AMERICAN INTERNATIONAL UNIVERSITY–BANGLADESH (AIUB)

FACULTY OF ENGINEERING

Course name: Data Communication

Course code: COE 3201

Section: H

Semester: Spring 2023-24

Name: MD. ABU TOWSIF

ID: 22-47019-1

Instructor name: Dr. Muhammad Morshed Alam

Experiment no: 01

Experiment name: Introduction to MATLAB

Submission date: Feb 9th, 2024

Performance Task for Lab Report: (your ID = AB-CDEFG-H)

**Generate two CDEF hertz sinusoids with different amplitudes and phases.

x1(t) = A1 cos(2π(CDEF)t + j1) x2(t) = A2 cos(2π(CDEF)t + j2)

(a) Select the value of the amplitudes as follows: let A1 = AB and A2 = GH. For the phases, use j1 = DG (in degrees), and take j2 = 30º. When doing computations in Matlab, make sure to convert degrees to radians.

ANSWER:

My ID is : 22-47019-1

AB-CDEFG-H. So,

AB = 22 = A1,

GH = 91 = A2

CDEF = 4701 = f

DG = 79 = J2

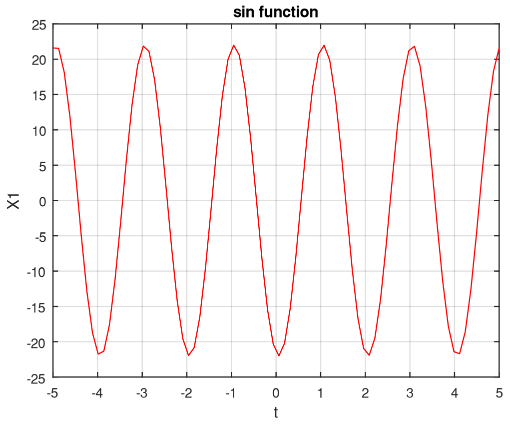
J2 = 30

(b) Make a plot of both signals over a range of t that will exhibit approximately 3 cycles. Make sure the plot starts at a negative time so that it will include t = 0, and make sure that you have at least 20 samples per period of the wave.

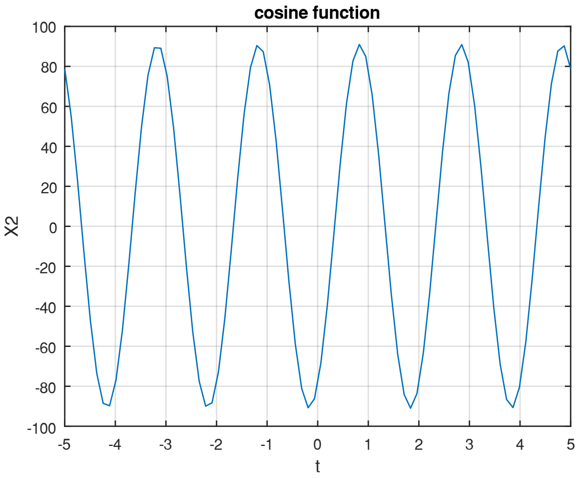
ANSWER:

MATLAB Code	Output Figure

```
% ID = 22-47019-1 AB = 22, GH = 91, CDEF = 4701, DG = 79
t = linspace(-5, 5,80);
% 80 samples
CDEF = 4701;
A1 = 22; %AB
phase_degree1 = 79; %j1
phase_rad1 = deg2rad(phase_degree1); %j1
x1 = A1*sin(2*pi*CDEF*t + phase_rad1);
figure;
plot(t, x1, 'r')
```



```
xlabel('t')
ylabel('X1')
title('sin function')
grid on;

% ID = 22-47019-1 , AB =
22, %GH = 91, CDEF = 4701
A2 = 91; %GH
phase_degree2 = 30;% j2
phase_rad2 =
deg2rad(phase_degree2); %j2
x2 = A2*cos(2*pi*CDEF*t +
phase_rad2); % Here
phase_rad2 = j2
figure;
plot(t, x2)
xlabel('t')
ylabel('X2')
title('cosine function')
grid on;
```



