ES96T-15 Advanced Wireless Systems and Networks

21/22

Department
School of Engineering
Level
Taught Postgraduate Level
Module leader
Subhash Lakshminarayana
Credit value
15
Module duration
10 weeks
Assessment
60% coursework, 40% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

ES96T-15 Advanced Wireless Systems and Networks

Module web page

Module aims

To understand the performance of different wireless networks in modern cities, in the context of: functionality, architecture, resource allocation and mutual interaction. The systems considered include legacy 1G/2G/3G systems, as well as current 4G/5G/IoT systems.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

1 Introduction to Wireless Networks and its History
2 Revision of Single Link Communications, including Link Adaption
3 Multiple Access Techniques

4 Legacy 1G-2G Systems
5 3G Cellular Network
6 4G Cellular Network
7 Radio Resource Management
8 Heterogeneous Networks
9 Stochastic Geometry
10 Traffic Models
11 Large-Scale Network Simulation
12 Wi-Fi Networks
13 Energy and Cost Metrics
14 5G and Future Trends

Learning outcomes

By the end of the module, students should be able to:

- Explain how channels adapt to real world conditions to achieve Shannon capacity subject to a certain quality of service demand.
- Analyse the achievable multiple user capacity of different multiple access schemes.
- Design efficient networks in terms of energy and/or cost.
- Acquire in depth knowledge and evaluate the architecture of legacy 1G/2G/3G, as well as current 4G/5G/IoT cellular and Wi-Fi networks.
- Analyse different cell planning patterns for different cellular network generations and traffic service demands.
- Design networks and analyse their performance through modelling their mutual interference interactions using simulation software and random graph theory for different network deployments.

Indicative reading list

1. Heterogeneous Cellular Networks, R. Hu and Y. Qian, Wiley, 2013
2. 4G LTE Networks: LTE for UMTS: OFDMA and SC-FDMA Based Radio Access, H. Holma and A. Toskala, Wiley, 2009
3. Heterogeneous Cellular Networks: Theory, Simulation, and Deployment, X. Chu and D. Lopez-Perez, and Y. Yang and F. Gunnarsson, Cambridge University Press, 2013
4. Mathematical Modeling: Stochastic Geometry for Wireless Networks, M. Haenggi, Cambridge University Press, 2013
5. Radio Resource Management for Mobile Traffic Offloading in Heterogeneous Cellular Networks, Y. Wu and L. Qian, Springer, 2017

Subject specific skills

Understanding of the evolution of cellular communication systems. Latest trends in 5G/6G cellular networks and IoT networks.

Transferable skills

Knowledge of how wireless communication systems work today and how the latest research trends in this field.

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Other activity	1 hour (1%)
Private study	119 hours (79%)
Total	150 hours

Private study description

Guided Independent Learning

Other activity description

1x1 hour Revision Class

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group D3

	Weighting	Study time
Essay Assignment - 1 Essay Assignment (4 pages)	20%	
Essay Assignment - 2 Coding and essay assignment	40%	
Online Examination QMP	40%	

	Weighting	Study time
~Platforms - AEP,QMP		

- Online examination: No Answerbook required
- Students may use a calculator
- Engineering Data Book 8th Edition

Feedback on assessment

Marked assignments with comments.

Past exam papers for ES96T

Availability

Pre-requisites

To take this module, you must have passed:

- All of
  - ES335-15 Communications Systems
  - ES3C5-15 Signal Processing

Courses

This module is Core for:

- Year 1 of TESA-H641 Postgraduate Taught Communications and Information Engineering

This module is Optional for:

- Year 1 of TCSA-G5PA Postgraduate Taught Data Analytics

This module is Option list A for:

- Year 4 of UESA-H63X MEng Electronic Engineering
- Year 5 of UESA-H63Y MEng Electronic Engineering with Intercalated Year
- Year 4 of UESA-H114 MEng Engineering
- Year 4 of UCSA-G408 Undergraduate Computer Systems Engineering
- Year 4 of UESA-H606 Undergraduate Electrical and Electronic Engineering MEng