Module Descriptor

Title	Mobile Networks and Smartphone Applications		
Session	2025/26	**Status**	Published
Code	COMP11062	**SCQF Level**	11
Credit Points	20	**ECTS (European Credit Transfer Scheme)**	10
School	**Computing, Engineering and Physical Sciences**		
Module Co-ordinator	Muhammad Zeeshan Shakir		

Summary of Module

This module will introduce the state-of-the-art mobile network technologies and standards and address the development of mobile applications taking account of various factors which affect the performance of both the networks and mobile applications, such as network protocols and standards. We will further cover the emerging 5G mobile technologies and their applications/use cases. The scope of this module includes both knowledge and practices towards a successful training of students and building a deep understanding of mobile technologies and networks and proficiency in mobile application development. Ideally the students should have the programming skills (Java is preferred) and the background of computing or engineering, however it is suitable for anyone who has the basic knowledge of networks and the interest to develop mobile applications.

This module will work to develop a number of the key 'I am UWS' Graduate Attributes to make those who complete this module:

Universal

Critical Thinker Ethically-minded Research-minded

Work Ready Problem-Solver

Effective Communicator

Ambitious

Successful

Autonomous Resilient Driven

Following topics will be covered:

Introduction to basic and advanced concepts of wireless communications and mobile networks.

Deep understanding of 5G mobile technologies , architectures and network infrastructures.

Smartphone application development environments and related platforms.

Smartphone application design, development and deliver processes including application trends and profiles.

Advanced skills to interact with Smartphone sensors and other multimedia contents to design smart Applications.

Java programming for the smartphone environment including good programming practice for smartphone environment. Techniques to apply and manage data structure, graphics, objects and text elements.

Module Delivery Method	**On-Campus**[1] ☒	**Hybrid**[2] ☐	**Online**[3] ☐	**Work -Based Learning**[4] ☐
Campuses for Module Delivery	☐ Ayr ☐ Dumfries	☐ Lanarkshire ☐ London ☒ Paisley	☐ Online / Distance Learning ☐ Other (specify)	

Terms for Module Delivery	Term 1	☒	Term 2	☐	Term 3	☐
Long-thin Delivery over more than one Term	Term 1 – Term 2	☐	Term 2 – Term 3	☐	Term 3 – Term 1	☐

Learning Outcomes	
L1	Demonstrate critical understanding of the wireless communications and mobile network structure, concepts, technologies, and protocols.
L2	Demonstrate analytical and systematic skills in analyzing and evaluating the requirements of smartphone applications and applying these criteria efficiently in practice.
L3	Demonstrate critical understanding of the process of smartphone application development, the key development techniques and programming concepts.
L4	Demonstrate a critical awareness of smartphone application industry and markets, state-of-the-art development tools and emerging mobile technologies.
L5	Demonstrate extensive knowledge and practical development skills through the development of mobile applications which meet industry standards.

Employability Skills and Personal Development Planning (PDP) Skills	
SCQF Headings	**During completion of this module, there will be an opportunity to achieve core skills in:**

[1] Where contact hours are synchronous/ live and take place fully on campus. Campus-based learning is focused on providing an interactive learning experience supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus contact hours will be clearly articulated to students.

[2] The module includes a combination of synchronous/ live on-campus and online learning events. These will be supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus and online contact hours will be clearly articulated to students.

[3] Where all learning is solely delivered by web-based or internet-based technologies and the participants can engage in all learning activities through these means. All required contact hours will be clearly articulated to students.

[4] Learning activities where the main location for the learning experience is in the workplace. All required contact hours, whether online or on campus, will be clearly articulated to students

Knowledge and Understanding (K and U)	**SCQF 11** Students will gain in-depth knowledge of mobile networks and mobile applications design methodology. Their understanding of these concepts will be further enhanced by critically examining different state-of-the-art mobile technologies, mobile network standards and application design process. They will also learn the key characteristics of mobile channels, smartphone architectures, audio-video modules and mobile operating systems. Furthermore, they will have practical understanding of the marketing issues of smartphones and the application industries and develop critical awareness of the commercial aspects of smartphone application development through the practical project design.
Practice: Applied Knowledge and Understanding	**SCQF 11** Students will have solid understanding the fundamentals of mobile networks and be aware of the factors such as mobile pattern, bandwidth, computing power etc. which should be considered in the practice of smartphone application development. They will also gain practical knowledge by identifying the key requirements of commercial products such as the visual and audio effects, and evaluating various aspects of their special features. Students will further develop the key practical skills including structure design, interface design and programming through laboratory work and project.
Generic Cognitive skills	**SCQF 11** This module will train the students to critically and systematically evaluate the mobile network factors towards the performance of smartphones. They will also gain skills through the training of complete overview of the technical aspects of smartphone applications and commercial and marketing issues. They will have the opportunity to manage a complicated development process using quantitative and qualitative skills and improve the associated cognitive skills. In addition, they will gain the learning skills by evaluating the academic literature in a self-driven manner.
Communication, ICT and Numeracy Skills	**SCQF 11** Students will gain extensive ICT skills through the laboratory sessions and project practice. In order to successfully finish their project, they need to communicate effectively with the group members through regular meetings, project management and planning. They will also enhance their writing and presentation skills by presenting technical work clearly and appropriately in both written and verbal formats. Furthermore, numeracy and skills will be developed through programming practice where they need to carefully manage the trade-off among the three key factors: network bandwidth, smartphone computing power and battery and the application complexity.
Autonomy, Accountability and Working with Others	**SCQF 11** Each student will work independently on their own laboratory task and acquire the autonomy and accountability through these tasks. In the lab sessions, they will autonomously plan and manage the work progress and finish the writing of the lab note and report in a timely and professional manner. They will also gain accountability and teamwork skills by finishing the final project which require cooperation from the team members and thus develop the teamwork spirit and cooperation skills. During these processes, they will critically reflect on the planning/designing process and his/her own PDP development through