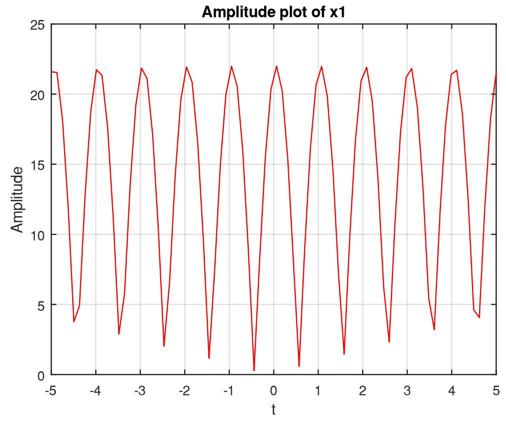
(c)Verify that the phase of the two signals x1(t) and x2(t) is correct at t = 0, and also verify that each one has the correct maximum amplitude.

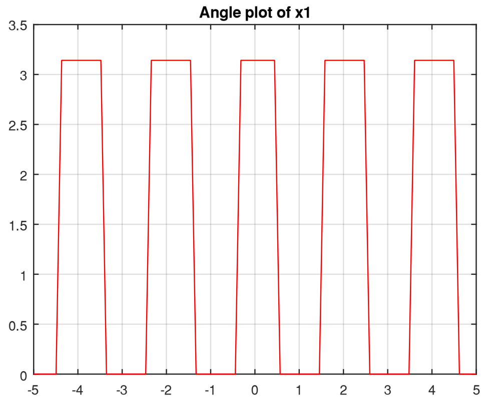
ANSWER:

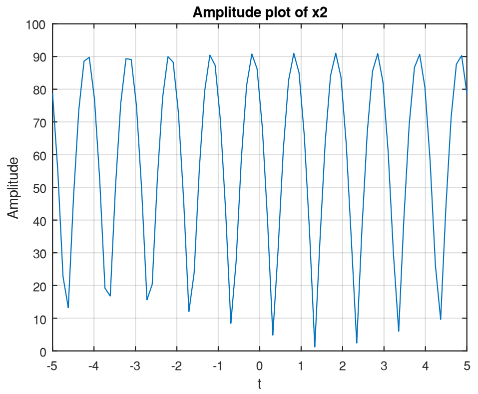
MATLAB Code

```
% ID = 22-47019-1 AB = 22, GH
= 91, CDEF = 4701, DG = 79
t = linspace(-5, 5,80);
% 80 samples
CDEF = 4701;
A1 = 22; %AB
phase_degree1 = 79; %j1
phase_rad1 =
deg2rad(phase_degree1); %j1
x1 = A1*sin(2*pi*CDEF*t +
phase_rad1);
figure;
plot(t, abs(x1), 'r')
title('Amplitude plot of x1')
ylabel('Amplitude')
xlabel('t')
grid on;

figure;
plot(t, angle(x1), 'r')
title('Angle plot of x1')
grid on

% ID = 22-47019-1 , AB = 22, %
GH = 91, CDEF = 4701
A2 = 91; %GH
phase_degree2 = 30;% j2
phase_rad2 =
deg2rad(phase_degree2); %j2
x2 = A2*cos(2*pi*CDEF*t +
phase_rad2);
% Here phase_rad2 = j2
figure;
plot(t, abs(x2))
title('Amplitude plot of x2')
ylabel('Amplitude')
xlabel('t')
grid on
```

