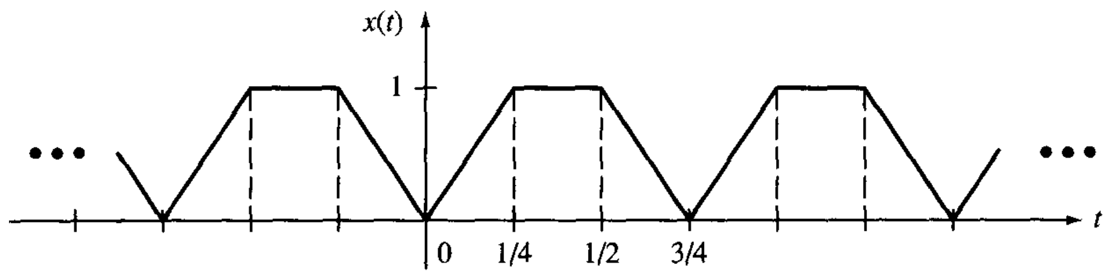
For the signal of 3.3f, use MATLAB to plot the exact $x(t)$ (dashed line) as well as compute & plot the Fourier series $x_N(t)$ for $N = 5$ (solid line) over the time range $-1.5 \le t \le 1.5$ s.

****

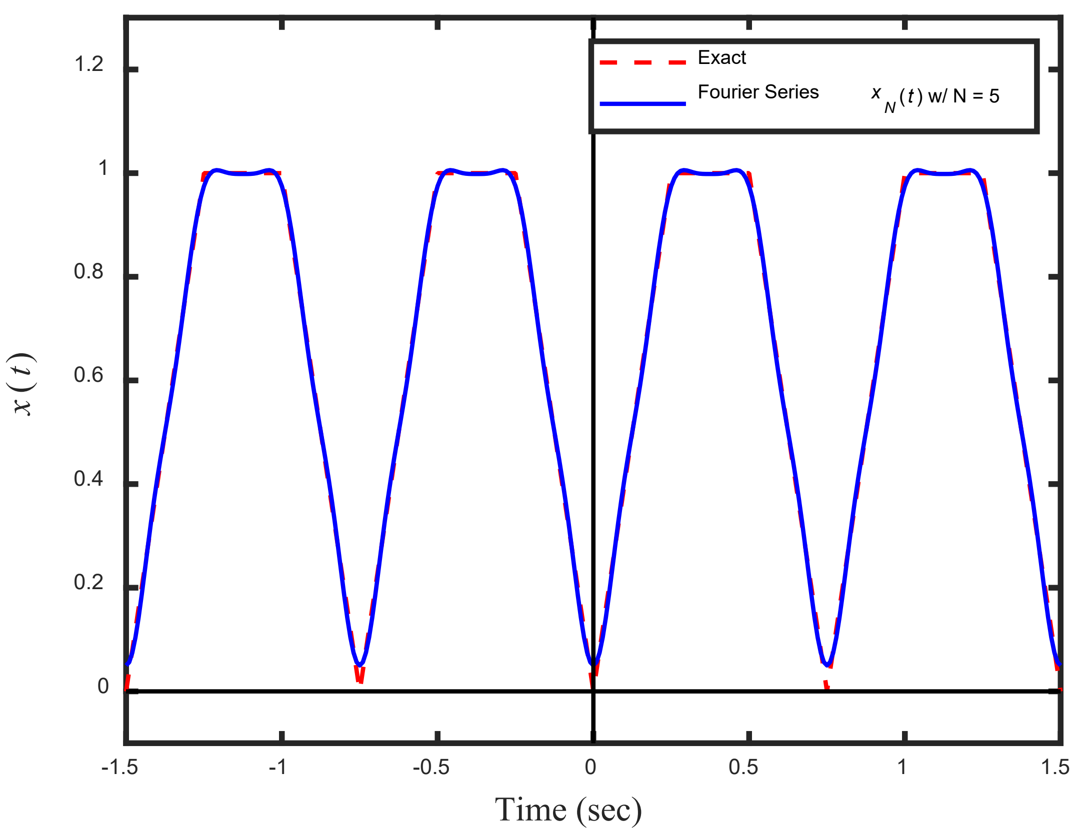
3.3. Compute the (sine/cosine) trigonometric Fourier series for each of the periodic signals shown in Figure P3.3. Use even or odd symmetry whenever possible.



(f)

****

Problem 3.3f



Note: Since $x(t)$ does NOT have step discontinuities, the trigonometric Fourier series does NOT suffer from Gibb's phenomenon. So, with 5 harmonics, the Fourier series is an excellent representation of $x(t)$.

```
% Chapter 3 Fourier series (chap3_3_03f.m)
% Compute Trigonometric Fourier series for 3.3f
clear;clc;close all;
x =[0,1,1,0,1,1,0,1,1,0,1,1,0]; % values for exact x(t)
tx = [-1.5,-1.25,-1,-0.75,-0.5,-0.25,0,0.25,0.5,0.75,1,1.25,1.5];
t = -1.5:0.01:1.5; % Compute trig Fourier series for this range
N = input('Number of harmonics ');
a0 = 2/3; w0 = 8*pi/3; % dc term and fundamental freq (rad/s)
xN = a0*ones(1,length(t));   % dc component
for k=1:N, % compute FS of x(t) for N harmonics
  ak = (3/pi^2/k^2)*(cos(2*pi/3*k)-1) % Even func. --> No bk terms
  xN = xN + ak*cos(k*w0*t);
end
plot(tx,x,'r-',t,xN,'b-',[-3 3],[0,0],'k-',[0 0],[-0.5,2.5],'k-'),
axis([-1.5 1.5 -0.1 1.3]),
title('Problem 3.3f','fontsize',18,'fontname','times')
legend('Exact',['Fourier Series {\itx_N}({\itt}) w/ N = ',num2str(N)])
xlabel('Time (sec)','fontsize',16,'fontname','times')
ylabel(['{\itx}({\itt})'],'fontsize',16,'fontname','times')
set(findobj('type','line'),'linewidth',1.5,'markersize',18)
set(findobj('type','axes'),'linewidth',2)
```