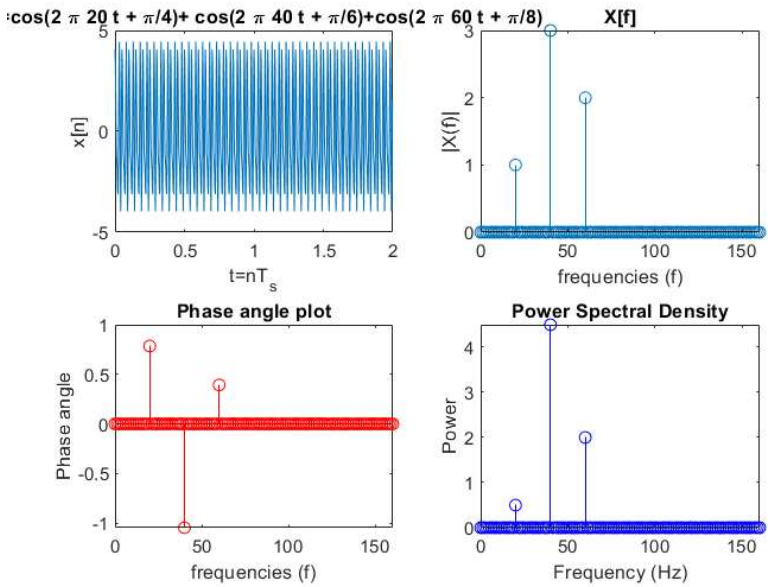
IRISH MEHTA

Experiment 1

Question 1

```
clc;
fc=10;%frequency of the carrier

fs=32*fc;%sampling frequency with oversampling factor=32
t=0:1/fs:2-1/fs;%2 seconds duration
%x=cos(2*pi*fc*t + pi/4);%time domain signal (real number)
x = cos(2*pi*20*t + pi/4) + 3*cos(2*pi*40*t -2* pi/6) +2* cos(2*pi*60*t + pi/8);


N=256; %FFT size
X = fft(x,N);
% N-point complex DFT, output contains DC at index 1
% Nyquist frequency at N/2+1 th index
% positive frequencies from index 2 to N/2
% negative frequencies from index N/2+1 to N
%calculate frequency bins with FFT
df=fs/N; %frequency resolution
%basically the scaling factor to make the frequency domain for the plot

sampleIndex = 0:N-1; %raw index for FFT plot
f=sampleIndex*df; %x-axis index converted to frequencies

subplot(2,2,1);plot(t,x);hold on; %plot the signal
title('x[n]=cos(2 \pi 20 t + \pi/4)+ cos(2 \pi 40 t + \pi/6)+cos(2 \pi 60 t + \pi/8)'); xlabel('t=nT_s'); ylabel('x[n]');

subplot(2,2,2); stem(f,abs(X)./128); %x-axis represent frequencies
title('X[f]'); xlabel('frequencies (f)'); ylabel('|X(f)|');
xlim([0 160]);


%Phase Spectrum
subplot(2,2,3);
tolerance = 0.00001;
X3 = ceil(abs(X) -tolerance);
X4 = round (X3 ./(X3+1)); %(X4 is the vector of 0s and 1s)
Angle_p = angle(X).*X4;
stem(f,Angle_p,'r')
title('Phase angle plot'); xlabel('frequencies (f)'); ylabel('Phase angle');

xlim([0 160]);
subplot(2,2,4);
Px=X.*conj(X)/(N^2); %Power of each freq components
stem(f,2*Px,'b'); title('Power Spectral Density');
xlabel('Frequency (Hz)');ylabel('Power');
xlim([0 160]);
```



Experiment 2

Question 2

```
clc;
fc=10;%frequency of the carrier
fs=32*fc;%sampling frequency with oversampling factor=32
t=0:1/fs:2-1/fs;%1 seconds duration
x = square(2*pi*10*t,50);

subplot(2,1,1);plot(t,x);hold on; %plot the signal
title('x[n]=square(2*pi*10*t,0.5)'); xlabel('t=nT_s'); ylabel('x[n]');

N=256; %FFT size
X = fft(x,N);
% N-point complex DFT, output contains DC at index 1
% Nyquist frequency at N/2+1 th index
% positive frequencies from index 2 to N/2
% negative frequencies from index N/2+1 to N


subplot(2,1,2);
Px=X.*conj(X)/(N^2); %Power of each freq components
stem(f,2*Px,'b'); title('Power Spectral Density');
xlabel('Frequency (Hz)');ylabel('Power');
xlim([0 160]);
```