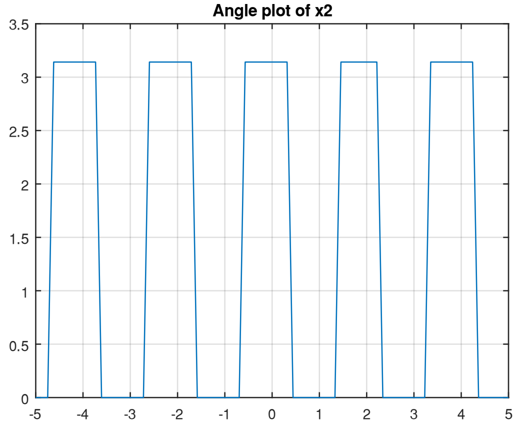
Output Figure


Amplitude plot of x1


Angle plot of x1


Amplitude plot of x2

```
figure;
plot(t, angle(x2))
title('Angle plot of x2')
grid on

% Phase verification
x1_phase_at_0_deg =
phase_degree1;
% Phase of x1 at t = 0 in
degrees
x2_phase_at_0_deg =
phase_degree2; % Phase of x2
at t = 0 in degrees

disp(['Phase of x1(t) at t =
0: ',
num2str(x1_phase_at_0_deg), '
degrees']);
disp(['Phase of x2(t) at t =
0: ',
num2str(x2_phase_at_0_deg), '
degrees']);

% Maximum amplitude
verification
x1_max_amplitude =
max(abs(x1)); % Maximum
amplitude of x1
x2_max_amplitude =
max(abs(x2)); % Maximum
amplitude of x2

disp(['Maximum amplitude of
x1(t): ',
num2str(x1_max_amplitude)]);
disp(['Maximum amplitude of
x2(t): ',
num2str(x2_max_amplitude)]);
```



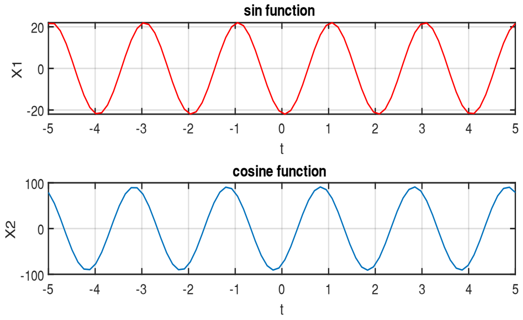
(d) Use subplot(3,1,1) and subplot(3,1,2) to make a three-panel subplot that puts both of these plots on the same window. See help subplot.

ANSWER:

<table>
<tr><th>MATLAB Code</th><th>Output Figure</th></tr>
<tr><td>

```
% ID = 22-47019-1 AB = 22, GH = 91, CDEF = 4701, DG = 79
t = linspace(-5, 5,80); % 80 samples
CDEF = 4701;
A1 = 22; %AB
phase_degree1 = 79; %j1
phase_rad1 = deg2rad(phase_degree1); %j1
x1 = A1*sin(2*pi*CDEF*t + phase_rad1);
subplot(3, 1, 1)
plot(t, x1, 'r')
xlabel('t')
ylabel('X1')
title('sin function')
grid on;

% ID = 22-47019-1 , AB = 22, GH = 91, CDEF = 4701
A2 = 91; %GH
phase_degree2 = 30;% j2
phase_rad2 = deg2rad(phase_degree2); %j2
x2 = A2*cos(2*pi*CDEF*t + phase_rad2); % Here phase_rad2 = j2
subplot(3, 1, 2)
plot(t, x2)
xlabel('t')
ylabel('X2')
title('cosine function')
grid on
```

</td><td>



</td></tr>
</table>

(e) Create a third sinusoid as the sum: x3(t) = x1(t) + x2(t). In Matlab this amounts to summing the

vectors that hold the samples of each sinusoid. Make a plot of x3 (t) over the same range of time

as used in the previous two plots. Include this as the third panel in the window by using subplot

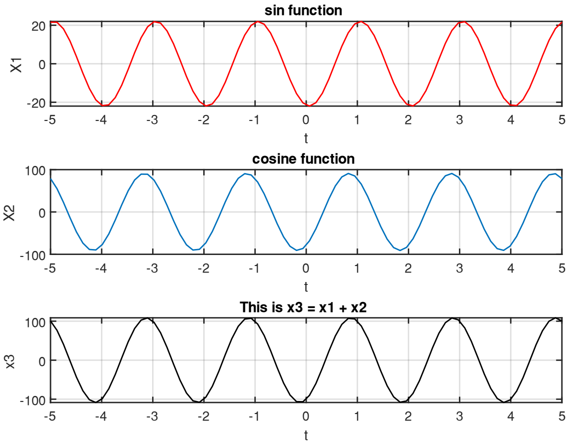
(3,1,3).

