Homework 1: Giri Subramanian

The code is given below.

Problem 1:

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%% Problem 1

t = 0:0.1:3;
Ts = 38;
T0 = 120;
k = 0.45;

T = Ts + (T0-Ts)*exp(-k*t);
T_end = round(T(end));

fprintf('The temperature of the can after 3 hours is %d degrees F \n',T_end)
% Answer is 59F
figure(1)
plot(t,T)
xlabel('Time (hours)')
ylabel('Temperature (Fahrenheit)')
print -dpng Giri_Subramanian_HW_1_Problem_1.png


%% Problem 2

m = 1.67*10^-27;
q = 1.6*10^-19;
B0 = 0.35;
v_perp = 4.69*10^6;
v_parallel = 1;

rho = (m*v_perp)/(q*B0);
omega = q*B0/m;

fprintf('The value of radius is %d m and that of the cyclotron frequency is %d rad/s \n' ...
        ,rho,omega);
t = 0:0.5:30;
x = rho*cos(omega*t);
y = rho*sin(omega*t);
z = v_parallel*t;

figure(2)
plot3(x,y,z)
xlabel('x')
ylabel('y')
zlabel('z')
grid on
print -dpng Giri_Subramanian_HW_1_Problem_2a.png

% Since it's moving perpendicular to the same magnetic field, it's parallel
% velocity is zero. But since the overall speed is the same, the
% perpendicular velocity will increase. The new variables are found using
% the mass of the electron
m_elec = 9.10938291*10^(-31);
v_perp_new = sqrt(v_perp^2 + v_parallel^2);
omega_new = q*B0/m_elec;
rho_new = (m_elec*v_perp_new)/(q*B0);
fprintf('The new value of radius is %d m and that of the frequency is %d rads/s \n', ...
         rho_new, omega_new);

% r_original = 0.139m , omega_original = 3.35e+07 rads/s
% r_new = 7.63*e-05, omega_new = 6.14e+10 rads/s

%% Problem 3

t = 0:0.05:8;
v = -8:0.1:8;
z = exp(-t/2).*cos(20*t - 6);
u = 6*log10(v.^2 + 20);
```

```
figure(3)
subplot(1,2,1)
plot(t,z)
xlabel('t')
ylabel('z')
text(3,0.8,'z = e^{-t/2}cos(20t-6)','FontSize',20)
subplot(1,2,2)
plot(v,u)
xlabel('v')
ylabel('u')
text(-2,11.5,'u = 6log_{10}(v^2 + 20)','FontSize',20)

print -dpng Giri_Subramanian_HW_1_Problem_3.png

%%  Problem 4

% All values taken here are in ratio to the chord
airfoil = input('Please enter the 4 digit NACA airfoil number alone: ', 's');

% Method given below can be used if digit input is taken
% if floor(airfoil/10000) ~= 0
%     fprintf('Please input only a 4 digit number \n')
%     return
% end
% t = mod(airfoil,100)/100;
% p = mod(floor(airfoil/100),10)/10;
% m = floor(airfoil/1000)/100;

if length(airfoil) ~= 4
     fprintf('Please input only a 4 digit number \n')
     return
 end


t = str2num(airfoil(3:4))/100;
p = str2num(airfoil(2))/10;
m = str2num(airfoil(1))/100;
x = 0:0.001:1;

max_camber_index = find(x==p);

y_camb(1:max_camber_index) = (m/p^2)*(2*p*x(1:max_camber_index) ...
                                      - x(1:max_camber_index).^2);
y_camb(max_camber_index+1:length(x)) = (m/(1-p)^2)*((1 - 2*p) ...
                                      + 2*p*x(max_camber_index+1:length(x)) ...
                                      - x(max_camber_index+1:length(x)).^2);

y_thick = (t/0.2)*(0.29690*sqrt(x) - 0.126*x - 0.3516*x.^2 + 0.2843*x.^3 ...
                   - 0.1015*x.^4);

y_u = y_camb + y_thick;
y_d = y_camb - y_thick;

figure(4)
h = plot(x,y_u,x,y_d,x,y_camb);
axis equal
legend('Upper surface','Lower Surface', 'Camber line');

