Analog Communication MATLAB Assignment

Group – 5 Set – II

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Question 1:

MATLAB Code:

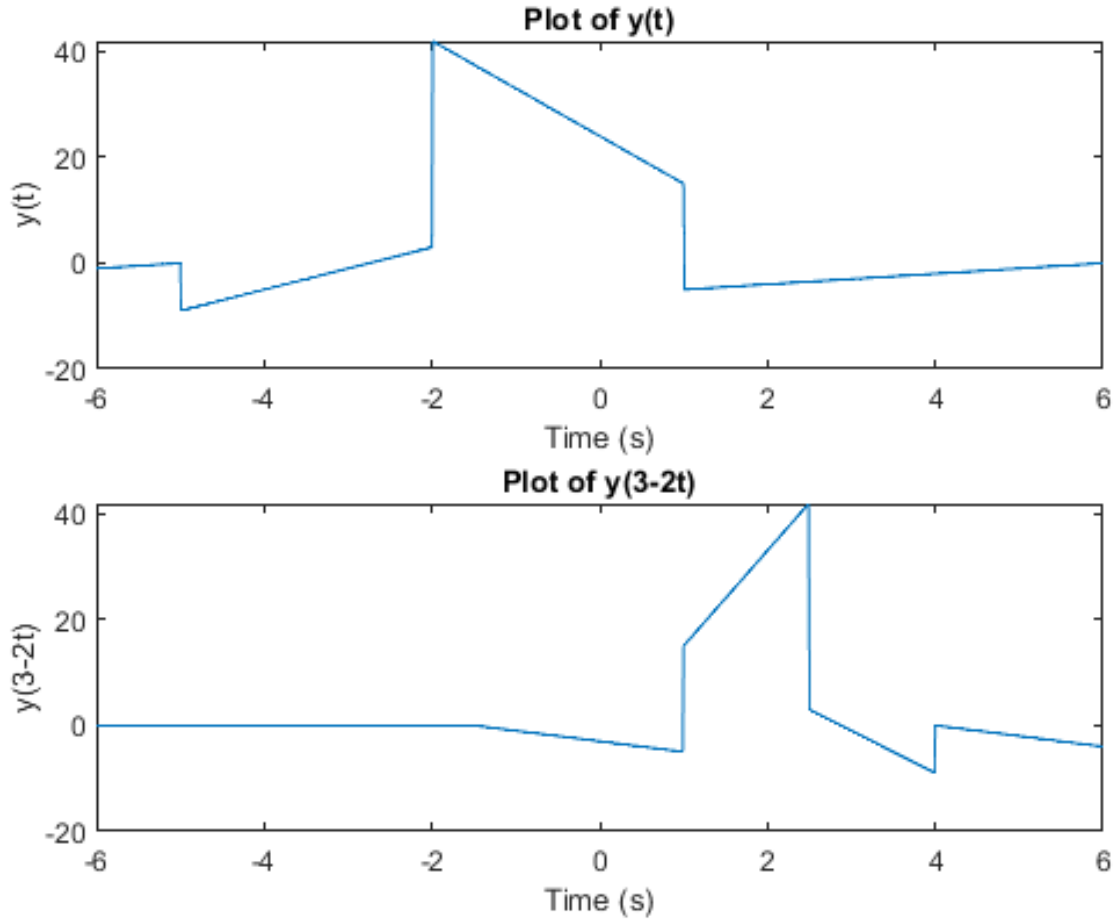
```
function y = signal_y(t)
    y = zeros(size(t));

    y(t <= -5) = t(t <= -5) + 5;
    y(t > -5 & t <= -2) = 11 + 4*t(t > -5 & t <= -2);
    y(t > -2 & t <= 1) = 24 - 9*t(t > -2 & t <= 1);
    y(t > 1 & t <= 3) = t(t > 1 & t <= 3) - 6;
    y(t > 3 & t <= 6) = t(t > 3 & t <= 6) - 6;
end

t = -6:0.01:6;

subplot(2,1,1);
plot(t, signal_y(t));
xlabel('Time (s)');
ylabel('y(t)');
title('Plot of y(t)');

subplot(2,1,2);
plot(t, signal_y(3-2*t));
xlabel('Time (s)');
ylabel('y(3-2t)');
title('Plot of y(3-2t)');
```



