

ES96T-15 Advanced Wireless Systems and Networks

22/23

Department

School of Engineering

Level

Taught Postgraduate Level

Module leader

Subhash Lakshminarayana

Credit value

15

Module duration

10 weeks

Assessment

40% coursework, 60% 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 D4

	Weighting	Study time
Assignment	40%	
Essay and simulation assignment (8 pages)		
Online Examination	60%	
QMP Examination		
~Platforms - AEP,QMP		

Weighting

Study time

- Online examination: No Answerbook required

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 4 of UESA-H116 MEng Engineering with Exchange Year
- Year 5 of UESA-H115 MEng Engineering with Intercalated Year
- Year 1 of TCSA-G5PA Postgraduate Taught Data Analytics
- Year 5 of UESA-H607 Undergraduate Electrical and Electronic Engineering with Intercalated Year

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 5 of UCSA-G409 Undergraduate Computer Systems Engineering (with Intercalated Year)
- Year 4 of UESA-H606 Undergraduate Electrical and Electronic Engineering MEng