

## **Τίτλος διδακτικής επινόησης.**

Problem Based Learning via the Coffee-Can Radar

**Να περιγράψετε την ανάγκη που έχει προκύψει για αλλαγή στη διδασκαλία του/των μαθήματος/μαθημάτων με την προτεινόμενη διδακτική επινόηση.**

### General background in ECE at UCY

The current syllabus in the Department of Electrical and Computer Engineering (ECE) is very “classical” in the sense that it consists almost exclusively of theory-based lectures, tutorials and formal laboratories in the first three years. The laboratories are highly structured and do not give much scope for students to develop independent ideas. Only in the fourth year do students embark on a project that allows for significant independent study. This dichotomy carries over to the Masters programmes, with the M.Eng. being exclusively course-based while the M.Sc. includes a project (which may not necessarily be linked to the preceding lecture courses).

### Courses in microwave and wireless technology at UCY

In terms of the specific ECE curriculum at UCY, there is an under-representation of courses in microwave and wireless technology and many students are deterred by these courses, which they perceive as very challenging. (This phenomenon is observed in many countries and is well documented.) This is partly due to the association with electromagnetism, which many students struggle with because of the difficulty in visualising the behaviour of electric and magnetic fields and the requirement for vector calculus.

However, these courses are vital to the development of key technologies such as mobile communications, radar and satellite navigation. Recently, a number of companies have been established in these areas in Cyprus, and there is anecdotal evidence that they are struggling to fill vacancies. From a didactic viewpoint, courses in this area are important because they link together fundamental topics from ECE, including circuits, electromagnetism, antennas, semiconductors and signal processing. They can also serve to illustrate that theory has practical applications (such as wireless communications and radar).

### The need for a problem based approach to learning

This proposal aims to improve student uptake of courses in the wireless area whilst simultaneously encouraging the development of problem-based learning (PBL) as a complement to the more traditional approaches described earlier. We believe that if students see a clear linkage with a physical artefact that they have designed themselves, and if they can conduct various field tests (e.g. measurement of car speed, sensing of large objects) that they will have greater “ownership” of the material and be more highly motivated. A key factor in this is the corresponding change in assessment methods, with more emphasis placed on encouragement of self-learning, enquiry-based techniques, evaluation of design work, report writing and presentation skills.

Specifically, for the group of courses in this proposal we will adopt and then develop the coffee-can radar concept, which was originally introduced at MIT, and enhance it through the development of custom-made circuits and antennas. Through student feedback, we will report the results to other ECE faculty members so as to encourage other PBL techniques in other ECE courses.

During the summer of 2017, a second-year student (under the supervision of Prof. Iezekiel and Dr. Zaggoulos) developed and tested a prototype Doppler radar system (for measuring car speed) using coffee-cans for the antenna elements and commercially available components for the rest of the system. This preliminary study will assist in the rapid implementation of this proposal.