ELG 3170 Summer 2008 Midterm Exam

2 hours; 30 points in total; closed-book with one-page double-sided aid-sheet allowed

Question 1 (8 points) *Let* $x(t) := 2\cos(2\pi \cdot 100t + \pi/3) + \sin(2\pi \cdot 150t + \pi/4)$.

1. Determine the Fourier Transform of $x(t)$
2. Determine whether the signal is a power-type signal or an energy-type signal, and find the power or energy of the signal whichever is finite and non-zero.

Question 2 (8 points) *Signal* $m(t)$ *is to be transmitted using an analogue modulation scheme. It is decided that the transmitted signal*

$$u(t) = A \cdot [m(t) + 10] \cdot \cos(2\pi \cdot 800000t)$$

for some A.

1. Suppose that the minimum value that $m(t)$ taked is -5. Can the signal be demodulated using an envelop detector?
2. Suppose that $m(t)$ has bandwidth $3.3KHz$ and that the channel is a band-pass filter. Discuss the required characteristics of the channel so that the modulated signal can pass through the channel.

Question 3 (8 points) *Compare DSB-SC, DSB-TC, and SSB modulations in terms of channel bandwidth requirement, power-consumption and receiver complexity.*

Question 4 (6 points) *Let*

$$y(t) = \cos(2\pi \cdot 500t) * sinc(100t)$$

Determine the low-pass equivalent of $y(t)$ with respect to center frequency $f_c = 300Hz$.