EET368L
ELECTRONIC COMMUNICATIONS LAB

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CREDIT HOURS: 1.0

IMPORTANT: This is an advanced laboratory. Concurrent enrollment in EET368 is strongly suggested.

EXPERIMENT NUMBER	EXPERIMENT TITLE	DUE WEEK #
1	SIGNAL ANALYSIS	3
2	AUDIO MONITOR	5
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4	AMPLITUDE MODULATION	8
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8	FREQUENCY MODULATION	14

Each person in EET368L will design and build his or her own circuits, and write his or her own laboratory report. Reports in EET368L should consist of the following parts (please pay attention to order):

All portions of the lab reports for EET368L (with the exception of raw data, which may be included in an appendix at the writer's discretion) must be created electronically. **No hand written work is acceptable**. Use the equation editor in Word (Insert → Object → Microsoft Equation 3.0) to type equations and formulas. Captured waveform data must be contained within the document file.

REPORT CONTENTS

1)COVER PAGE contains:

a)Your name
b)Your class and section (EET368L 7DA)
c)Experiment Title
d)For: SR. PROFESSOR WHEELER
e)Due Date of report (Week # or date given in class)
f)Statement: "This is the original work of <your name>". Sign below.
g)Operational sign-off blank
g)Final sign-off blank.

2)CHECK PAGE -- From this syllabus. This page has a checklist that serves as a reminder of items required in each report. The checklist is a minimum standard and you may add items as needed.

3)EVALUATION PAGE -- The document "labeval.doc" from the EET368 page of the instructor's web site. (Incorporate this page into your document).

3) WRITTEN THEORY OF OPERATION - Explains the circuitry at both a system and component level of detail. This section should be written at a level appropriate for field-service personnel (technical).

This section must provide the following discussions:

a) What the purpose of the circuit or functional block is;
b) The signal flow path (describing what each part does to process the signal).

The function of each component must be explained.

4) SCHEMATIC(S) -- Shows the circuitry as designed and built. Must be generated using OrCAD. Schematics must be technically accurate and neat. "Technically accurate" means that a working model of the unit can be built using your drawing.

Your name must appear on all schematic diagrams within the title block (if used). Schematics must be incorporated into the electronic document. To do this, highlight the graphic elements within OrCAD, then switch to Word and choose "Paste."

5) RECORDED DATA. Some experiments call for the production of graphs of waveforms or other phenomenon.

Waveform data must be captured electronically. See COMP125 lab 6, "Electronic Data Gathering," <http://faculty.kc.devry.edu/twheeler/comp125/> for a complete explanation of integrating digital scope data into Word documents.

All waveform photographs must be accompanied by a caption that describes the data being portrayed, and lists the circuit measurement points. For example:

Figure 1: AM Output versus Information Signal

Ch1: 1 KHz information signal, Q1 Base
Ch2: Modulated signal, Junction of C29 and R4.

Graphical data will be handled using MATLAB, EXCEL, or other graphing software. See COMP125 lab 8, "Numerical Analysis" for instruction in generating EXCEL graphs.

All graphs will have the following features:

a) Appropriate title. Example: Phase Detector Output Voltage versus Phase Difference
b) Correctly dimensioned and labeled graph axes.
c) Sized appropriately to fit within a page of the document (writer discretion required)

Graphs built from repeated measurements will also include a data table showing all the measurement values. (This data table can be the spreadsheet cells). The data table must also be appropriately titled identifying its contents.

6) CONCLUSION - A conclusion is more than a mere summary of events. A conclusion makes quantitative deductions. The word "quantitative" is important. It means *numerical*.

The conclusion section of the report makes quantitative deductions based on the recorded data from the report, which is numerical in nature. An example of a quantitative discussion:

"When the input voltage was set to 1V, 2V, and 3V, the VCO output frequencies were 1 KHz, 2 KHz, and 3 KHz, as shown in Graph 1. The VCO therefore has a linear transfer characteristic described by:

$f_{out} ? V_{IN} K_0$ With a K_0 value of 1 KHz/Volt."

Examples of non-quantitative conclusion statements include:

"The experiment went very well."

"The measurements were well within expected tolerances."

"The circuitry worked exactly as expected."

"The measurements were very close to the expected values."

GRADING

Each report in EET368L is worth 100 points; there are 7 reports due, for a total of 700 points in the course.

Each report must contain a sign-off for credit. A sign-off is provided by the instructor or other authorized person. Performance of each critical portion of the experiment vs recorded data will be verified prior to sign-off. Have schematic drawings and recorded data handy when requesting sign-off.

Letter grades are assigned as follows:

Letter Grade	Percentage %	Quality Of Work
A	90 - 100%	Far above average
B	80 - 89 %	Above average
C	70 - 79 %	Average; meets expectations
D	60 - 69 %	Below expectations
F	< 60 %	Inadequate, failing

POLICIES

I. LAB PARTNERS

There are no lab partners allowed in EET368L. EACH PERSON IS EXPECTED TO DESIGN AND BUILD HIS/HER OWN CIRCUITS AND WRITE HIS/HER OWN REPORTS.

All circuits must be CLEARLY AND PERMANENTLY MARKED ON TOP (OR SIDE) with your name to obtain a sign-off.

II. LAB SUCCESS HINTS

The successful student will have all circuits built and ready to test BEFORE going to lab. Lab handouts and other information distributed in class are extremely important, and should be studied and understood before attempting the experiment. Try a "dry run" in your mind the day before the experiment to see if you can recall the important steps, setups, and results. SAVE ALL LAB HANDOUTS, YOU WILL NEED THE INFORMATION FROM THEM ALL TERM!