title(sprintf('Plot of airfoil %s',airfoil))
xlabel('x/c')
ylabel('y/c')
set(h,'LineWidth',2)
print -dpng Giri_Subramanian_HW_1_Problem_4.png
```

The plots generated have been attached below.

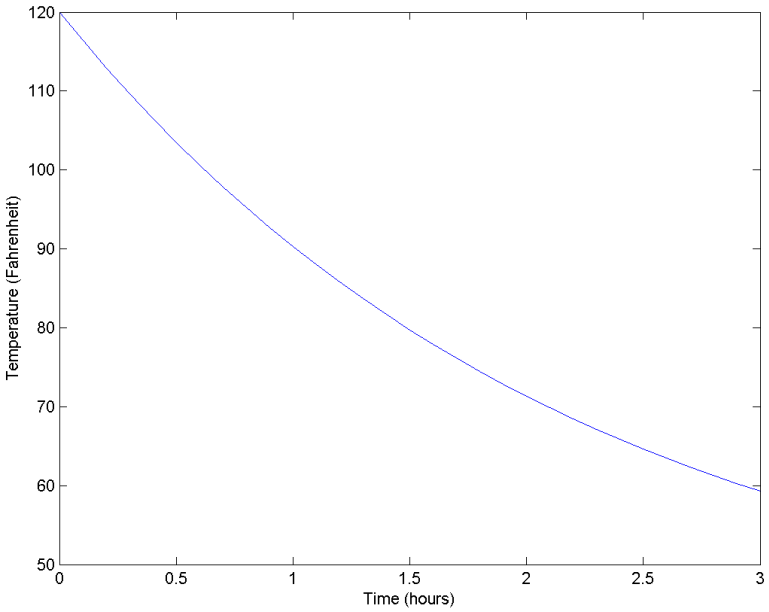

Figure 1: Question 1

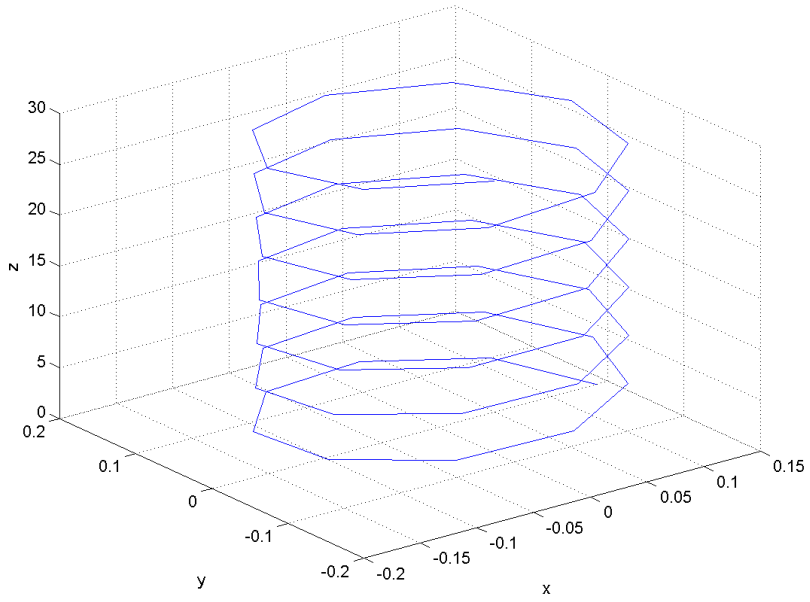

Figure 2: Question 2

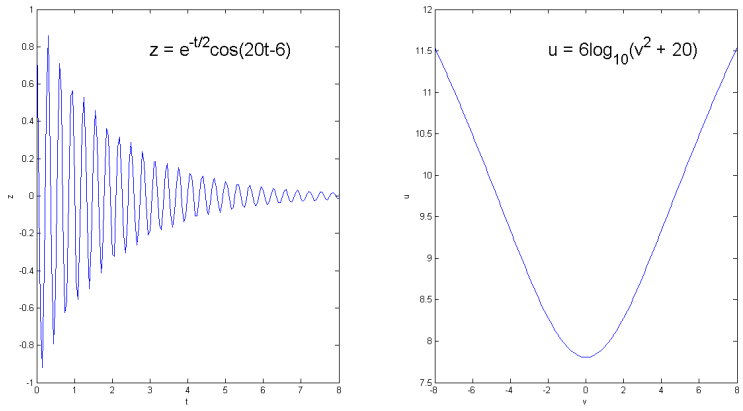

Figure 3: Question 3

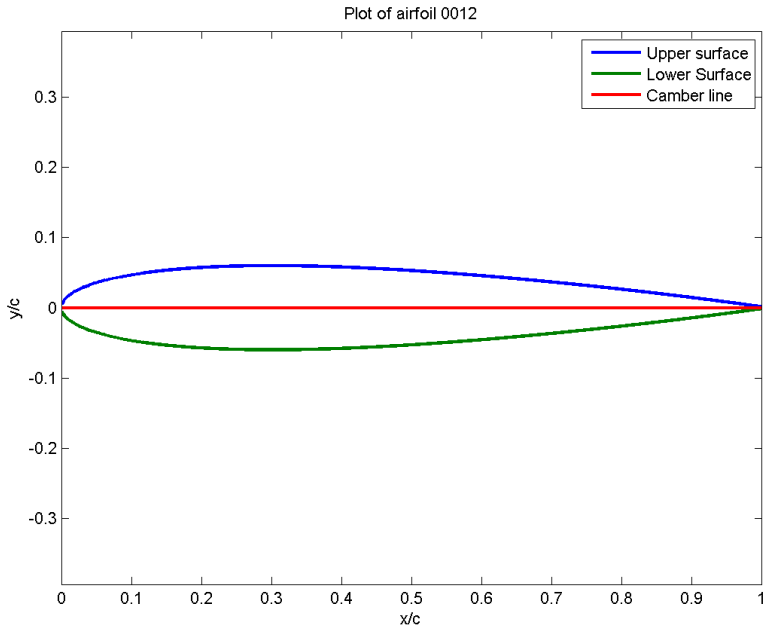

Figure 4: Question 4