

1)

```
clear all;
clc;
% Initial Values
I0 = 10;
S0 = 990;
R0 = 0;

N = I0 + S0 + R0;

Beta = [.3 1 2];
gamma = [.1 .1 .2];
ti = ["Seasonal Influenza", "COVID-19", "Measles"];
leg = ["Recovered", "Susceptible", "Infected"];

h = 1;
t0 = 0; tf = 100;
tiledlayout(3,1);
RValsFinal = zeros(3,101);
SValsFinal = zeros(3,101);
IValsFinal = zeros(3,101);
% Change of Virus loop
for j = 1:length(Beta)
    Gamma=gamma(j);
    BN1=Beta(j)/1000;
    time = t0:h:tf;
    Rvals = zeros(size(time));
    Svals = zeros(size(time));
    Ivals = zeros(size(time));
    Nvals = zeros(size(time));

    Rvals(1) = R0;
    Svals(1) = S0;
    Ivals(1) = I0;
    Nvals(1) = 1000;
    dRdt = @(I) Gamma*I;
    dSdt = @(I,S) -BN1*S*I;
    dIdt = @(I,S) (BN1*S*I)-(Gamma*I);
    % Time loop
    for i = 1:length(time)-1
        R=Rvals(i);
        S=Svals(i);
        I=Ivals(i);

        rk1 = dRdt(I);           % Runge Kutta Recovered K1
        sk1 = dSdt(I,S);        % Runge Kutta Susceptible K1
        ik1 = dIdt(I,S);        % Runge Kutta Infected K1
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        ik2 = dIdt((I + ik1 * (h/2)) , S + sk1 * (h/2));           % Runge
Kutta Infected K2
        rk2 = dRdt(I + ik1 * (h/2));                               % Runge Kutta Recovered K2
        sk2 = dSdt(I + ik1 * (h/2) , (S + sk1 * (h/2)));          % Runge
Kutta Susceptible K2

        sk3 = dSdt(I + ik2 * (h/2) ,(S + sk2 * (h/2)));           % Runge
Kutta Susceptible K3
        ik3 = dIdt((I + ik2 * (h/2)) ,S + sk2 * (h/2));           % Runge Kutta
Infected K3
        rk3 = dRdt(I + ik2 * (h/2));                               % Runge Kutta Recovered K3

        ik4 = dIdt((I + ik3 * h),S + sk3 * h);                     % Runge Kutta Infected
K4
        sk4 = dSdt(I + ik3 * h , (S + sk3 * h));                  % Runge Kutta
Susceptible K4
        rk4 = dRdt(I + ik3 * h);

        Rvals(i+1) = R + (1/6) * (rk1 + 2*(rk2) + 2*(rk3) + rk4) * h;
        Svals(i+1) = S + (1/6) * (sk1 + 2*(sk2) + 2*(sk3) + sk4) * h;
        Ivals(i+1) = I + (1/6) * (ik1 + 2*(ik2) + 2*(ik3) + ik4) * h;
        Nvals(i+1) = Rvals(i+1) + Svals(i+1) + Ivals(i+1);
        RvalsFinal(j,i+1) = Rvals(i+1);
        SvalsFinal(j,i+1) = Svals(i+1);
        IvalsFinal(j,i+1) = Ivals(i+1);
end

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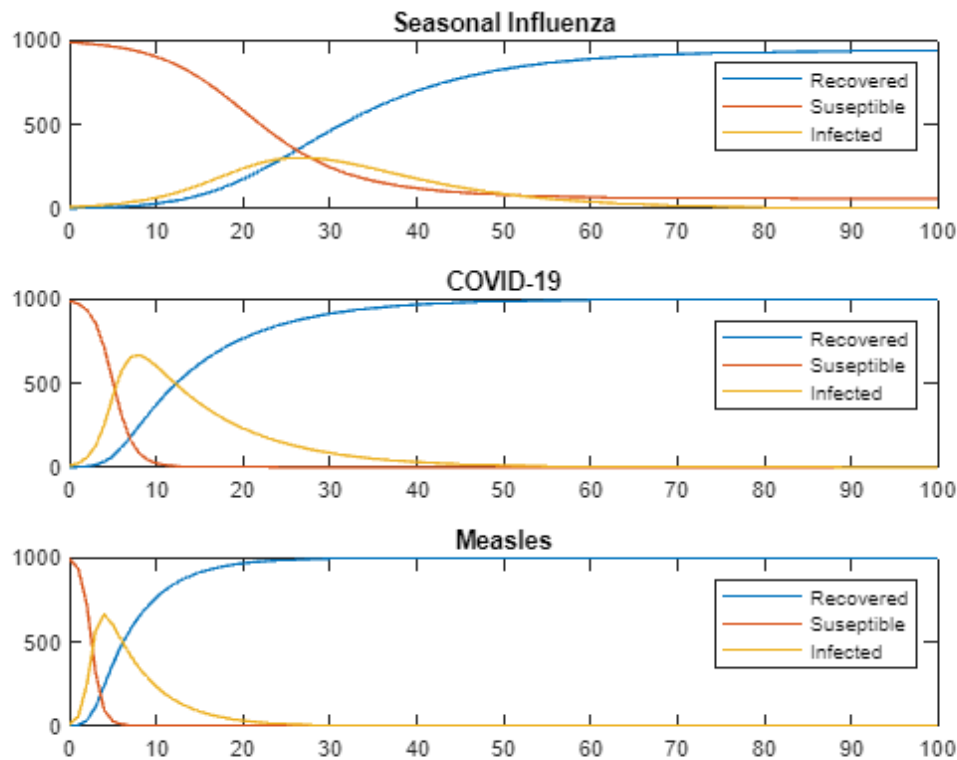
2)

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nexttile;
plot(time,Rvals);
hold on;
plot(time,Svals);
plot(time,Ivals);
title(ti(j));
legend(leg);
hold off;

end

```



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RValsFinal(:,1) = R0;
SValsFinal(:,1) = S0;
IValsFinal(:,1) = I0;

% Seasonal Influenza Data
% Recovered Values = RValsFinal(1,:);
% Suseptible Values = SValsFinal(1,:);
% Infected Values = IValsFinal(1,:);

% COVID-19 Data
% Recovered Values = RValsFinal(2,:);
% Suseptible Values = SValsFinal(2,:);
% Infected Values = IValsFinal(2,:);

% Measles Data
% Recovered Values = RValsFinal(3,:);
% Suseptible Values = SValsFinal(3,:);
% Infected Values = IValsFinal(3,:);

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3)

The Plots for the Recovered and Suseptible data for each virus resemble hyperbolic tangent functions while the Plots for Infected resemble a hyperbolic secant function.

The gamma value affects the magnitude of the rate of change of recovered people. As gamma increases, so does the magnitude of the rate of those recovered. Likewise, as Beta increases, the magnitude of the rate of change of susceptible people also increases. This, in turn, causes the rate of which people are infected to spike. Therefore, the order of contagiousness of the viruses is:

Measles - Most infectious -> COVID-19 -> Seasonal Influenza - Least infectious.