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SCHOOL OF ELECTRICAL ENGINEERING

COMMUNICATION ENGINEERING (EEE2006)

NAME : SHANT RAKSHIT
REG. NO. : 19BEE0154
SLOT : L 55+56

EXPT. NO: 3
DATE: 13/07/2021
AM WITH NOISE

Aim:

1. Demonstrate the AM DSB FC, DSB SC and SSB system using MATLAB. Also prove that the modulating signal is successfully demodulated using inbuilt functions.
2. From the AMDSBFC envelope, calculate the modulation index. Analyse that the modulation index arrived form the envelope and modulation index calculated using message and carrier is same.
3. Also realize the over modulation, under-modulation, and ideal modulation by varying the value of m and plot it using the MATLAB.

MATLAB Code:

```
%Shant Rakshit 19BEE0154
clear all;
vm = 2;
vc = 2;
fm = 15;
fc = 500;
fs = 10000;
t = 0:1/fs:5/fm;
message = vm*sin(2*pi*fm*t);
figure(1);
subplot(3,1,1);
plot(t,message);
title("The Modulating Signal 19BEE0154");
carrier = vc*sin(2*pi*fc*t);
figure(1);
subplot(3,1,2);
plot(t, carrier);
title("The Carrier Signal 19BEE0154");
%Generation of Am using mathemtical expression
%AMM_math = vcsinwct+(mavc/2)cos(wc-wm)t-(mavc/2)coswmt
ma = vm/vc;
AMM_math = vc*sin(2*pi*fc*t)+(ma*vc/2)*cos(2*pi*(fc-fm)*t)-
(ma*vc/2)*cos(2*pi*(fc+fm)*t);
figure(1);
subplot(3,1,3);
plot(t,AMM_math);
title("AM Modulated wave using mathematical expression
19BEE0154");
```

