**Lab2.m**

%Exercise I

%a)

t = -5:0.01:5;

m = 3 \* cos(2 \*pi\*t) ;

t2 = -1:0.001:1;

s = 10\* (1 + 0.6 \* cos(2 \*pi\*t2) ) .\* cos(40\*pi\*t2); %k =0.2

subplot(3,1,1); % 3 rows, 1 column, 1st spot

plot(t,m);

xlabel('Time');

ylabel('m(t)');

title('Baseband signal');

subplot(3,1,2); % 3 rows, 1 column, 2nd spot

plot(t2,s);

xlabel('Time');

ylabel('s(t)');

title('Amplitude Modulated Signal with K = 0.2');

%b)

s = 10\* (1 + 0.3 \* cos(2 \*pi\*t2) ) .\* cos(40\*pi\*t2); %k =0.1

subplot(3,1,3); % 3 rows, 1 column, 3rd spot

plot(t2,s);

xlabel('Time');

ylabel('s(t)');

title('Amplitude Modulated Signal with K = 0.1');

% extra

t = -5:0.01:5;

m = 3 \* cos(2 \*pi\*t) ;

t2 = -1:0.001:1;

s = 10\* (1 + 0.6 \* cos(2 \*pi\*t2) ) .\* cos(40\*pi\*t2); %k =0.2

s2 = 10\* (1 + 0.3 \* cos(2 \*pi\*t2) ) .\* cos(40\*pi\*t2); %k =0.1

s3 = 10\* (1 + 3 \* cos(2 \*pi\*t2) ) .\* cos(40\*pi\*t2); %k =1

s4 = 10\* (1 + 9 \* cos(2 \*pi\*t2) ) .\* cos(40\*pi\*t2); %k =3

s5 = 10\* (1 + cos(2 \*pi\*t2) ) .\* cos(40\*pi\*t2); %k =1/3

subplot(5,1,1); % 5 rows, 1 column, 1st spot

plot(t2,s5);

xlabel('Time');

ylabel('s(t)');

title('Amplitude Modulated Signal with K = -1');

subplot(5,1,3); % 5 rows, 1 column, 3rd spot

plot(t2,s);

xlabel('Time');

ylabel('s(t)');

title('Amplitude Modulated Signal with K = 0.2');

subplot(5,1,2); % 5 rows, 1 column, 2nd spot

plot(t2,s2);

xlabel('Time');

ylabel('s(t)');

title('Amplitude Modulated Signal with K = 0.1');

subplot(5,1,4); % 5 rows, 1 column, 4th spot

plot(t2,s3);

xlabel('Time');

ylabel('s(t)');

title('Amplitude Modulated Signal with K = 1');

subplot(5,1,5); % 5 rows, 1 column, 5th spot

plot(t2,s4);

xlabel('Time');

ylabel('s(t)');

title('Amplitude Modulated Signal with K = 3');

% Exercise 2

% 2i)

syms y(t) x

eqn = diff(y,t) +y == 0;

Dy = diff(y,t);

cond = [y(0)== 5];

f = dsolve(eqn,cond);

fplot(f, [0,5])

xlabel('Time');

ylabel('Yzi');

title('Zero Input Response');

% 2ii)

syms y(t) x

eqn = diff(y,t) +y == 0.5.\*heaviside(t);

Dy = diff(y,t);

cond = [y(0)== 5];

f = dsolve(eqn,cond);

fplot(f, [0, 5])

xlabel('Time');

ylabel('Y(t)');

title('Total Output Response');

Reference

% https://www.dummies.com/education/science/science-electronics/analyze-a-series-rc-circuit-using-a-differential-equation/

% 2i)

syms y(t) x

eqn = diff(y,t,2) + 2\*diff(y,t) + y == 0;

Dy = diff(y,t);

cond = [y(0)== 1, Dy(0) == 8];

f = dsolve(eqn,cond);

fplot(f, [0,50])

xlabel('Time');

ylabel('Yzi');

title('Zero Input Response');

% 2ii)

syms y(t) x

eqn = diff(y,t,2) + 2\*diff(y,t) + y(t) == 2\*sin(0.1\*pi\*t);

Dy = diff(y,t);

cond = [y(0)== 1, Dy(0) == 8];

f = dsolve(eqn,cond);

fplot(f, [0, 50])

xlabel('Time');

ylabel('Y(t)');

title('Total Output Response with x(t) = 2sin(0.1?t) ');

% 2iii)

syms y(t) x

eqn = diff(y,t,2) + 2\*diff(y,t) + y(t) == 2\*sin(2\*pi\*t);

Dy = diff(y,t);

cond = [y(0)== 1, Dy(0) == 8];

f = dsolve(eqn,cond);

fplot(f, [0, 50])

xlabel('Time');

ylabel('Y(t)');

title('Total Output Response with x(t) = 2sin(2 ?t) ');