# A "hands-on" approach to teaching and learning of electronic communications subject

R.A.Rahim, O. M. Fisol, M.N.Junita, S. Zarihan
School of Computer and Communication
Kolej Universiti Kejuruteraan Utara Malaysia (KUKUM), Perlis

## ABSTRACT

Electronic Communications is one of the core subject for the degree course in Communications Engineering. The understanding of electronic section in a communications system is the key element of the subject. Due to the fact that this subject is actually a mixture of both electronics and communications systems, the learning process of it might get complicated and confusing. This paper outlines the successful practical oriented approach to teaching and learning of the subject including the objectives, subject structure, outcomes, and skills trained during practical sessions.

## 1. INTRODUCTION

The practical oriented approach is the approach that requires students to understand latest practice in technologies used in communication field today and apply their understanding to solve the problems. The objective of this approach is to produce an engineer who is able to identify problems, create solutions, innovate and improve current designs and practices. Through this practice, we hope that the students will be able to use techniques, skills and modern engineering tools necessary for engineering practice and easily adaptable to industrial needs.

## 2. COURSES OVERVIEW

The teaching and learning of Electronic Communications plays important role to the students as this subject is conducted with purely "hands-on" practice without any structured experiment during the laboratory sessions. The main objective of this subject is to introduce and familiarized the students to electronics elements, components and circuits used in radio frequency (RF) communications. At the end of the course, students would also be able to design and analyze the RF communications circuit. They will also have extra useful skills on using the appropriate engineering tools and software. The major features of the practice of this subject include research and development, communications skill, leadership and multi-skills.

The subject duration is one semester and is total of three credit hours. The topics covered in this course includes Introduction to Electronic Communications, Amplitude Modulations (AM) and Single Side Band (SSB) Modulations, AM circuits, Frequency Modulations, FM circuits, Radio Transmitter and Communications Receivers. In assessing students' learning progress, the assessment is divided into two parts of mark allocations, which are the final examination and the coursework. Final examination covers 50 percent of the overall grades, while the remaining assessment is allocated for the coursework. The coursework assessment consists of the following components:

- Mini projects
- Tests
- Assignments

In normal practices, the mini projects are done using laboratory sessions. Test is conducted by the mid of the semester, while assignments are given throughout the whole semesters' durations.

## 3. LABORATORY SESSIONS

In some universities, Electronic Communications may be conducted using structured experiments. Meaning that the students are given laboratory manual to conduct their experiments and do the observations. In KUKUM, Electronic Communications is conducted through "hands-on" approach as while doing experiments [1,2] whereby the students are required to do mini projects throughout the semester as their experiments.

There are two mini projects which are required to be completed by the students throughout the semester. These projects are actually the applications of what they've learned during the lecture. The idea is that the students will be able to apply the theoretical understanding in lectures to practical by completing the projects. In the last two semesters in KUKUM, the two mini projects which are given to the students are:

- Amplitude Modulator and Demodulator
- Frequency Modulator and Demodulator

In these projects, students are required to design a complete circuit for modulator and demodulator for Amplitude Modulation (AM) and Frequency Modulation (FM). The circuit is needed to be design, construct and test. The circuit simulation using ORCAD is performed at the early stage of the design process. This is to ensure that the circuit they have chosen works properly before they can construct it into hardware.

Figure 1 and 2 show an example of AM modulator circuit and AM modulator project done by the students. While Figure 3 and 4 show an example of FM modulator circuit and FM modulator project. The project concept is taken from two major topics in Electronic Communications, which are Amplitude Modulation and Frequency Modulation.