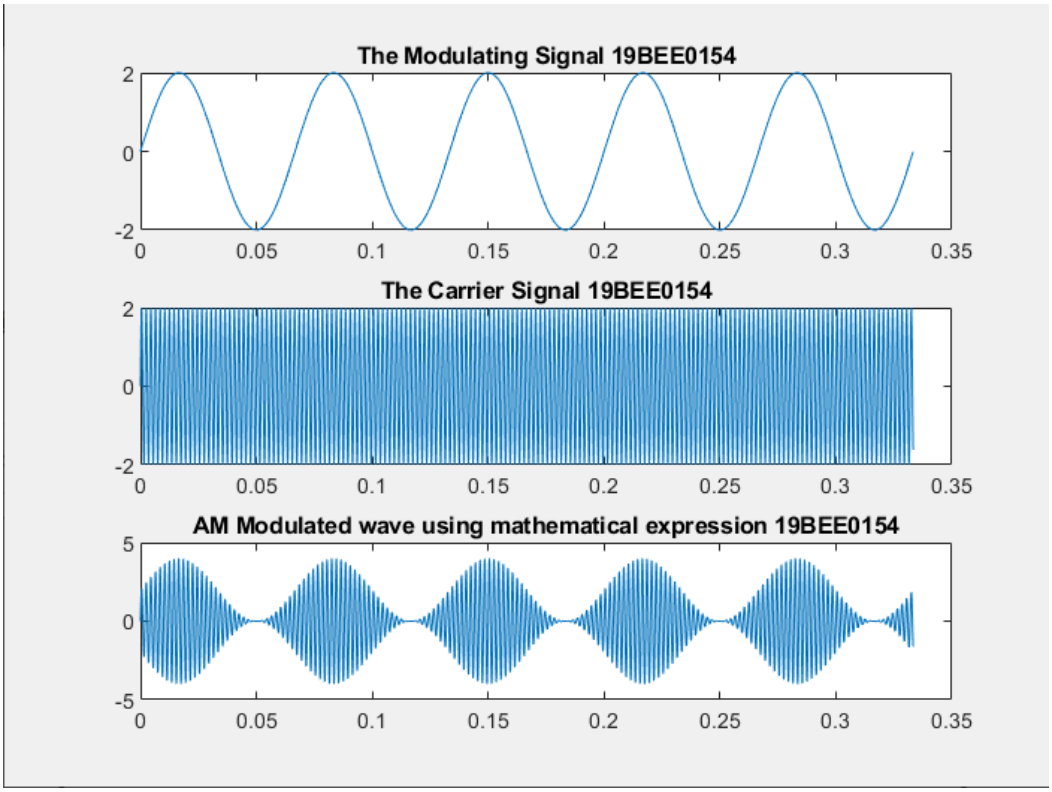
```
%Generation of DSB SC
dsbsc = ((ma*vc/2)*cos(2*pi*(fc-fm)*t)-
(ma*vc/2)*cos(2*pi*(fc+fm)*t));
figure(2);
subplot(3,1,1);
plot(t,dsbsc);
title("Double side band supressed carrier 19BEE0154");
%low side band
lsb = (ma*vc/2)*cos(2*pi*(fc-fm)*t);
figure(2);
subplot(3,1,2);
plot(t,lsb);
title("Low side band 19BEE0154");
usb = (ma*vc/2)*cos(2*pi*(fc+fm)*t);
figure(2);
subplot(3,1,3);
plot(t,usb);
title("Upper side band 19BEE0154");
m = 1;
ideal_signal = vc*sin(2*pi*fc*t)+(m*vc/2)*cos(2*pi*(fc-fm)*t)-
(m*vc/2)*cos(2*pi*(fc+fm)*t);
figure(3);
subplot(3,1,1);
plot(t,ideal_signal);
title("Ideal modulation 19BEE0154");
m = 0.4;
under_mod = vc*sin(2*pi*fc*t)+(m*vc/2)*cos(2*pi*(fc-fm)*t)-
(m*vc/2)*cos(2*pi*(fc+fm)*t);
subplot(3,1,2);
plot(t,under_mod);
title("Under modulation 19BEE0154");
m = 2;
over_mod = vc*sin(2*pi*fc*t)+(m*vc/2)*cos(2*pi*(fc-fm)*t)-
(m*vc/2)*cos(2*pi*(fc+fm)*t);
figure(3);
subplot(3,1,3);
plot(t,over_mod);
title("Over modulation 19BEE0154");

Vinam = ammod(message,fc,fs);
figure(4)
subplot(3,1,1);
plot(t,Vinam);
title("Modulated output using inbulit ammod - 19BEE0154");
Vdemod = amdemod(Vinam,fc,fs);
figure(4)
subplot(3,1,2);
plot(t,Vdemod);
title("Demodulated output using inbulit amdemod - 19BEE0154");
Vdemodulate = amdemod(Vinam,fc,fs);
```

