BSc in Computer Engineering

CMP4204
Wireless Technologies

Eng Diarmuid O'Briain, CEng, CISSP

Department of Electrical and Computer Engineering,
College of Engineering, Design, Art and Technology,
Makerere University

Copyright © 2018 Diarmuid Ó Briain

Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.3 or any later version published by the Free Software Foundation; with no Invariant Sections, no Front-Cover Texts, and no Back-Cover Texts. A copy of the license is included in the section entitled "GNU Free Documentation License".

Author

Diarmuid is a Chartered Engineer (CEng) with over 30 years experience in Telecommunications, Information Networking and Security. He has designed and implemented next-generation networks and information security solutions for major multi-national communications companies as well as serving as Chief Technical Officer for an Irish Internet Service Provider for over 5 years. Since 1999 he has also lectured on Telecommunications and Computing programmes at both the Dublin Institute of Technology (DIT) and the Institute of Technology, Carlow (ITC) in Ireland and more recently at the College of Engineering, Design, Art and Technology (CEDAT) at Makerere University, Uganda.

Table of Contents

This page is intentionally blank

1. Module Aims

Interest in wireless technology is booming and wireless networks are enjoying very fast growth. This course introduces students to advanced network concepts with application to wireless technologies. They will be introduced to various the wireless and mobile network- technologies and protocols with an emphasis on their utilisation in various real world computing and communications situations.

2. Objectives

- To recap the OSI and the TCP/IP models and their application in computer networks
- To introduce to the student various wireless and mobile network technologies and protocols with an emphasis on impact to various layers of the OSI stack.
- To introduce the students to the established and next generation wireless systems and introduce the scenarios where they compare and (possibly) complement each other.
- To sensitise the computer engineering student to potential security concerns that arise when utilising wireless systems and how to deal with them.

3. Learning Outcomes

On completing this course the student should be able to:

- Understand the significance that specific layers the TCP/IP protocol have in wireless communications.
- Identify the different types of wireless communications protocols contained in the IEEE 802.11 WLAN standard.
- Identify the most critical antenna design parameters and understand their impact in wireless communications.
- Understand Radio Frequency (RF) propagation.
- Understand spread spectrum technology.
- Demonstrate the ability to design and implement a wireless data collection system.
- Demonstrate the ability to communicate and document technical information in a professional, structured, timely, and effective manner.

4. Teaching and Learning Strategies

Formal lectures, group-based activities, class discussion, case studies and laboratory sessions may be used in the presentation of this module. Typically the lectures will include practical sessions providing students with the immediate opportunity to implement and reinforce the material presented in the lectures.

5. Module Lectures

Lecture 00 – Module Introduction

Lecture 01 – Radio Principles

Lecture 02 – Antenna Principles

Lecture 03 – Digital Modulation

Lecture 04 – Internetworking Models

Lecture 05 – Microwave Radio

Lecture 06 – Wireless Local Area Networks

Lecture 07 – Personal Access Networks

Lecture 08 – 2G, GSM, CDMA and GPRS Cellular Mobile

Lecture 09 – WiMAX HiperLAN HiperWAN

Lecture 10 – 3G and UMTS Cellular mobile

Lecture 11 – 4G LTE Cellular mobile

Lecture 12 – 5G NR Cellular mobile

Annex 01 – Table of Abbreviations

Annex 02 – Free Document License

6. Assignments

All assignments will be submitted in both Open Document Format (ODF) and Portable Document Format (PDF). Assignments will be typed in FreeSans Arial font size 12 single spaced with the text paragraphs justified. The header on each page must include on a single line the title of the assignment in bold type FreeSans or Arial font, size 10.5 while the footer should include the authors name, e-mail address and the page number, all again in font size 10.5 FreeSans or Arial. A coversheet will also be included which will have the assignment title and author's name in font FreeSans or Arial, size 14 bold typeface centred on the page both horizontally and vertically. Header and footer will be separated from the body text by a horizontal line.

Assignments will NOT be accepted after the deadline.