```
% Initail Conditions
beta0 = 0.3; % transmission rate
A = 5; % amplitude
omega = (2*pi) * (365/365); % angular frequency
gamma = 0.1; % recovery rate
N = 1000; % total population
h = 0.1; % step size
T = 30; % total time
S0 = 990;
I0 = 10;
R0 = 0;
omega2 = (2*pi) * (100/365); % for part 6

% Initialize Vectors
t = 0:h:T;
nSteps = length(t);
S = zeros(1, nSteps);
I = zeros(1, nSteps);
R = zeros(1, nSteps);
S2 = zeros(1, nSteps); % for part 6
I2 = zeros(1, nSteps); % for part 6
R2 = zeros(1, nSteps); % for part 6
S(1) = S0;
I(1) = I0;
R(1) = R0;
S2(1) = S0; % for part 6
I2(1) = I0; % for part 6
R2(1) = R0; % for part 6

% Eulars Method
for n = 1:nSteps-1
    beta_t = beta0 * (1+A*sin(omega*t(n)));
    beta_t2 = beta0 * (1+A*sin(omega2*t(n))); % for part 6
    dS = -beta_t / N * S(n) * I(n);
    dS2 = -beta_t2 / N * S2(n) * I2(n); % for part 6
    dI = beta_t / N * S(n) * I(n) - gamma * I(n);
    dI2 = beta_t2 / N * S2(n) * I2(n) - gamma * I2(n);% for part 6
    dR = gamma * I(n);
    dR2 = gamma * I2(n); % for part 6
    S(n+1) = S(n) + h * dS;
    I(n+1) = I(n) + h * dI;