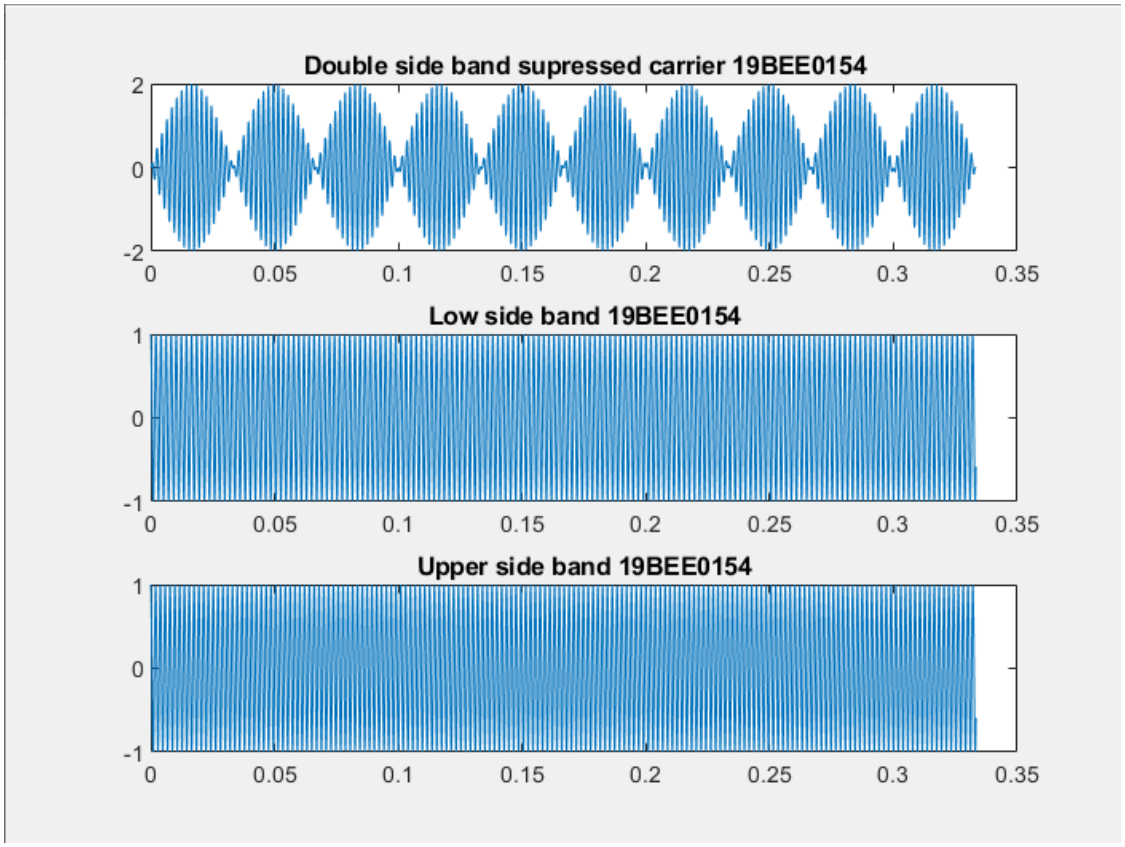
```
figure(4)
subplot(3,1,3);
plot(t,Vdemodulate);
title("Demodulated output using inbulit demod - 19BEE0154");
Vdemod_sup = amdemod(dsbsc,fc,fs);
figure(5)
subplot(3,1,1);
plot(t,Vdemod_sup);
title("suppresed band demodulation - 19BEE0154");
Vdemod1 = amdemod(lsb,fc,fs);
figure(5)
subplot(3,1,2);
plot(t,Vdemod1);
title("lower side band demodulation - 19BEE0154");
Vdemod_up = amdemod(usb,fc,fs);
figure(5)
subplot(3,1,3);
plot(t,Vdemod_up);
title("upper side band demodulation - 19BEE0154");
Vnoiseless = awgn(Vinam,100);
figure(6)
subplot(2,1,1);
plot(t,Vnoiseless);
title("Less Noisy signal Modulation - 19BEE0154")
VnDemodless = amdemod(Vnoiseless,fc,fs);
figure(6)
subplot(2,1,2);
plot(t,VnDemodless);
title("Demodulated less noisy signal - 19BEE0154");
Vnoisemore = awgn(Vinam,10);
figure(7)
subplot(2,1,1);
plot(t,Vnoisemore);
title("Mre Noisy signal Modulation - 19BEE0154")
VnDemodless = amdemod(Vnoisemore,fc,fs);
figure(7)
subplot(2,1,2);
plot(t,VnDemodless);
title("Demodulated more noisy signal - 19BEE0154");
```

