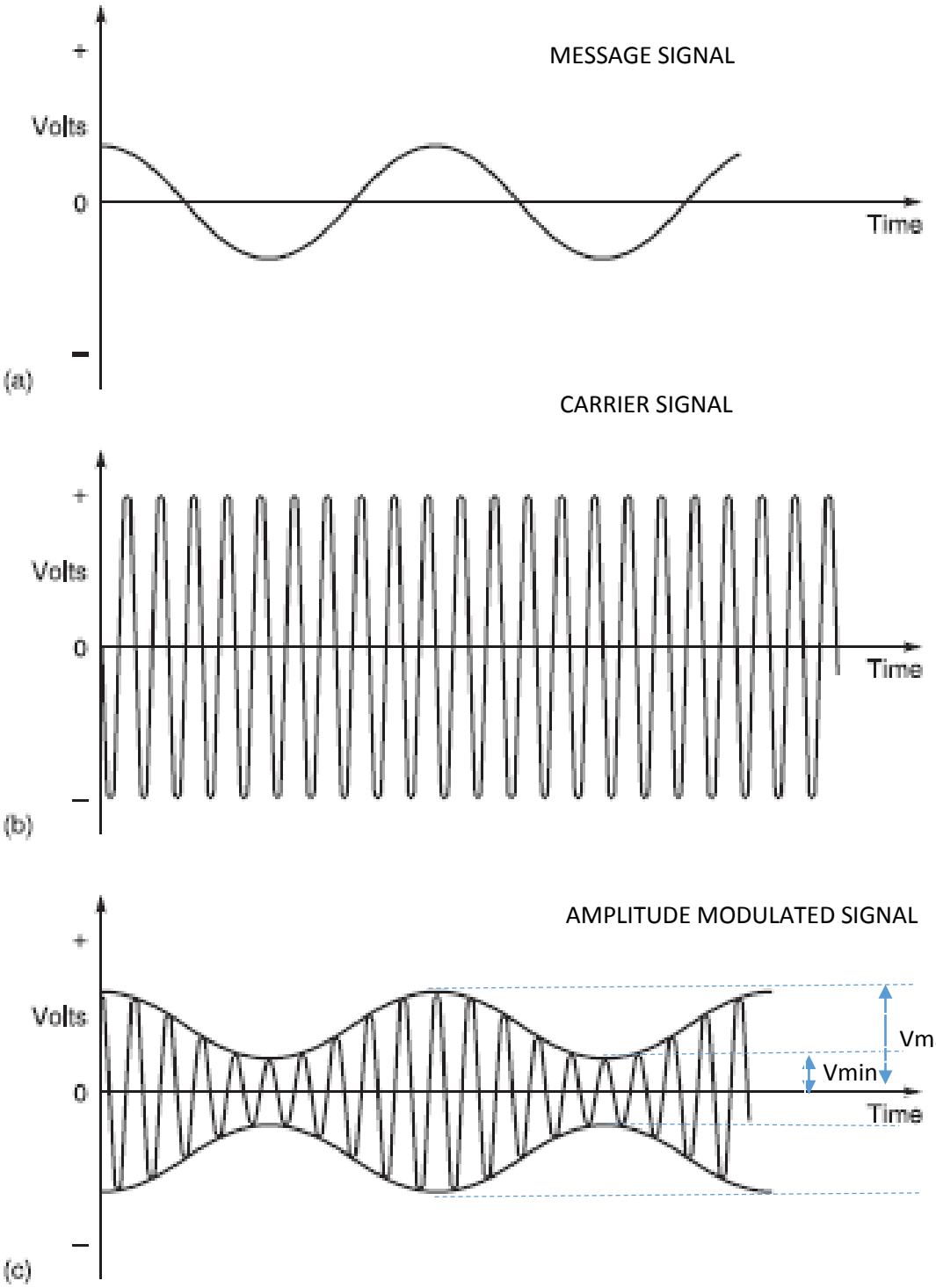
$X_{CC} = \frac{1}{2\pi fc}$

$C_E = \frac{1}{2\pi \text{ x } 455k \text{ x } 120} = 0.003H \approx 10\mu F$

CIRCUIT DIAGRAM:



WAVEFORM:


MESSAGE SIGNAL
+
Volts
0
−
Time
(a)
CARRIER SIGNAL
+
Volts
0
−
Time
(b)
AMPLITUDE MODULATED SIGNAL
+
Volts
0
−
Vmax
Vmin
Time
(c)

PROCEDURE:

1. Give 455 kHz input at transistor base.
2. IFT should be tuned to get maximum gain at 455 kHz.
3. Apply AF input at emitter.
4. Modulation Index, m = $\frac{Vmax - Vmin}{Vmax + Vmin}$

RESULT:

An AM Generator was setup and the modulation index was measured and verified. The modulation index was _____.