```
function [Kx, Kr] = ObtainCartFeedback(m1,m2,R, Ts, MOS)

% m1 = 1; m2 = 4; R = 1;
[A,B] = linearizedCartPend(m1,m2,R) %#ok<NOPRT>
sig = getSigForTs(Ts);
[zeta, th, w] = getForOS(MOS,sig); %#ok<ASGLU>
dom_poles = [sig+1j*w, sig-1j*w];
des_poles = [dom_poles, 5*sig, 5*sig-1] %#ok<NOPRT>

C1 = [1 0 0 0]; % Position of cart
C2 = [0 1 0 0]; % Angle of bar
C = C1;
% olPoles = flip(eig(A));

[Kx,Kr] = placePoles(A,B,C,des_poles) %#ok<NOPRT>

G1 = ss(A-B*Kx, B*Kr, C1, 0);
G2 = ss(A-B*Kx, B*Kr, C2, 0);
G = G1;
U = ss(A-B*Kx, B*Kr, -Kx, Kr);

step(G);
hold on;
step(G2);
step(U);
legend('x(t)','\theta(t)','F(t)');
xlabel('Time (s)'); title('Linearized System Model: Step
Response');
hold off;

end
```

```
% Cart and Pendulum
% EC 463 Lecture 7
% main calling routine

X = zeros(4,1);
dX = zeros(4,1);
Ref = 1;
dt = 0.01;
t = 0;

m1 = 1;
m2 = 4;
R = 1;
Ts = 8; MOS = 0.05;
[Kx, Kr] = ObtainCartFeedback(m1,m2,R,Ts,MOS);
% Kx = [-1.0714, -78.5964, -2.5230, -12.5230];
% Kr = -1.0714;

pause;
U = 0;
y = [];
dim = [0.3 0.6 0.2 0.15];
an = annotation('textbox', dim, 'String', '', 'FitBoxToText',
'on');
while(t < Ts*2)
    U = Kr*Ref - Kx*X;
    dX = CartDynamics(X, U, m1, m2, R);
    X = X + dX * dt;
    t = t + dt;

    CartDisplay(X, Ref);
    y = [y ; X(1), X(2), Ref];

    str = sprintf('Time = %.2f s', t);
    an.String = str;
    drawnow;
end

t = linspace(0,Ts*10,length(y));
plot(t,y);
xlabel('Time (s)'); title('Nonlinear System Model: Step
Response');
```