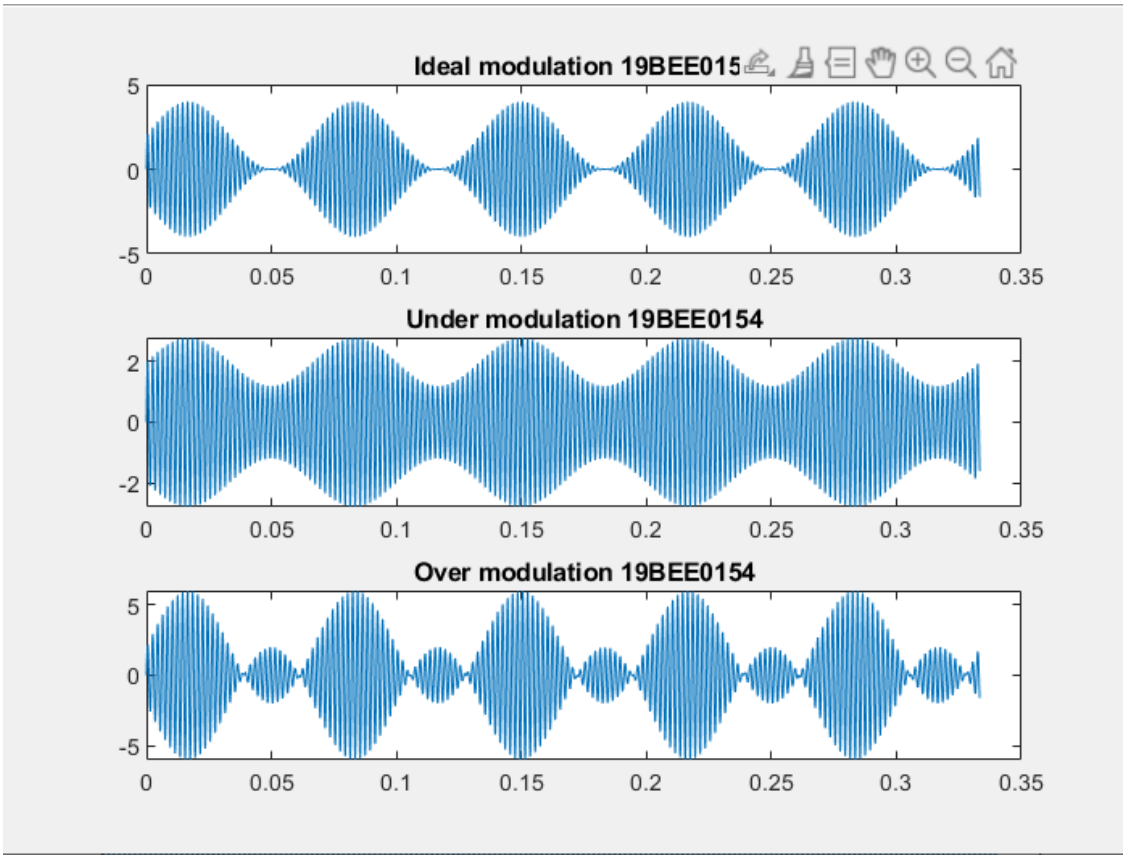
MATLAB Stimulation:

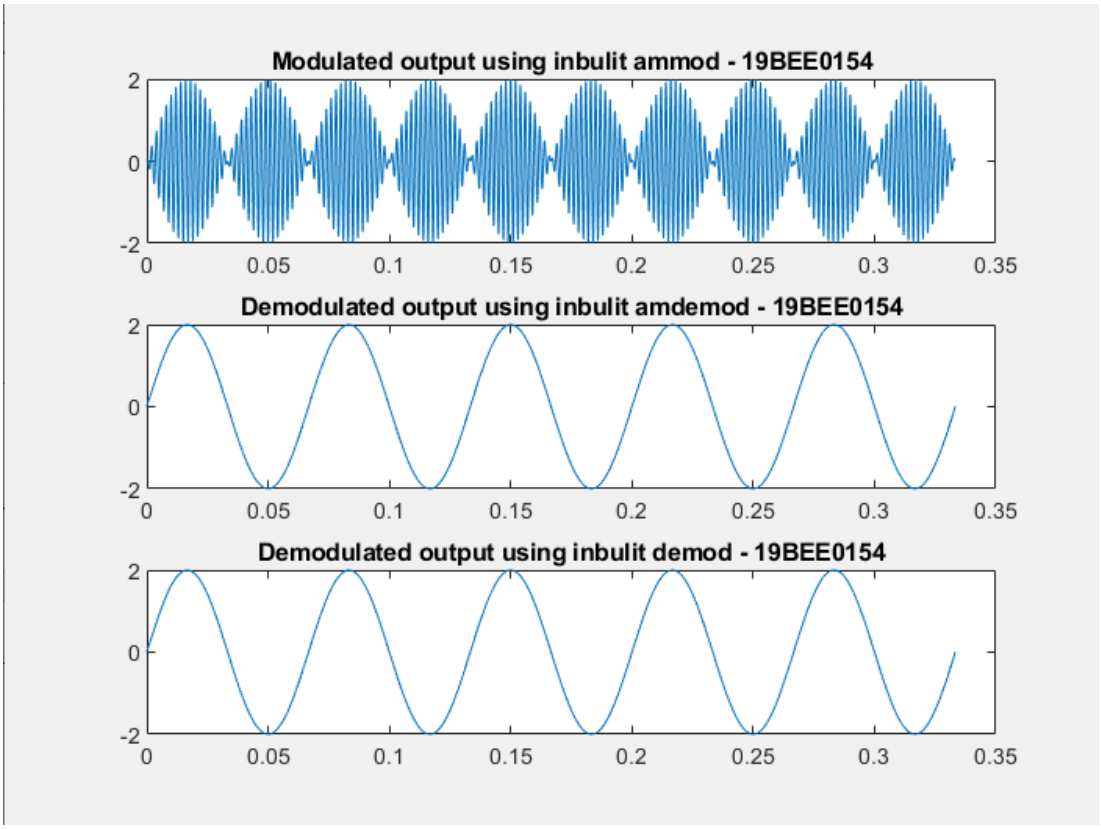
Finding modulation index by envelope:
Vm = Vc = 2
Thus, Modulation index = 2/2 =1

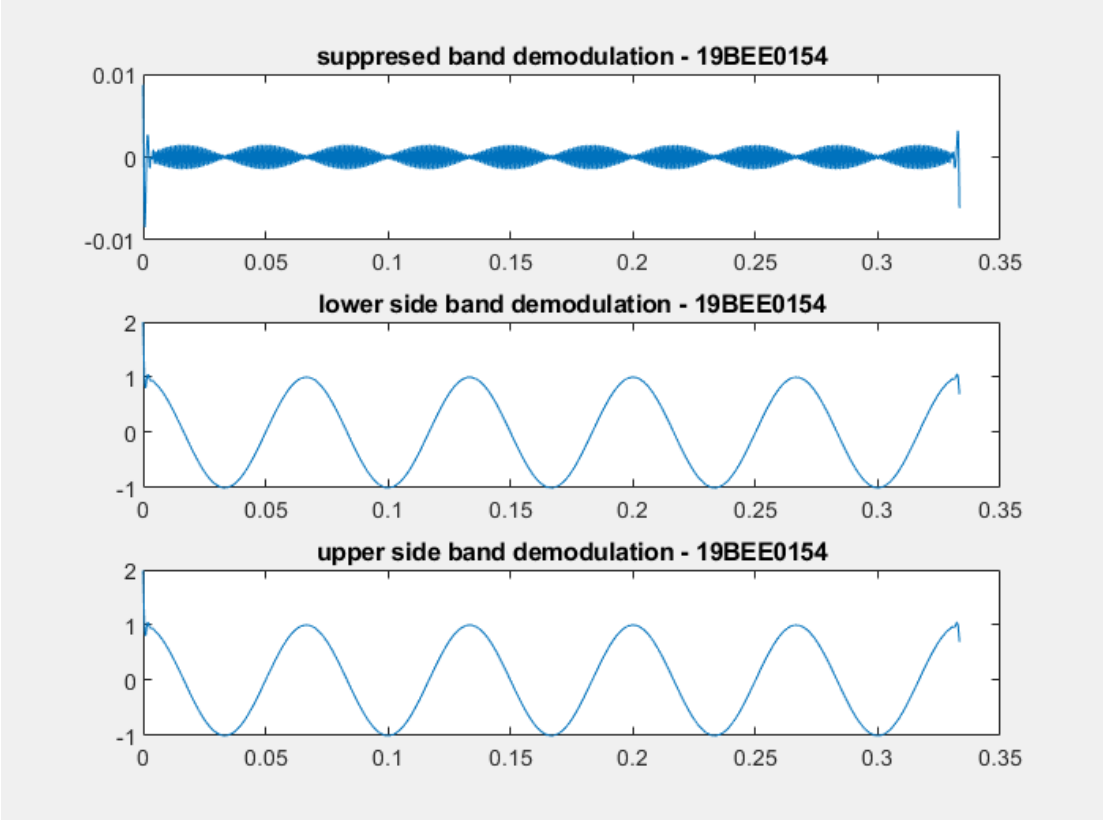
For envelope Amax = 4 and Amin = 0
Modulation Index = (Amax-Amin)/(Amax+Amin)
Therefore Mod Index = (4-0)/(4+0) = 1
Thus, both the answers are same