    R(n+1) = R(n) + h * dR;
    S2(n+1) = S2(n) + h * dS2; % for part 6
    I2(n+1) = I2(n) + h * dI2; % for part 6
    R2(n+1) = R2(n) + h * dR2; % for part 6
end

% Plot of S(t), I(t), and R(t)
figure;
plot(t, S, 'b'); hold on;
plot(t, I, 'r');
plot(t, R, 'g');
```

```
xlabel('Time (days)');
ylabel('Population');
legend('S(t)', 'I(t)', 'R(t)');
title('SIR Model');
grid on

% Fast Fourier Transforms
S_fft = fft(S);
R_fft = fft(R);
I_fft = fft(I);
N_fft = length(I_fft);
f = (0:N_fft/2-1) / T;
I_fft_mag = abs(I_fft(1:N_fft/2));
S2_fft = fft(S2); % for part 6
R2_fft = fft(R2); % for part 6
I2_fft = fft(I2); % for part 6
N2_fft = length(I2_fft); % for part 6
f2 = (0:N2_fft/2-1) / T; % for part 6
I2_fft_mag = abs(I2_fft(1:N2_fft/2)); % for part 6

% Plot of Infected Cases
figure;
plot(f, I_fft_mag, 'r');
xlabel('Frequency (1/day)');
ylabel('Amplitude');
title('Fourier Spectrum of I(t)');
grid on;

% Plot of S2(t), I2(t), and R2(t)
figure;
plot(t, S2, 'b'); hold on;
plot(t, I2, 'r');
plot(t, R2, 'g');
xlabel('Time (days)');
ylabel('Population');
legend('S2(t)', 'I2(t)', 'R2(t)');
