# Experiment 02: AM - Answer Book

- **Name:** **Lab Date:**
- **Student No.:** **Day of the week:** **Time:**
- **Name:** **TA Signature:**
- **Student No.:** **Grade:**

## 3. Experiment

### 3.1 Designing and Simulating an AM Modulator

- *Build and run a* `Simulink` *block diagram of an AM Modulator. Use a 1.5KHz, 0.5$V_p$ sinusoid as your message signal, and a 1$V_p$, 12KHz sinusoid as your carrier. Use 48KHz as your sampling rate. Display time domain and frequency domain. Show the TA what you have done and have the TA sign the box below.*

- *Explain the resulting voltage values you found on your simulation.* **(0.5)**

- *On the frequency domain plot, identify and explain the frequency values you found on your simulation.* **(0.5)**

- *Now modify your system to obtain a modulating index greater than 1 (i.e., greater than 100%). Assuming you only have an envelope detector available for receiving your signal, what is the consequence of overmodulation?* **(0.5)**

- *Draw below a block diagram for an AM-DSB-SC system (use a sinusoidal input). Run it and sketch the time-domain and frequency domain results. Would this method be preferable over AM-DSB in any way? Why?***(0.5)**

- *Suppose, hypothetically, that you have a bandlimited signal to transmit using AM. The bandwidth of this signal is contained between 1KHz and 5KHz. If you had a choice, which of the methods would you prefer to use: AM-DSB, AM-DSB-SC or AM-SSB? Why? Remember: bandwidth is always costly.* **(0.5)**

### 3.2 Designing and Simulating an AM Demodulator

- *Build and run a* `Simulink` *block diagram of an AM Demodulator. Use as input the AM signal obtained from your simulated modulator. Display time domain and frequency domain. Show the TA what you have done and have the TA sign the box below.*

- *Explain the demodulation process with a rather simple frequency domain plot.* **(1.0)**

## 3.3 Implementing an AM Modulator and Demodulator

### 3.3.1 Modulator

- *Make the modulator run on the DSP platform. Show the TA what you have done and have the TA sign the box below.*

- *Sketch the time domain results. Don't forget the labels on the axes, the values and units. This is a practice of reporting what you see on the scope.***(1.0)**

- *Use the XY display on your scope (that is known as the Lissajous Figure) to determine at what point you have overmodulation. Explore the oscilloscope to find out where the XY display is. Show the TA and have the TA sign off the box.* **(1.0)**

- *Change your DC value to zero on the code, then recompile, reload and run it. If you change your DC value to zero, what is the advantage, if any? Does it make any difference for demodulating the signal?* **(0.5)**

- *Use the FFT capability of your scope to obtain the Frequency Domain display. Sketch the Frequency Domain results both with and without DC. Identify the location of the missing component, and explain what it is.***(1.0)**

#### 3.3.2 Demodulator

- *Run the demodulator on the DSP platform, using the specifications given in the experiment outline. Show the TA what you have done and have the TA sign the box below.*

- *You have a bandlimited signal, whose spectrum is flat with magnitude A between 0 and* $4KHz$*, and you multiply it by* $\cos(2\pi 680000t)$*. Draw the resulting frequency domain plot. If you do not specify all values and labels in the plot, your mark will be zero.*

### 3.4 The Full System

- *Following the directions given in the outline, make your full system work for a sinusoidal message and for music. Earn bragging rights. Now show the TA what you have done and have the TA sign the box below.*