ANSWER:

MATLAB Code

```
% ID = 22-47019-1 AB = 22, GH = 91, CDEF = 4701, DG = 79
t = linspace(-5, 5,80); % 80 samples
CDEF = 4701;
A1 = 22; %AB
phase_degree1 = 79; %j1
phase_rad1 = deg2rad(phase_degree1); %j1
x1 = A1*sin(2*pi*CDEF*t + phase_rad1);
subplot(3, 1, 1)
plot(t, x1, 'r')
xlabel('t')
ylabel('X1')
title('sin function')
grid on;

% ID = 22-47019-1 , AB = 22, GH = 91, CDEF = 4701
A2 = 91; %GH
phase_degree2 = 30;% j2
phase_rad2 = deg2rad(phase_degree2); %j2
x2 = A2*cos(2*pi*CDEF*t + phase_rad2); % Here phase_rad2 = j2
subplot(3, 1, 2)
plot(t, x2)
xlabel('t')
ylabel('X2')
title('cosine function')
grid on
```

Output Figure



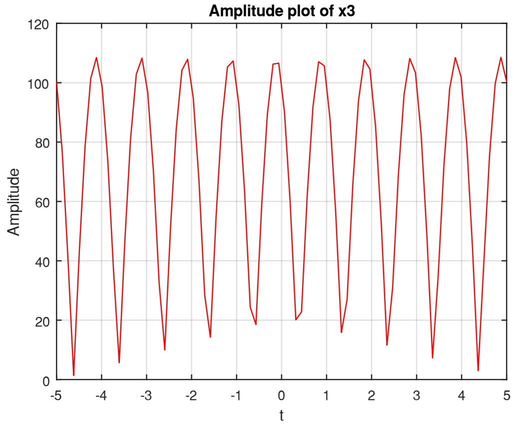
```
x3 = x1 + x2;
subplot(3, 1, 3);
plot(t, x3, 'k');
xlabel('t')
ylabel('x3')
title('This is x3 = x1 + x2')
grid on
```

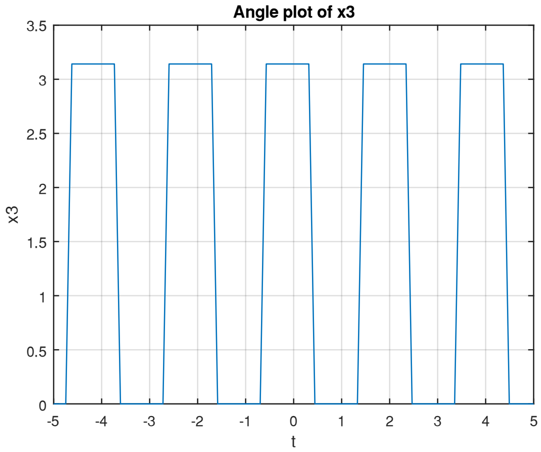
(f) Measure the magnitude and phase of x3 (t) directly from the plot. In your lab report, explain how the magnitude and phase were measured by making annotations on each of the plots

ANSWER:

MATLAB Code	Output Figure

```
% ID = 22-47019-1 AB = 22, GH = 91, CDEF = 4701, DG = 79
t = linspace(-5, 5,80); % 80 samples
CDEF = 4701;
A1 = 22; %AB
phase_degree1 = 79; %j1
phase_rad1 = deg2rad(phase_degree1); %j1
x1 = A1*sin(2*pi*CDEF*t + phase_rad1);

% ID = 22-47019-1 , AB = 22, GH = 91, CDEF = 4701
A2 = 91; %GH
phase_degree2 = 30;% j2
phase_rad2 = deg2rad(phase_degree2); %j2
x2 = A2*cos(2*pi*CDEF*t + phase_rad2); % Here phase_rad2 = j2


x3 = x1 + x2;
figure;
plot(t, abs(x3), 'r')
xlabel('t')
ylabel('x3')
title('Amplitude plot of x3')
ylabel('Amplitude')
xlabel('t')
```





```
grid on

figure;
plot(t, angle(x3))
xlabel('t')
ylabel('x3')
title('Angle plot of x3')
grid on
```