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Question 2:

MATLAB Code:

```
T = 2*pi;
f = 1;
N = 10;
x = @(t) abs(sin(2*pi*f*t));

Do = (1/T) * integral(x, 0, T);

n = -N:N;
Dn = zeros(size(n));

for k = 1:length(n)
    nk = n(k);
    fun = @(t) x(t) .* exp(-1j*2*pi*nk*t/T);
    Dn(k) = (1/T) * integral(fun, 0, T);
end

magnitude = abs(Dn);
phase = angle(Dn);

figure;
subplot(2,1,1);
stem(n, magnitude, 'b');
xlabel('Harmonic number (n)');
ylabel('Magnitude');
title('Magnitude Spectrum');

subplot(2,1,2);
stem(n, phase, 'r');
xlabel('Harmonic number (n)');
ylabel('Phase (radians)');
title('Phase Spectrum');

disp(['DC component (Do): ', num2str(Do)]);
disp(['Complex Fourier coefficient (D1): ', num2str(Dn(N+2))]);
```

```
DC component (Do): 0.6385
Complex Fourier coefficient (D1): 0.0018944-0.00083886i
```

Figure/Plot:

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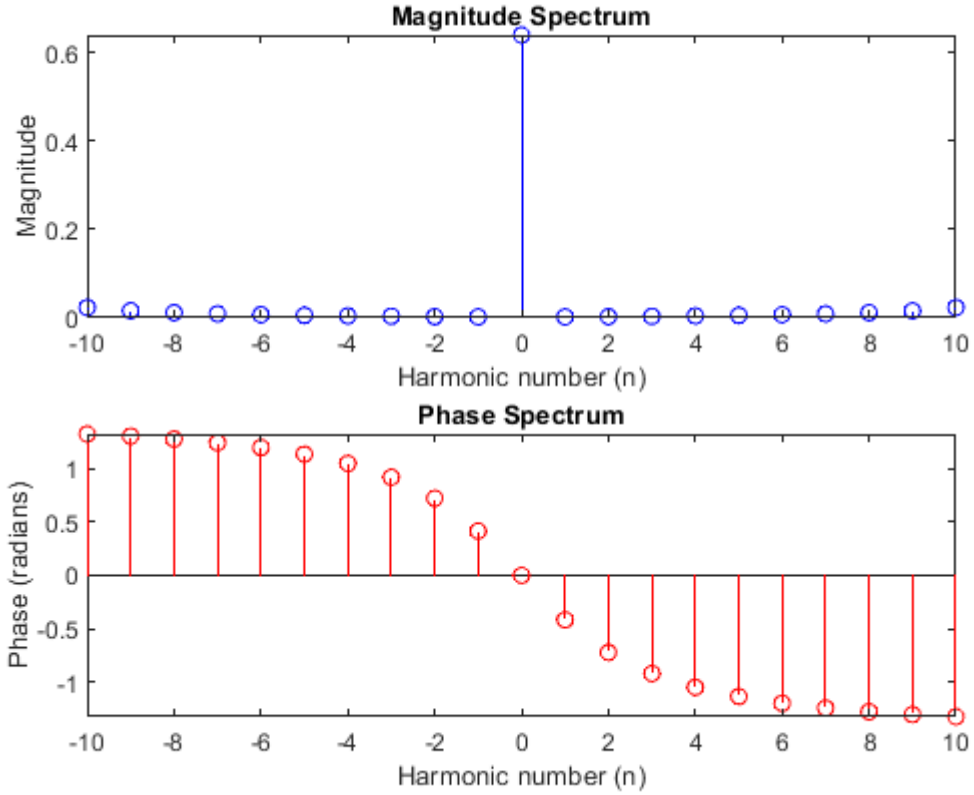

