

Module Specification

1. Factual information			
Module title	T316: Advanced Networking	Level	Undergraduate
Module tutor		Credit value	30
Module type	Taught	Notional learning hours	8

2. Rationale for the module and its links with other modules

- With the continuous advancements in the networking field, the need arises for teaching advanced networking concepts. This advanced undergraduate course aims to meet this objective by discussing advanced networking topics complementing those introduced in T216A/B.

3. Aims of the module

The aims and objectives of this course are to:

- Describe the various wireless networks along with their coexistence, cooperation, and interaction, while introducing a system level approach and providing an overview of recent research topics.
- Describe the concepts of sensor networks along with their underlying challenges, including power efficiency, routing, and multihop communications
- Discuss the challenges related to massive machine type communications inherent in large sensor networks deployments under the internet of things (IoT) paradigm).
- Explain the concepts of software defined networks (SDN) and network function virtualization (NFV).
- Define big data and describe its use in cloud computing.
- Discuss cloud computing issues, and analyse the role of mobile clouds.
- Define and discuss quality of experience (QoE) requirements, and compare and contrast QoE with quality of service (QoS).
- Teach students the concepts of large data centres, data mining, their relation to big data, and explain data management and backup techniques.
- Explain advanced network management and administration topics, such as: self-organizing networks, network planning and design, and advanced routing.
- Equip students with advanced skills in personal updating and researching in the field of advanced networking. Students will be taught how to use third-party material in order to extract useful information for their personal and professional development.

4. Pre-requisite modules or specified entry requirements

Students should have completed the study of the course T216AB

5. Intended learning outcomes	
A. Knowledge and understanding	Learning and teaching strategy
<p>After studying the course you will be able to:</p> <p>A1. Describe and analyse the operation of co-existing wireless networks and the possibilities of cooperation and interaction between these networks</p> <p>A2. Discuss the role of sensor networks and machine-to-machine communications (M2M) in the internet of things (IoT) and describe the underlying challenges</p> <p>A3. Describe the concepts of software defined networks (SDN) and network function virtualization (NFV), and discuss their role in advanced network management and administration</p> <p>A4. Discuss advanced routing concepts, such as the Border Gateway Protocol (BGP)</p> <p>A5. Discuss Cloud Computing and Big Data concepts</p> <p>A6. Differentiate between QoE and QoS, and discuss QoE metrics for specific applications, e.g. voice (VoIP) and video</p> <p>A7. Describe the operation of self-organizing networks (SON), and differentiate between self-configuration, self-optimization, and self-healing</p>	<ul style="list-style-type: none"> • 25% face-to-face tutorial sessions • TMA work • Course textbook and support material

B. Cognitive skills	Learning and teaching strategy
<p>After studying the course you will be able to:</p> <p>B1. Analyse the interaction between different technologies and networks in a complex setup involving multiple networks</p> <p>B2. Analyse the challenges faced by the different networks and assess the required techniques for enhancing the performance metrics (QoS, QoE, energy efficiency, security, etc.) of the various network types studied in the course</p> <p>B3. Read, evaluate, and critically review advanced technical documents and extract useful information from these documents on a specific networking topic</p>	<ul style="list-style-type: none"> • 25% face-to-face tutorial sessions • TMA work • Course textbook and support material

C. Practical and professional skills	Learning and teaching strategy
<p>After studying the course you will be able to:</p> <p>C1. Use the studied concepts to analyse and assess the operation of complex networks</p> <p>C2. Design and plan basic implementations of the advanced networks studied, and assess the management and operation of these networks, including the use of self-organization techniques</p> <p>C3. Design QoE measurement and resource allocation techniques for enhancing QoE performance of networks using the studied concepts</p>	<ul style="list-style-type: none"> • 25% face-to-face tutorial sessions • TMA work • Course textbook and support material

C. Practical and professional skills	Learning and teaching strategy
C4. Be ready to tackle complex networking scenarios through self-learning and research skills coupled with the learned course material	

D Key transferable skills	Learning and teaching strategy
<p>After studying the course you will be able to:</p> <p>D1. Become an independent self-learner in order to remain up-to-date with the continuous advancements in the field of advanced networking</p> <p>D2. Improve your technical writing skills on topics related to networking and advanced networking</p>	<ul style="list-style-type: none"> • 25% face-to-face tutorial sessions • TMA work • Course textbook and support material

6. Indicative content.
1. Multi radio access technology (multiRAT) networks: WiMax IEEE 802.16e/m, WiMax/WiFi coexistence, (4/5G and 802.11ac/ad coexistence).
2. Heterogeneous Networks (HetNets), Green Networks
3. Sensor Networks, Ad-Hoc Networks + Routing in these networks: multihop communication, etc.
4. Internet of Things (IoT), Machine to Machine communications (M2M)
5. IP v6, and its application in IoT/M2M
6. Software Defined networks (SDN)

6. Indicative content.	
7.	Network Function Virtualization (NFV)
8.	Advanced network configuration and routing, BGP
9.	Big data, Cloud Computing, Mobile cloud computing
10.	Data centers, server farms, data management, backup, archive, etc.
11.	QoE measurement and assessment, management of QoE, Maintaining QoS/QoE levels across a network
12.	Self-organizing Networks (SON) (self-configuration, self-optimization, self-healing)

7. Assessment strategy, assessment methods and their relative weightings
TMA Work: 20%
MTA: 30%
Exam: 50%

8. Mapping of assessment tasks to learning outcomes																
Assessment tasks	Learning Outcomes															
	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	C1	C2	C3	C4	D1	D2
TMA	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓
MTA	✓	✓	✓								✓					✓
Final Exam	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓			✓

9. Teaching staff associated with the module	
Tutor's name and contact details	Contact hours
To be appointed at a later date since this is a new course.	

10. Key reading list				
Author	Year	Title	Publisher	Location
William Stallings	2015	Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud, 1 st Edition	Addison-Wesley	USA

11. Other indicative text (e.g. websites)
<ul style="list-style-type: none"> • Andrew S. Tanenbaum, “Computer Networks,” 5th ed., Pearson Education, Inc., Upper Saddle River, NJ, USA, 2011 • Peterson and Davie, “Computer Networks: A Systems Approach,” 5th ed., Morgan Kaufmann, 2011 • Kurose and Ross, “Computer Networking: A Top-Down Approach,” 6th ed., Pearson Education, Inc., 2013 • Technical articles from conferences and journals, in addition to IETF documents