

# Winter 2007 ELG3170 Midterm Exam

Three Hours, One-Page Aid Sheet Allowed

**The term Fourier Transform (or FT in short) throughout this paper refers to the continuous-time Fourier Transform.**

## Question 1

1. (6 points) Find the FT of signal

$$x(t) = e^{j(2000\pi t + \pi/3)} + 2 \cos(1000\pi t) + 3 \cos(2000\pi t).$$

2. (6 points) Find the low-pass equivalent of signal

$$y(t) = 3 \cos(2000\pi t) - 4 \sin(2000\pi t).$$

with center frequency  $f_c$  taken as 1000 Hz.

3. (6 points) If signal  $x(t) = \cos(2000\pi t)$  is multiplied with impulse train  $\text{III}(6000\pi t)$ , determine the fundamental frequency of the resulting signal.

## Question 2

Signal  $m(t) = \cos(3000\pi t) + \cos(6000\pi t)$  is transmitted as a DSB signal  $u(t) = (A + m(t))\cos(1600000\pi t)$ .

1. (6 points) Determine the power of  $u(t)$  for  $A = 2$ .
2. (4 points) If demodulation is to be carried out by an envelop detector, what is the requirement of  $A$ ?
3. (8 points) Suppose that the signal  $m(t)$  is transmitted to a receiver through a communication channel which is an ideal band-pass filter with pass band from 798 KHz to 802 KHz. Determine the received signal at the output of the channel. Comment on whether the signal  $m(t)$  can be recovered at the receiver.