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Question 3: MATLAB Code:

```
clc; clear; close all;

n = 0:12;

X = (n >= 0) - (n >= 5);
h = ((n >= 0) - (n >= 7)).*(2.^n);

Lx = length(X);
Lh = length(h);
Ly = Lx + Lh - 1;

y_manual = zeros(1, Ly);
for i = 1:Lx
    for j = 1:Lh
        y_manual(i + j - 1) = y_manual(i + j - 1) + X(i) * h(j);
    end
end

y_builtin = conv(X, h);

n_conv = 0:(Ly - 1);

figure;
stem(n, X, 'b', 'LineWidth', 2);
grid on;
xlabel('n'); ylabel('X(n)');
title('Input Sequence X(n)');

figure;
stem(n, h, 'r', 'LineWidth', 2);
grid on;
xlabel('n'); ylabel('h(n)');
title('Impulse Response h(n)');

figure;
stem(n_conv, y_manual, 'g', 'LineWidth', 2);
grid on;
xlabel('n'); ylabel('y(n)');
title('Convolution Result using Normal Method');

figure;
stem(n_conv, y_builtin, 'm', 'LineWidth', 2);
grid on;
xlabel('n'); ylabel('y(n)');
title('Convolution Result using MATLAB "conv" function');

disp('Manual Convolution Result:');
disp(y_manual);
disp('Built-in CONV Function Result:');
disp(y_builtin);

% Validate the result
if isequal(y_manual, y_builtin)
    disp('Validation Successful: Both results match!');
else
    disp('Validation Failed: Results do not match.');
end
```

