BASKENT UNIVERSITY
ELECTRICAL & ELECTRONICS ENGINEERING DEPARTMENT
EEM 441 COMMUNICATION SYSTEMS I – 1st MIDTERM EXAM

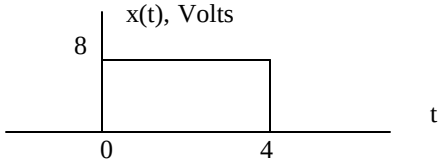
Duration: 2 hours 21/11/2003

1. Given a rectangular signal $v(t) = (A/T)\ \text{rect}\ [(t-t_d)/T)]$

a) Determine its energy.
b) Find and sketch its spectral denisty.
c) Find and sketch the autocorrelation function.

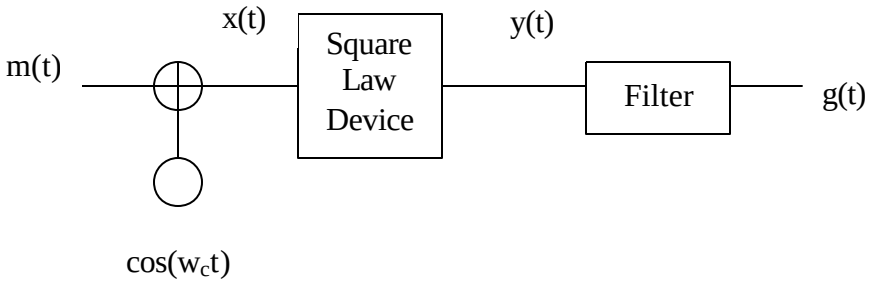
2. $x_c(t) = 50\cos[w_c t + 2pf_d \int x(a)da]$

$f_d = 20$ Hz/Volts



a) Sketch the instantaneous phase in radians.
b) Sketch the instantaneous frequency in Hz.

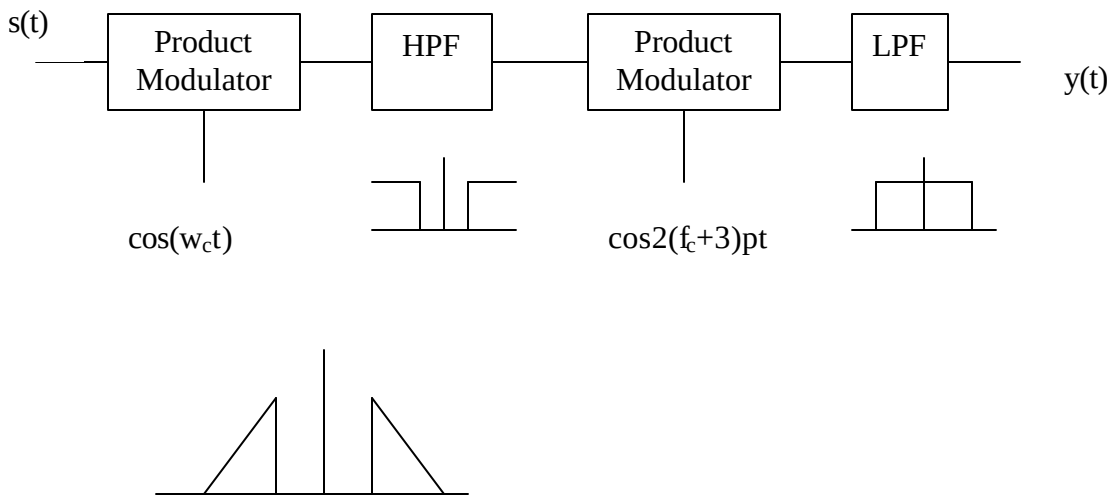
3. Consider the system shown below.



Assume that the average value of m(t) is zero and the minimum value of x(t) is M. Also assume that the square law device is defined by $y(t) = 6x(t) + 4x^2(t)$.

a) Write the equation for y(t) and sketch its fequency spectrum.
b) Describe the filter that yields an AM signal for g(t). Give the necessary filter type and frequencies of interest.
c) What value of M yields a modulation index of 0.1 ?

4. In the following system, the message signal s(t) has the spectrum as shown below.



Sketch Y(f). Take $f_c >> 3$ kHz.