	this module and their capability and employability will be greatly improved.

Prerequisites	**Module Code**	**Module Title**
	Other	
Co-requisites	**Module Code**	**Module Title**

Learning and Teaching

In line with current learning and teaching principles, a 20-credit module includes 200 learning hours, normally including a minimum of 36 contact hours and maximum of 48 contact hours.

The module will be delivered by means of lectures, tutorials exercises and practical laboratory work on an individual and group basis aimed at developing the knowledge and skills required for mobile network research and application development. The lectures will introduce the fundamentals of the networking technologies, mobile networks and mobile application programming techniques which will be practiced in the follow-on laboratory work by students. The tutorial sessions will help consolidate both the lecture materials and the practical skills.

Learning Activities During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below:	**Student Learning Hours** (Note: Learning hours include both contact hours and hours spent on other learning activities)
Lecture / Core Content Delivery	24
Tutorial / Synchronous Support Activity	24
Laboratory / Practical Demonstration / Workshop	16
Asynchronous Class Activity	36
Independent Study	100
Please select	
TOTAL	200

Indicative Resources

The following materials form essential underpinning for the module content and ultimately for the learning outcomes:

Imran, M. A., Zaidi, S. A. R., & Shakir, M. Z. (2017). Fronthaul and Backhaul Networks for 5G & Beyond. IET. http://www.theiet.org/resources/books/telecom/front.cfm

Wong, D. (2012). Fundamentals of Wireless Communication Engineering Technologies. Wiley-Blackwell.

Ismail, M., Shakir, M. Z., Qaraqe, K., and, Serpedin, E., Green heterogeneous wireless network. Wiley-IEEE Press; 1st edition.

Tse, D. and Viswanath, P. (20015). Fundamentals of wireless communication. Cambridge University Press. Google Android (2017). [Online]. Available: http://developer.android.com/about/start.html

Fitzek, Frank H.P. and Reichert, F. (2007). Mobile phone programming and its application to wireless networking. Springer. [electronic book] https://link.springer.com/book/10.1007/978-1-4020-5969-8

Module additional resources:

Follow module Moodle site for the most up-to-date information on material/topics. Other useful books/material:

Stallings, W. (2011). Wireless Communications and Networks. Prentice Hall. Proakis, J. G. (2008). Digital communications. New York: McGraw-Hill Inc.

Knuth, D. (2011). The Art of Computer Programming. Addison-Wesley Professional.

Burnette, E. (2010). Hello, Android: Introducing Google's Mobile Development Platform (Pragmatic Programmers). Pragmatic Bookshelf.

Students will be referred to articles in research journals and other reading materials

T. Qiu, N. Chen, K. Li, M. Atiquzzaman and W. Zhao, "How Can Heterogeneous Internet of Things Build Our Future: A Survey," in IEEE Communications Surveys & Tutorials, vol. 20, no. 3, pp. 2011-2027, thirdquarter 2018, doi: 10.1109/COMST.2018.2803740.

Agiwal, M., Roy, A., and Saxena, N., “Next Generation 5G Wireless Networks: A Comprehensive Survey,” in IEEE Communications Surveys & Tutorials, vol. 18, no. 3, pp. 1617-1655, Thirdquarter 2016.

Mustafa, H. A. U., Imran, M. A., Shakir, M. Z., Imran, A., and Tafazolli, R., “Separation Framework: An Enabler for Cooperative and D2D Communication for Future 5G Networks,” in IEEE Communications Surveys & Tutorials, vol. 18, no. 1, pp. 419-445, Firstquarter 2016.

Fan, P., Zhao, J., and I, C. L., “5G high mobility wireless communications: Challenges and solutions,” in China Communications, vol. 13, no. Supplement2, pp. 1-13, 2016.