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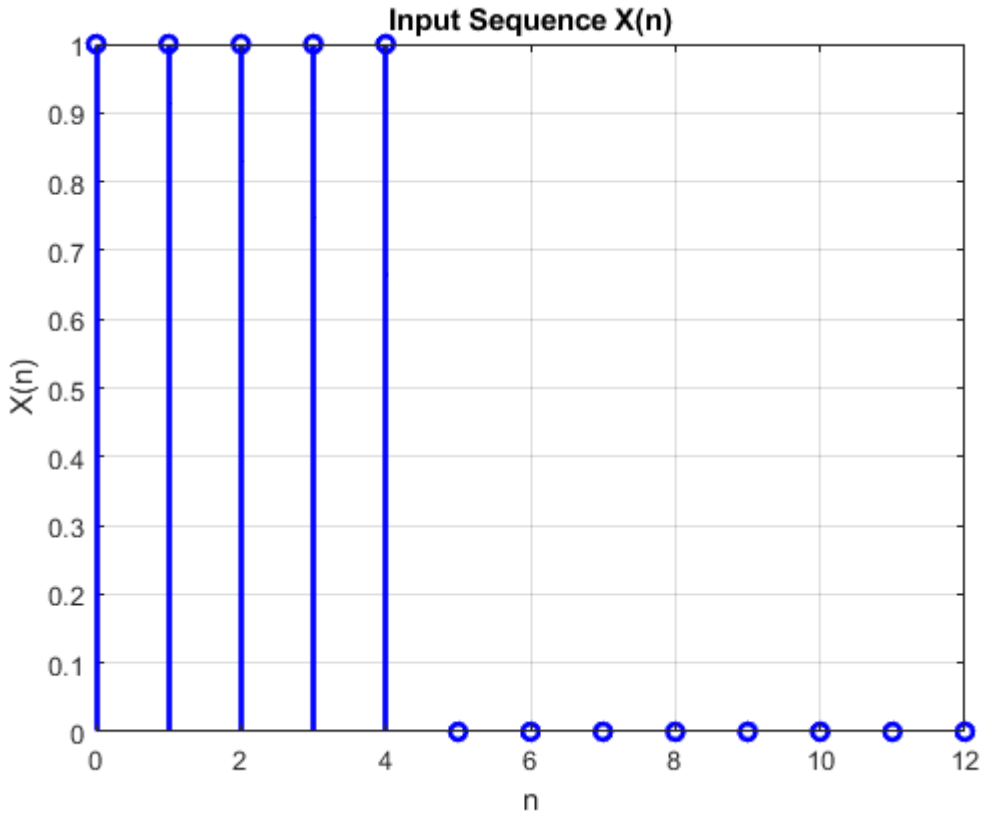
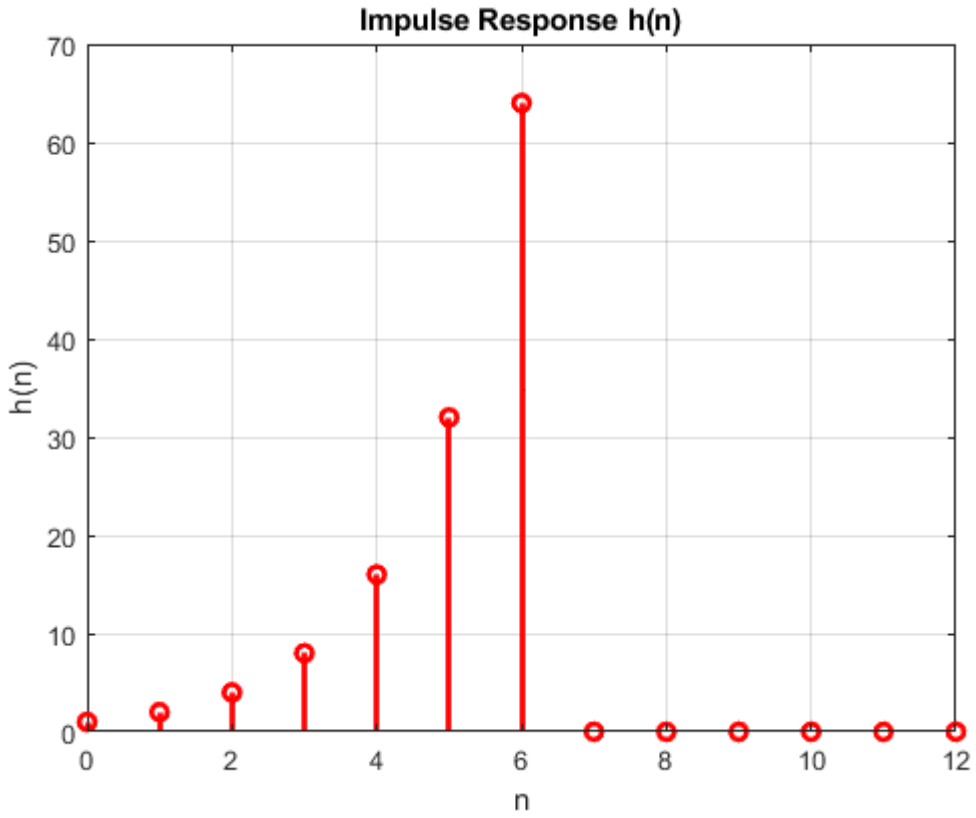
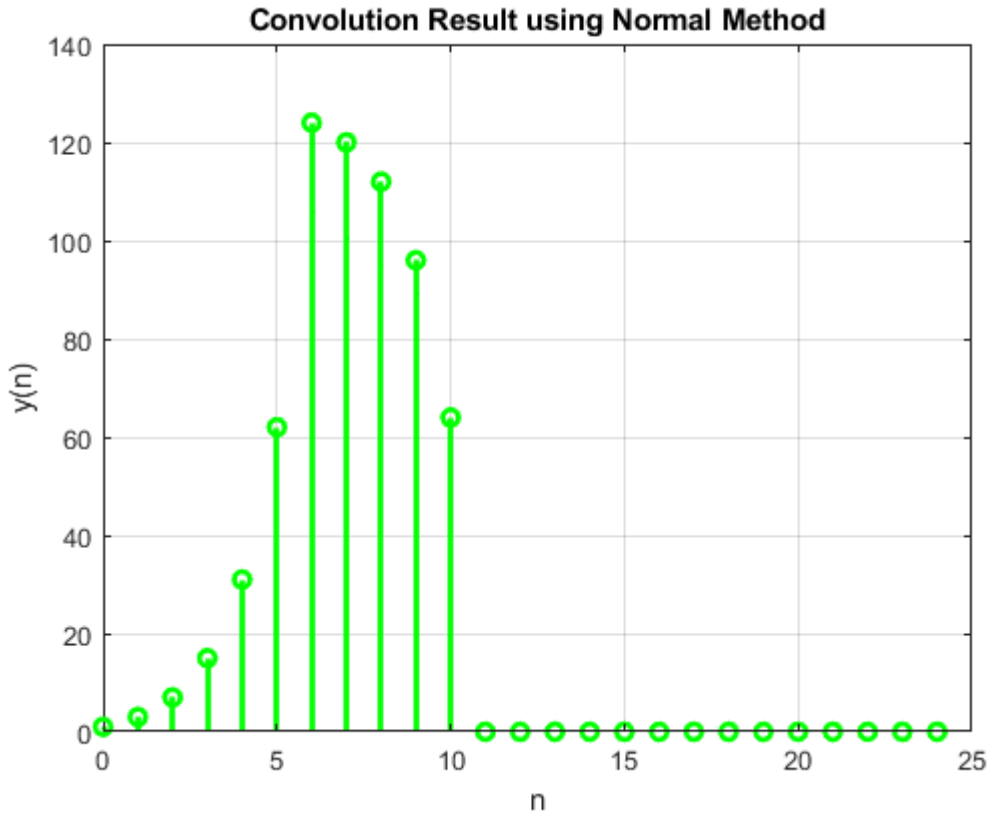
```
Manual Convolution Result:
  Columns 1 through 13

     1     3     7    15    31    62   124   120   112    96    64     0     0

  Columns 14 through 25

     0     0     0     0     0     0     0     0     0     0     0     0

Built-in CONV Function Result:
  Columns 1 through 13

     1     3     7    15    31    62   124   120   112    96    64     0     0

  Columns 14 through 25

     0     0     0     0     0     0     0     0     0     0     0     0

Validation Successful: Both results match!
```