title('SIR Model Bi-Weekly');
grid on

% Plot of Infected Cases for Changed Omega
figure;
plot(f, I2_fft_mag, 'r');
xlabel('Frequency (1/day)');
ylabel('Amplitude');
title('Fourier Spectrum of I2(t)');
grid on;
```

```
Warning: Integer operands are required for colon
operator when used as index.
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operator when used as index.
```
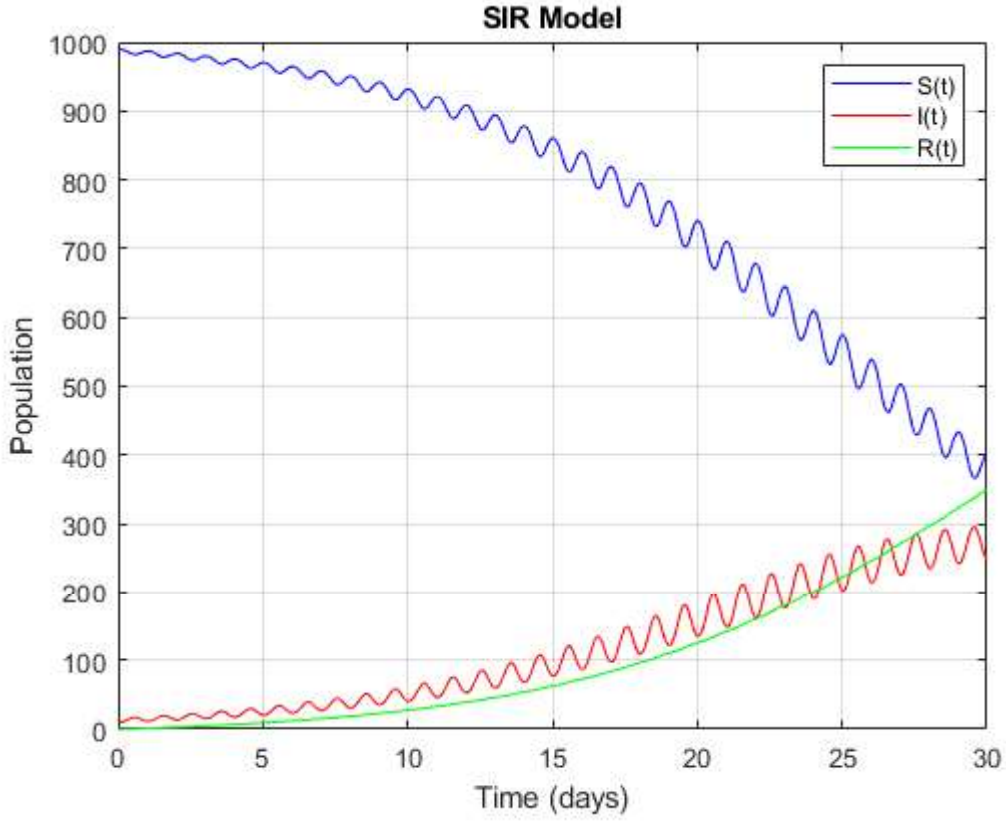
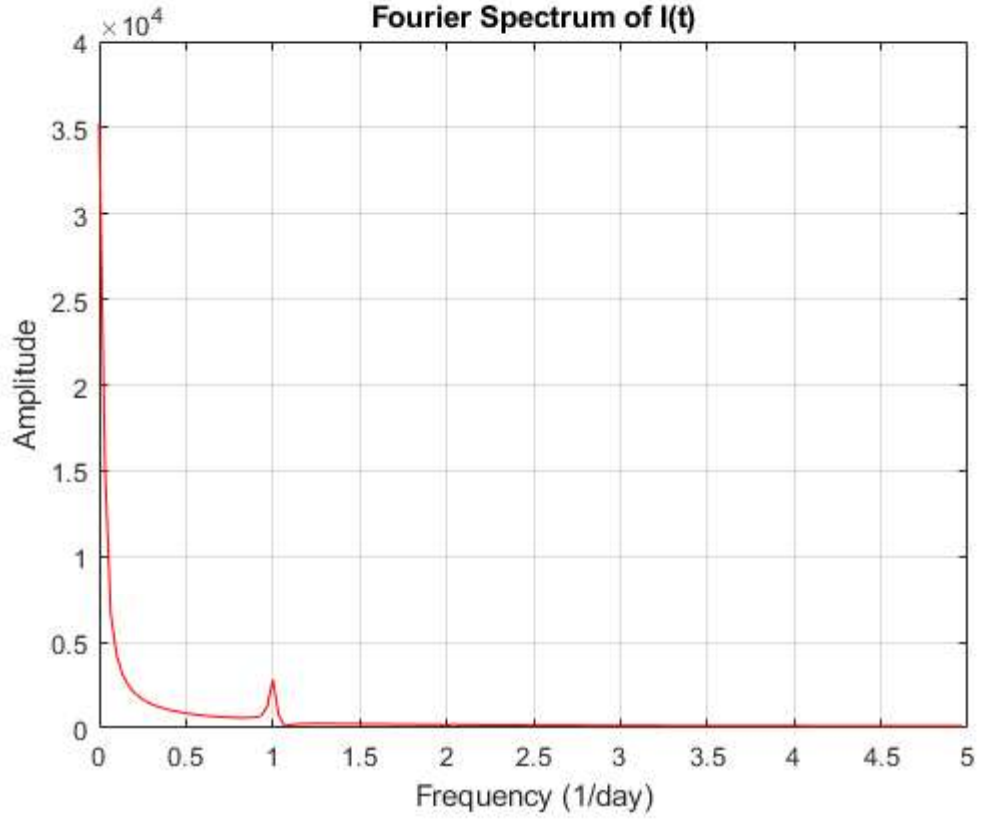
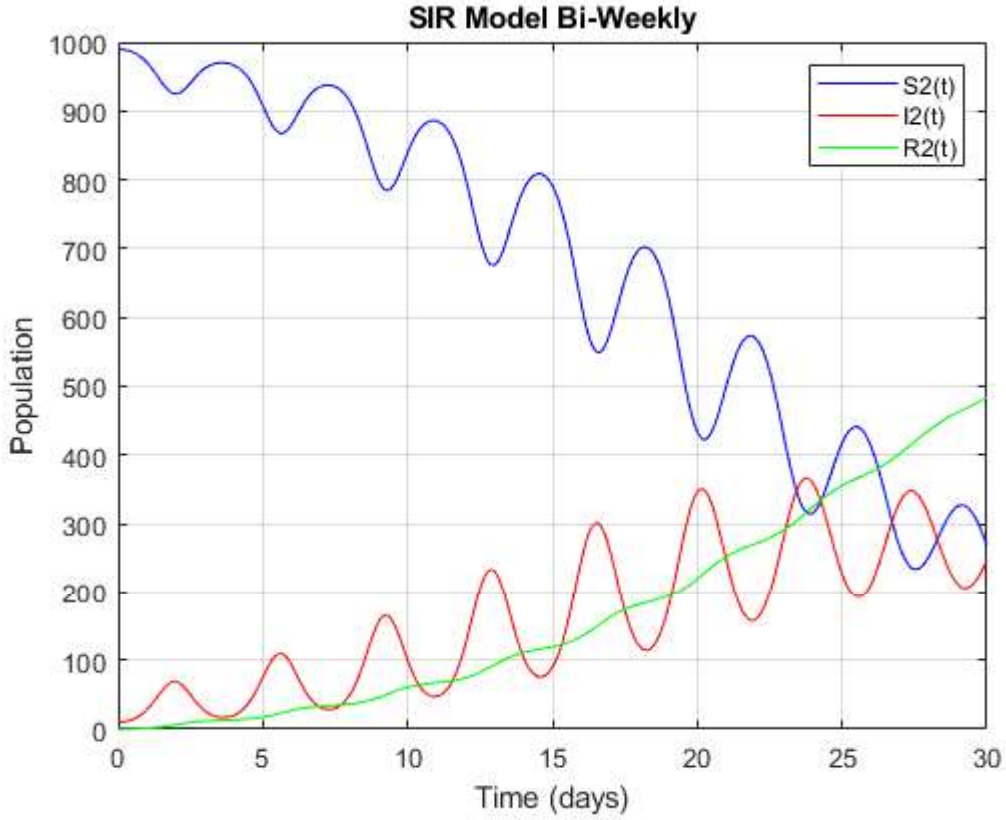
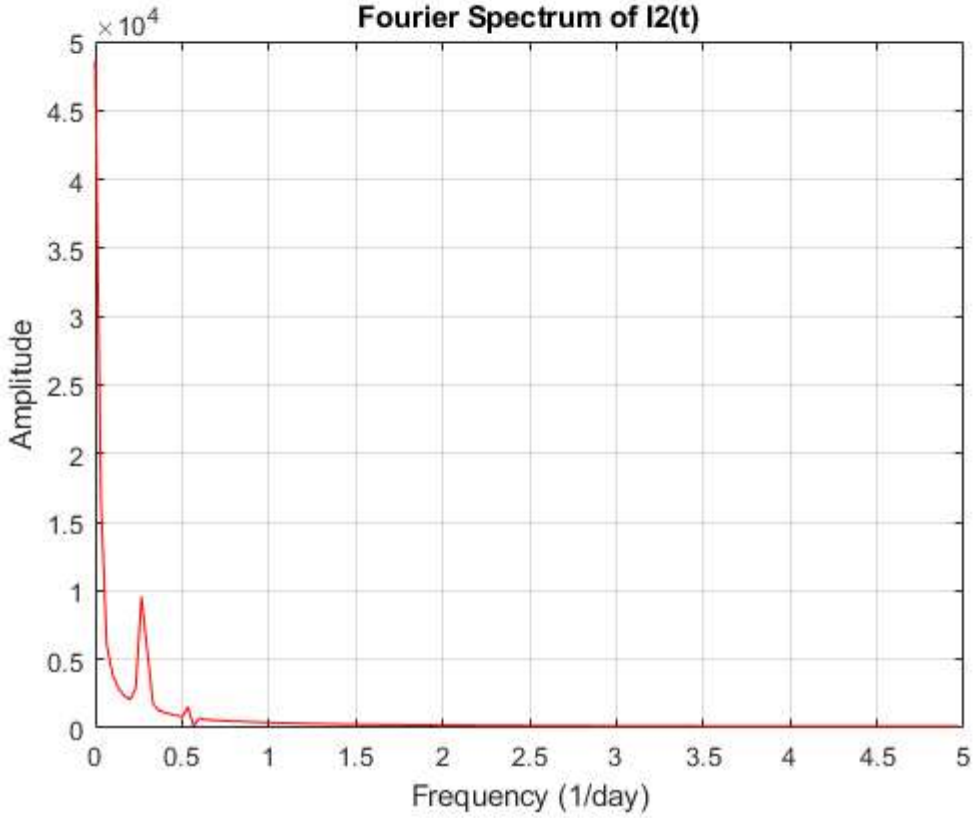


SIR Model
S(t)
I(t)
R(t)
Population
Time (days)
0
100
200
300
400
500
600
700
800
900
1000
0
5
10
15
20
25
30


Fourier Spectrum of I(t)
×10^4
Amplitude
Frequency (1/day)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5


SIR Model Bi-Weekly
S2(t)
I2(t)
R2(t)
Population
Time (days)
0
100
200
300
400
500
600
700
800
900
1000
0
5
10
15
20
25
30


Fourier Spectrum of I2(t)
×10^4
Amplitude
Frequency (1/day)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5

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