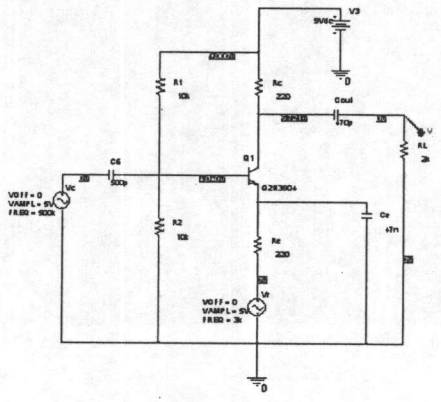

**Figure 1. Example of AM modulator circuit**

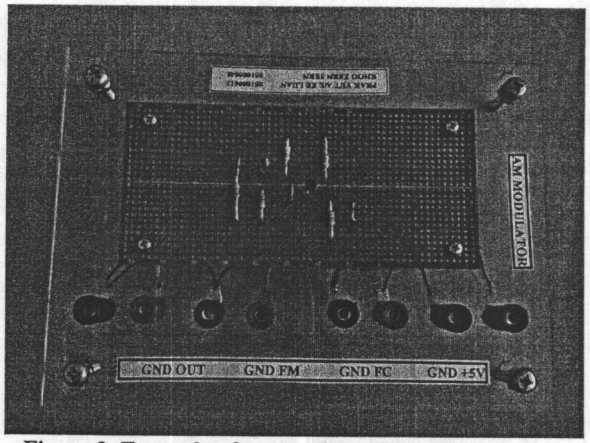


**Figure 2. Example of a complete AM modulator**

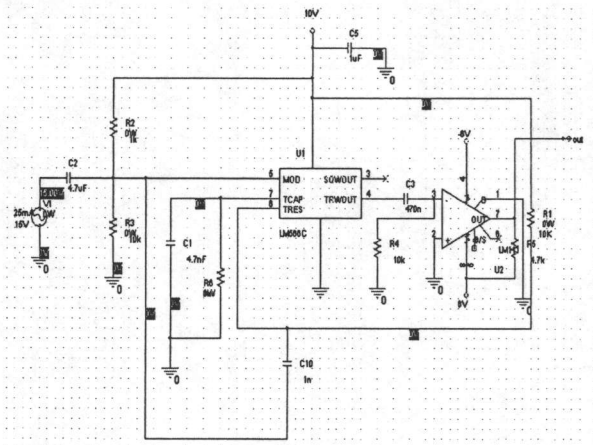

**Figure 3. Example of FM modulator circuit**

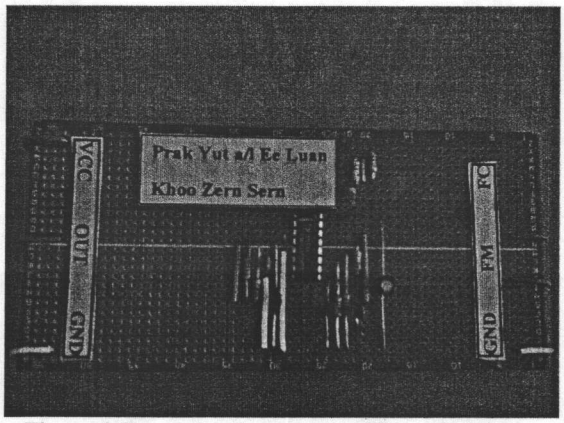


**Figure 4. Example of a complete FM modulator**

The students are given components and they will use their creativity to construct a circuit. With the aid of devices and equipments in the laboratory such as digital storage oscilloscope, function generator and power supply, the circuit can be tested and they can do the troubleshooting before the circuit is finalized.
Throughout the semester, students will have to submit their logbook to show their progress on the project every week during the laboratory sessions. At the end of the project timeline, a technical report should be submitted and the project is to be presented to the instructor for evaluation. The evaluation of the circuit is done by considering some factors which are circuit's originality, tidiness of the circuit, workability of the circuit and output.

## 3.1 Technical Report

Students are required to prepare a technical report for each of the project. The report should contain theory and applications of their project. The major contribution in the report is the results and observation part. In this part, they have to show all their findings which are the required parameters, waveform, simulation results, discussions and conclusions. All the calculations should be presented clearly.