ENEL 471 - Winter 2019
1st Midterm Exam

Notes:

- This exam is closed book and closed notes.
- Non-programmable calculators are allowed.
- The exam duration is 50 minutes.
- The exam is composed of 2 Problems and 3 pages. All the problems are independent.
- Please write your name and ID# in each page

Problem 1 [10 pts]

A lower sideband SSB-SC signal is generated by multiplying a 660 kHz cosine carrier with amplitude $A_c = 1$, by the message signal $m(t) = \sin(4000\pi t)$ and filtering out the upper sideband.

1. Determine the expression of the frequency domain representation of this lower-sideband SSB-SC signal. *[3 pts]*
2. Sketch the frequency spectrum of this lower-sideband SSB-SC signal. Show all frequencies and amplitudes of interest. *[3 pts]*
3. Determine the time domain expression for this lower-sideband SSB-SC signal. *[2 pts]*
4. Propose a demodulator to recuperate the message m(t) from this lower sideband SSB-SC signal. Provide the expression of all the input and output signals and the cutoff frequencies of any filter used. *[2 pts]*

Student ID: _____ February 15, 2019 – 9:00 AM
Student name: _____ Duration: 50 minutes

Problem 2 [10 pts]
An AM signal has the form:

$$s(t) = \left[20 + 10\cos(6000\pi t)\right]\cos(2\pi f_c t)$$

Where $f_c = 10^5$ *Hz*

1. Sketch the spectrum of s(t). *[3 pts]*
2. Determine the power in each of the frequency components. *[3 pts]*
3. Determine the modulation index. *[2 pts]*
4. Determine the sidebands' power, the total power, and the ratio of the sidebands power to the total power (the power efficiency of this modulation). *[2 pts]*