% Filter specifications

N = 50; % Filter order

Wn = 0.4; % Normalized cutoff frequency

suptitle('FIR FILTER- 22BEC109’)

% Design lowpass FIR filter using different window functions

b\_rect\_lowpass = fir1(N, Wn, rectwin(N+1));

b\_hamming\_lowpass = fir1(N, Wn, hamming(N+1));

b\_hanning\_lowpass = fir1(N, Wn, hanning(N+1));

b\_blackman\_lowpass = fir1(N, Wn, blackman(N+1));

% Design highpass FIR filter using different window functions

b\_rect\_highpass = fir1(N, Wn, 'high', rectwin(N+1));

b\_hamming\_highpass = fir1(N, Wn, 'high', hamming(N+1));

b\_hanning\_highpass = fir1(N, Wn, 'high', hanning(N+1));

b\_blackman\_highpass = fir1(N, Wn, 'high', blackman(N+1));

% Design bandpass FIR filter using different window functions

Wn\_bandpass = [0.2, 0.6];

b\_rect\_bandpass = fir1(N, Wn\_bandpass, rectwin(N+1));

b\_hamming\_bandpass = fir1(N, Wn\_bandpass, hamming(N+1));

b\_hanning\_bandpass = fir1(N, Wn\_bandpass, hanning(N+1));

b\_blackman\_bandpass = fir1(N, Wn\_bandpass, blackman(N+1));

% Design stopband FIR filter using different window functions

Wn\_stopband = [0.2, 0.6];

b\_rect\_stopband = fir1(N, Wn\_stopband, 'stop', rectwin(N+1));

b\_hamming\_stopband = fir1(N, Wn\_stopband, 'stop', hamming(N+1));

b\_hanning\_stopband = fir1(N, Wn\_stopband, 'stop', hanning(N+1));

b\_blackman\_stopband = fir1(N, Wn\_stopband, 'stop', blackman(N+1));

% Frequency response calculation

freq\_response\_rect\_lowpass = freqz(b\_rect\_lowpass, 1, 1024);

freq\_response\_hamming\_lowpass = freqz(b\_hamming\_lowpass, 1, 1024);

freq\_response\_hanning\_lowpass = freqz(b\_hanning\_lowpass, 1, 1024);

freq\_response\_blackman\_lowpass = freqz(b\_blackman\_lowpass, 1, 1024);

freq\_response\_rect\_highpass = freqz(b\_rect\_highpass, 1, 1024);

freq\_response\_hamming\_highpass = freqz(b\_hamming\_highpass, 1, 1024);

freq\_response\_hanning\_highpass = freqz(b\_hanning\_highpass, 1, 1024);

freq\_response\_blackman\_highpass = freqz(b\_blackman\_highpass, 1, 1024);

freq\_response\_rect\_bandpass = freqz(b\_rect\_bandpass, 1, 1024);

freq\_response\_hamming\_bandpass = freqz(b\_hamming\_bandpass, 1, 1024);

freq\_response\_hanning\_bandpass = freqz(b\_hanning\_bandpass, 1, 1024);

freq\_response\_blackman\_bandpass = freqz(b\_blackman\_bandpass, 1, 1024);

freq\_response\_rect\_stopband = freqz(b\_rect\_stopband, 1, 1024);

freq\_response\_hamming\_stopband = freqz(b\_hamming\_stopband, 1, 1024);

freq\_response\_hanning\_stopband = freqz(b\_hanning\_stopband, 1, 1024);

freq\_response\_blackman\_stopband = freqz(b\_blackman\_stopband, 1, 1024);

% Plot frequency responses

figure;

% Lowpass Filters

subplot(4, 4, 1);

plot(linspace(0, 1, length(freq\_response\_rect\_lowpass)), 20\*log10(abs(freq\_response\_rect\_lowpass)));

title('Rectangular Lowpass');

xlabel('Normalized Frequency');

ylabel('Magnitude (dB)');

grid on;

subplot(4, 4, 2);

plot(linspace(0, 1, length(freq\_response\_hamming\_lowpass)), 20\*log10(abs(freq\_response\_hamming\_lowpass)));

title('Hamming Lowpass');

xlabel('Normalized Frequency');

ylabel('Magnitude (dB)');

grid on;

subplot(4, 4, 3);

plot(linspace(0, 1, length(freq\_response\_hanning\_lowpass)), 20\*log10(abs(freq\_response\_hanning\_lowpass)));

title('Hanning Lowpass');

xlabel('Normalized Frequency');

ylabel('Magnitude (dB)');

grid on;

subplot(4, 4, 4);

plot(linspace(0, 1, length(freq\_response\_blackman\_lowpass)), 20\*log10(abs(freq\_response\_blackman\_lowpass)));

title('Blackman Lowpass');

xlabel('Normalized Frequency');

ylabel('Magnitude (dB)');

grid on;