III. LATE WORK

NO late work is accepted. Work may only be turned in directly to the instructor during the assigned laboratory period.

IV. PLAGIARISM, AND OTHER FORMS OF CHEATING

PLAGIARISM

Copying the work of another, and claiming it to be your own is plagiarism. This includes (but is not limited to) copying others homework, copying from a lab manual or textbook, or collusion. The minimum penalty for cheating in any form is a grade of zero for the element involved; in some cases, failure of the course and/or expulsion from the Institute will also result. **All cases of misconduct will be documented and forwarded to Student Services for disciplinary consideration**. The DeVry Student Handbook contains complete information on this topic.

Please do not turn in any work that is not your own! If in doubt, ask the instructor. Here are some ways to avoid any problems:

- Don't share your computer files (text, OrCAD, etc) with anyone else.
- Don't share a diskette (or other media) with another student; it's too easy to get files mixed up.
- Don't copy answers from a neighbor. If you don't understand how to do it, ask!
- Decline any request from fellow students for a copy of your work. Anybody needing help should ask the instructor.

GOOD DATA PROCESSING PROCEDURES

Computers will be used for the generation of schematic drawings in this lab. The student can expect to spend many hours creating and updating these drawings; loss of this data can be disastrous! The following tips will help to minimize the chance of losing a project:

- Make frequent backups. These backups should be in at least two different physical locations.
- Always keep schoolwork on two different diskettes. Both of these disks will contain identical information. If one diskette is damaged by a computer, the data can still be recovered from the other during the lab period.
- Don't save your data to the hard disk on the workstation, except in an emergency. The hard disks on lab workstations are periodically "cleaned" of any extra information as part of a housekeeping program.
- Keep the work for each class on a separate disk.
- Write your name, course, section, and professor's name on each disk. This will make it easier for others to return your work to you should you accidentally leave a disk behind.
- If you're using a computer at home, an *anti-virus* program is strongly recommended.

V. MISCELLANEOUS INFORMATION

EMERGENCY PROCEDURES - There are plaques located in the lab discussing emergency procedures. The instructor will remain in charge of your class group in an emergency situation.

FOOD - DRINK - Are NOT allowed in the laboratory at any time. With liquids especially, there is a great potential for damage to equipment and injury to yourself or others.

INVENTORY SHEET - WAVEFORM ANALYSIS

NAME_____

_____ Written portion complete, with theory of operation and conclusion page.

_____ Recorded data is complete:

a. Spectrogram measured from pure 10 KHz sine wave.
b. Spectrogram measured from 10 KHz square wave.
c. Theoretical spectrogram for 10 KHz square wave (Table required).
d. Spectrogram from 10 KHz triangle wave.
e. Theoretical spectrogram for 10 KHz triangle wave (Table required).

Please Note: When a graph is constructed from multiple measurements or calculations, a data table is required. Show a sample of each calculation performed.

(There is NO operational sign-off required for Lab 1.)

INVENTORY SHEET - AUDIO MONITOR

NAME_____

_____ Schematic accurate and circuit correctly designed.

_____ Written portion complete, with theory of operation, design method, and conclusion page.

_____ Recorded data is complete:

a. Frequency response plot - AB terminals open (no feedback.)
Data table required.

b. Frequency response plot - RC network on AB terminals.
Data table required.

c. Frequency response plot - RL network on AB terminals.
Data table required.

Please Note: When a graph is constructed from multiple measurements or calculations, a data table is required. Show a sample of each calculation performed.

INVENTORY SHEET - CARRIER GENERATION

NAME_____

_____ Schematic accurate and circuit correctly designed.

_____ Written portion complete, with theory of operation and conclusion page.

_____ Recorded data is complete:

a. Oscilloscope reading of RF from Junction of R3 and R4
b. Oscilloscope reading of Q1 collector
c. Oscilloscope reading of Q2 emitter

INVENTORY SHEET - AMPLITUDE MODULATION

NAME_____

_____ Schematic accurate and circuit correctly designed.

_____ Written portion complete, with theory of operation,
and conclusion page.

_____ Recorded data is complete:

a. Oscilloscope reading of Vm (intelligence)
b. Oscilloscope reading of AM output with respect to the intelligence.

c. AM output when overmodulated.

INVENTORY SHEET - AM DETECTOR

NAME_____

_____ Schematic accurate and circuit correctly designed.

_____ Written portion complete, with theory of operation, design method, and conclusion page.

_____ Recorded data is complete:

a. Oscilloscope reading of 1 KHz intelligence input to modulator.
b. Oscilloscope reading of detector output with respect to intelligence input to modulator.

c. Oscilloscope reading of detector output for Fm = 10 KHz.
d. Oscilloscope reading of detector output for Fm = 20 KHz.

SIGN-OFF SHEET - PHASE LOCKED LOOP

NAME_____

_____ Schematic accurate and circuit correctly designed.

_____ Written portion complete, with theory of operation, design method, and conclusion page.

_____ Recorded data is complete:

a. Oscilloscope reading of VCO when loop is out-of-lock (when triggering off the reference frequency input; see step 5 on page 6-5).

b. Data table showing capture and lock ranges for each size capacitor used in the low-pass filter.

c. Oscilloscope reading of low-pass filter output: Fin=1 KHz and C=.10 uF. (Step 10 on page 6-5).

d. Oscilloscope reading of low-pass filter output: Fin=1 KHz and C=.001 uF. (Step 14 on page 6-6).

INVENTORY SHEET - FREQUENCY MODULATION

NAME_____

_____ Schematic accurate and circuit correctly designed.

_____ Written portion complete, with theory of operation and conclusion page.

_____ Recorded data is complete:

Answer the questions on page 8-8.