Khan, W. Z., Yan X., Aalsalem, M. Y, and Arshad, Q., “Mobile Phone Sensing Systems: A Survey,” IEEE Communications Surveys & Tutorials, vol. 15, no. 1, pp. 402-427, First Quarter 2013.

Gupta, M., Jha, S. C., Koc, A. T., and Vannithamby, R., “Energy impact of emerging mobile internet applications on LTE networks: issues and solutions,” IEEE Communications Magazine, vol. 51, no. 2, pp. 90-97, February 2013.

(N.B. Although reading lists should include current publications, students are advised (particularly for material marked with an asterisk*) to wait until the start of session for confirmation of the most up-to-date material)

Attendance and Engagement Requirements

In line with the Student Attendance and Engagement Procedure, Students are academically engaged if they are regularly attending and participating in timetabled on-campus and online teaching sessions, asynchronous online learning activities, course-related learning resources, and complete assessments and submit these on time.

For the purposes of this module, academic engagement equates to the following:

The School of Computing, Engineering and Physical Sciences considers attendance and engagement to mean a commitment to attending, and engaging in, timetabled sessions. You will scan your attendance via the scanners each time you are on-campus and you will login to the VLE several times per week. Where you are unable to attend a timetabled learning session due to illness or other circumstance, you should notify the Programme Leader that you cannot attend. Across the School an 80% attendance threshold is set. If you fall below

this, you will be referred to the Student Success Team to see how we can best support your studies.

Equality and Diversity
The University's Equality, Diversity and Human Rights Procedure can be accessed at the following link: UWS Equality, Diversity and Human Rights Code. Aligned with the University's commitment to equality and diversity, this module supports equality of opportunity for students from all backgrounds and learning needs. Using the VLE, material will be presented electronically in formats that allow flexible access and manipulation of content. This module complies with University regulations and guidance on inclusive learning and teaching practice. This module has lab-based teaching and as such you are advised to speak to the Module Co-ordinator to ensure that specialist assistive equipment, support provision and adjustment to assessment practice can be put in place, in accordance with the University's policies and regulations.
(N.B. Every effort will be made by the University to accommodate any equality and diversity issues brought to the attention of the School)

Supplemental Information

Divisional Programme Board	**Computing**
Overall Assessment Results	☐ **Pass / Fail** ☒ **Graded**
Module Eligible for Compensation	☐ **Yes** ☒ **No** **If this module is eligible for compensation, there may be cases where compensation is not permitted due to programme accreditation requirements. Please check the associated programme specification for details.**
School Assessment Board	Business & Applied Computing
Moderator	Shahid Awan
External Examiner	R Menzies
Accreditation Details	
Module Appears in CPD catalogue	☐ **Yes** ☒ **No**
Changes / Version Number	1.13

Assessment (also refer to Assessment Outcomes Grids below)
Assessment 1
Project: This assignment requires students to work in a group of three or four members and use the knowledge learned from lectures and laboratory practices to design and present a mobile application (app). Each group should write a formal academic report reflecting their knowledge and understanding of 4G/5G applications, smartphone app design and development procedure. Your group report should clearly explain chosen functions and methods including working and development principles. Your report should show originality and innovation of the chosen app concept. Suggested sections in your group report include cover page, abstract, table of contents, introduction, mobile app concept (4G/5G network and emerging applications scenario definition with some excellent graphical illustration), app development and procedures (overall system architecture and implementation, graphics/visual effects, practical considerations, performance evaluation etc.), discussion (constraints and future modification), conclusion and references. The students should write

the reports using appropriate academic style. Students are also expected to write an individual critical review of the project work including peer-appraisal and self-assessment. In this work, students can choose from a wide range of proper topics including smart home applications, health care application, an organization/company services, card games, sports, media centre, education and learning, personal management, etc. Ideal projects should at least demonstrate successful integration of key concepts and skills learned during the lab sessions of the module. In addition, it is encouraged for students to propose his/her application theme and discuss it with the module coordinator for approval and suggestions. Weighted at 70%
Assessment 2
Laboratory work/ log book: In this assessment work, students are expected to timely complete the weekly lab work and submit/present the work to the module coordinator for assessment. Weighted at 30%.
Assessment 3
(N.B. (i) Assessment Outcomes Grids for the module (one for each component) can be found below which clearly demonstrate how the learning outcomes of the module will be assessed. (ii) An indicative schedule listing approximate times within the academic calendar when assessment is likely to feature will be provided within the Student Module Handbook.)

Component 1							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Dissertation/ Project report/ Thesis	☒	☒	☒	☒	☒	70	0

Component 2							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Workbook/ Laboratory notebook/ Diary/ Training log/ Learning log	☒	☒	☒	☒	☒	30	0

Component 3							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
	☐	☐	☐	☐	☐		
Combined total for all components						100%	0 hours

Change Control

What	When	Who
Attendance Update & EDI Update	21/1/2025	A Adamson