% Highpass Filters

subplot(4, 4, 5);

plot(linspace(0, 1, length(freq\_response\_rect\_highpass)), 20\*log10(abs(freq\_response\_rect\_highpass)));

title('Rectangular Highpass');

xlabel('Normalized Frequency');

ylabel('Magnitude (dB)');

grid on;

subplot(4, 4, 6);

plot(linspace(0, 1, length(freq\_response\_hamming\_highpass)), 20\*log10(abs(freq\_response\_hamming\_highpass)));

title('Hamming Highpass');

xlabel('Normalized Frequency');

ylabel('Magnitude (dB)');

grid on;

subplot(4, 4, 7);

plot(linspace(0, 1, length(freq\_response\_hanning\_highpass)), 20\*log10(abs(freq\_response\_hanning\_highpass)));

title('Hanning Highpass');

xlabel('Normalized Frequency');

ylabel('Magnitude (dB)');

grid on;

subplot(4, 4, 8);

plot(linspace(0, 1, length(freq\_response\_blackman\_highpass)), 20\*log10(abs(freq\_response\_blackman\_highpass)));

title('Blackman Highpass');

xlabel('Normalized Frequency');

ylabel('Magnitude (dB)');

grid on;

% Bandpass Filters

subplot(4, 4, 9);

plot(linspace(0, 1, length(freq\_response\_rect\_bandpass)), 20\*log10(abs(freq\_response\_rect\_bandpass)));

title('Rectangular Bandpass');

xlabel('Normalized Frequency');

ylabel('Magnitude (dB)');

grid on;

subplot(4, 4, 10);

plot(linspace(0, 1, length(freq\_response\_hamming\_bandpass)), 20\*log10(abs(freq\_response\_hamming\_bandpass)));

title('Hamming Bandpass');

xlabel('Normalized Frequency');

ylabel('Magnitude (dB)');

grid on;

subplot(4, 4, 11);

plot(linspace(0, 1, length(freq\_response\_hanning\_bandpass)), 20\*log10(abs(freq\_response\_hanning\_bandpass)));

title('Hanning Bandpass');

xlabel('Normalized Frequency');

ylabel('Magnitude (dB)');

grid on;

subplot(4, 4, 12);

plot(linspace(0, 1, length(freq\_response\_blackman\_bandpass)), 20\*log10(abs(freq\_response\_blackman\_bandpass)));

title('Blackman Bandpass');

xlabel('Normalized Frequency');

ylabel('Magnitude (dB)');

grid on;

% Stopband Filters

subplot(4, 4, 13);

plot(linspace(0, 1, length(freq\_response\_rect\_stopband)), 20\*log10(abs(freq\_response\_rect\_stopband)));

title('Rectangular Stopband');

xlabel('Normalized Frequency');

ylabel('Magnitude (dB)');

grid on;

subplot(4, 4, 14);

plot(linspace(0, 1, length(freq\_response\_hamming\_stopband)), 20\*log10(abs(freq\_response\_hamming\_stopband)));

title('Hamming Stopband');

xlabel('Normalized Frequency');

ylabel('Magnitude (dB)');

grid on;

subplot(4, 4, 15);

plot(linspace(0, 1, length(freq\_response\_hanning\_stopband)), 20\*log10(abs(freq\_response\_hanning\_stopband)));

title('Hanning Stopband');

xlabel('Normalized Frequency');

ylabel('Magnitude (dB)');

grid on;

subplot(4, 4, 16);

plot(linspace(0, 1, length(freq\_response\_blackman\_stopband)), 20\*log10(abs(freq\_response\_blackman\_stopband)));

title('Blackman Stopband');

xlabel('Normalized Frequency');

ylabel('Magnitude (dB)');

grid on;

% Adjusting layout

sgtitle('Frequency Responses of FIR Filters with Different Window Functions and Types');