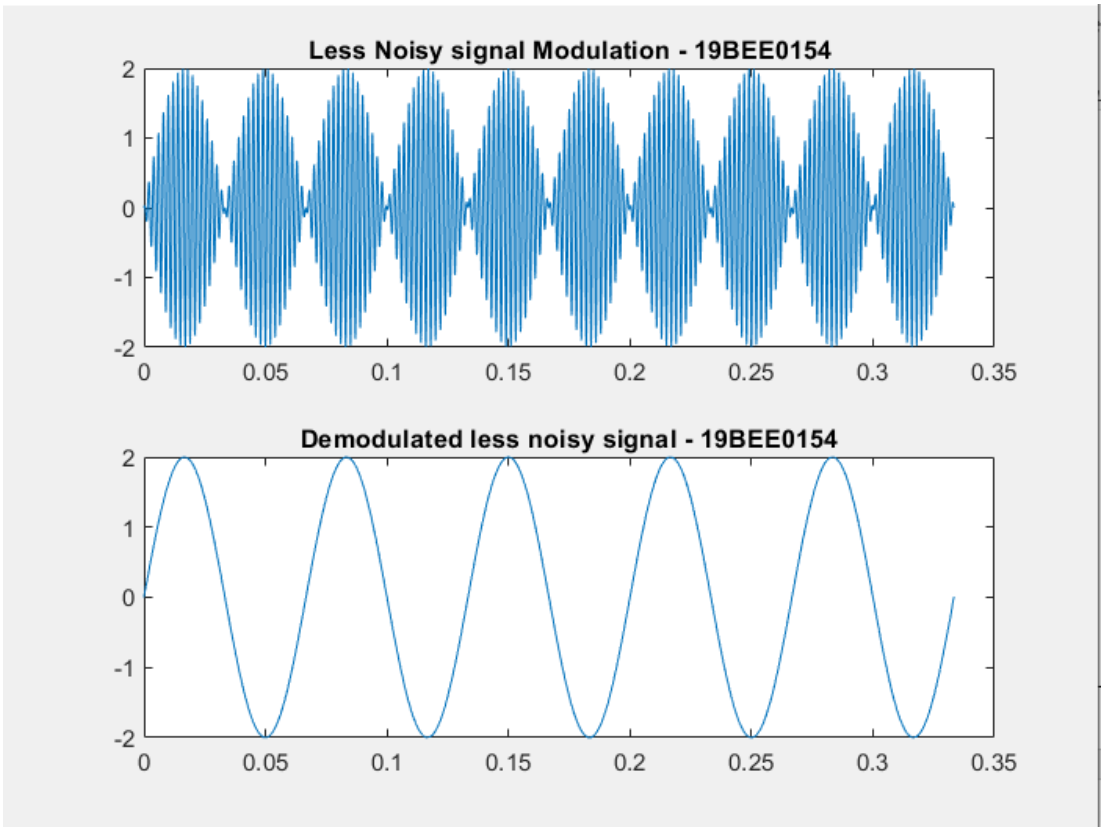


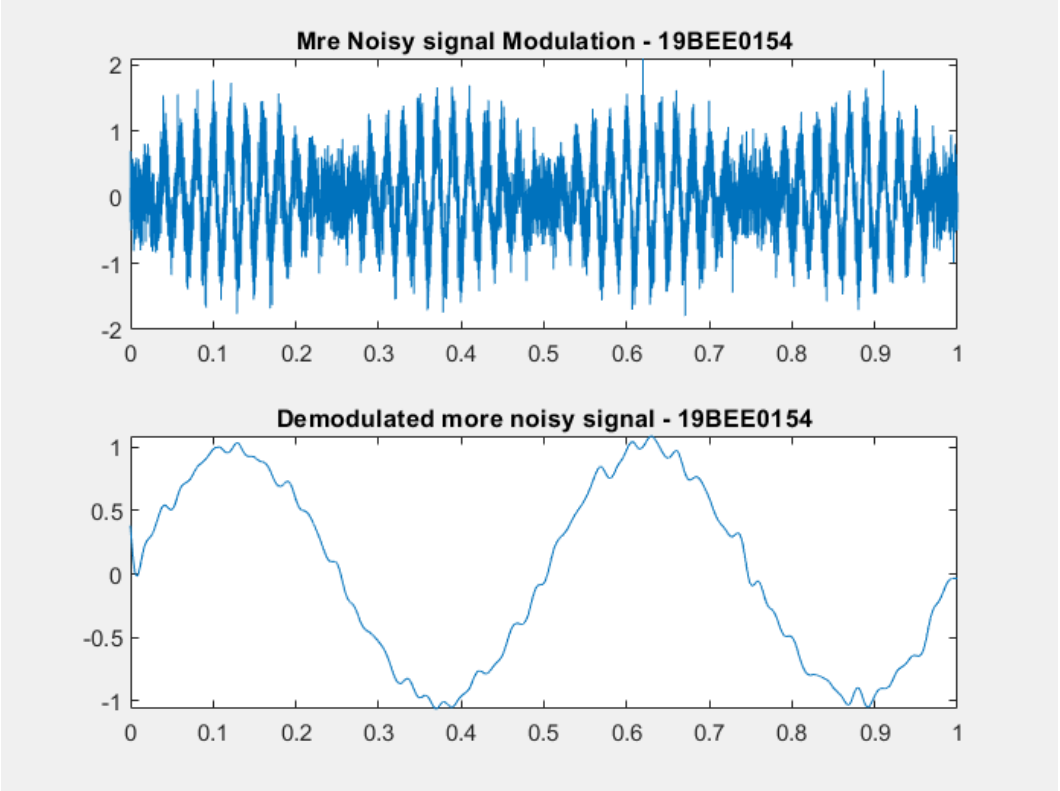

Double side band supressed carrier 19BEE0154
Low side band 19BEE0154
Upper side band 19BEE0154


Ideal modulation 19BEE015
Under modulation 19BEE0154
Over modulation 19BEE0154


Modulated output using inbulit ammod - 19BEE0154
Demodulated output using inbulit amdemod - 19BEE0154
Demodulated output using inbulit demod - 19BEE0154


suppresed band demodulation - 19BEE0154
lower side band demodulation - 19BEE0154
upper side band demodulation - 19BEE0154


Less Noisy signal Modulation - 19BEE0154
2
1
0
-1
-2
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
Demodulated less noisy signal - 19BEE0154
2
1
0
-1
-2
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35


Mre Noisy signal Modulation - 19BEE0154
2
1
0
-1
-2
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Demodulated more noisy signal - 19BEE0154
1
0.5
0
-0.5
-1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

Result:

Thus, we have demonstrated and verified the output using MATLAB