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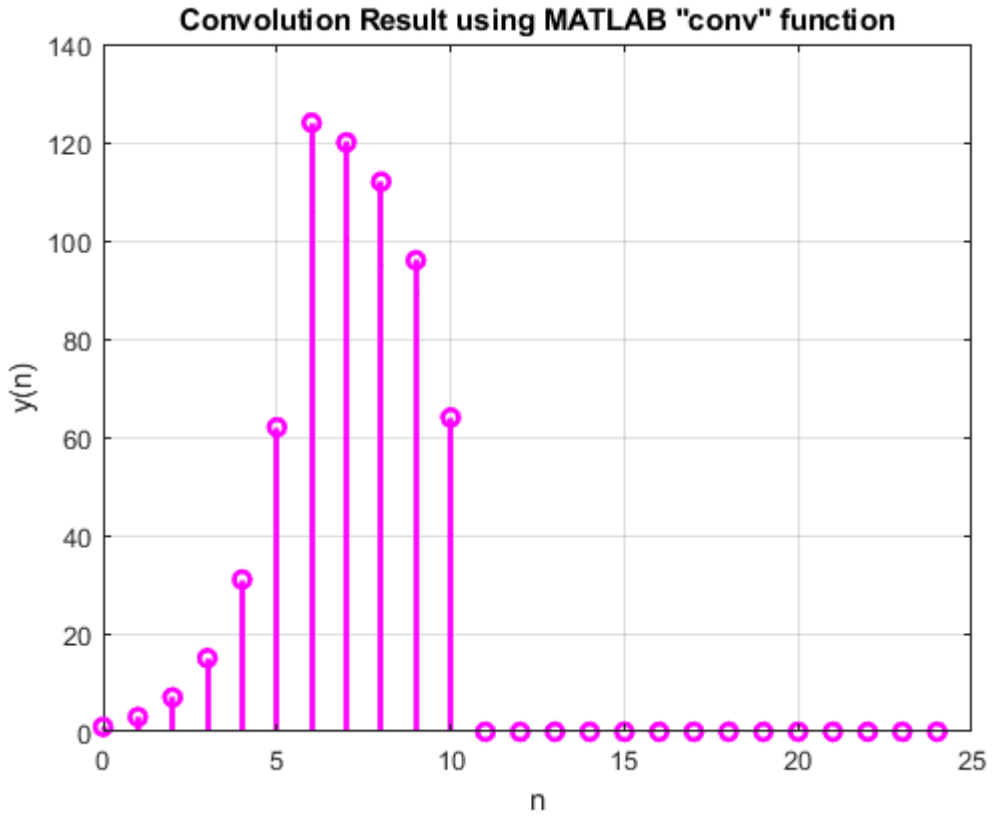

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