

# University of the West of Scotland

## Module Descriptor

Session: 2021/22

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**Title of Module: Mobile Networks and Smartphone Applications**

<b>Code: COMP11062</b>	<b>SCQF Level: 11</b> (Scottish Credit and Qualifications Framework)	<b>Credit Points: 20</b>	<b>ECTS: 10</b> (European Credit Transfer Scheme)
<b>School:</b>	School of Computing, Engineering and Physical Sciences		
<b>Module Co-ordinator:</b>	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.
- 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.

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

Module Delivery Method		
Face-To-Face	Blended	Fully Online
✓		
<p><b>Face-To-Face</b> Term used to describe the traditional classroom environment where the students and the lecturer meet synchronously in the same room for the whole provision.</p> <p><b>Fully Online</b> Instruction that is solely delivered by web-based or internet-based technologies. This term is used to describe the previously used terms distance learning and e learning.</p> <p><b>Blended</b> A mode of delivery of a module or a programme that involves online and face-to-face delivery of learning, teaching and assessment activities, student support and feedback. A programme may be considered “blended” if it includes a combination of face-to-face, online and blended modules. If an online programme has any compulsory face-to-face and campus elements it must be described as blended with clearly articulated delivery information to manage student expectations</p>		

Campus(es) for Module Delivery						
The module will <b>normally</b> be offered on the following campuses / or by Distance/Online Learning: (Provided viable student numbers permit)						
Paisley:	Ayr:	Dumfries:	Lanarkshire:	London:	Distance/Online Learning:	Other:
✓						

Term(s) for Module Delivery					
(Provided viable student numbers permit).					
Term 1	✓	Term 2		Term 3	

Learning Outcomes: (maximum of 5 statements)
<p>On successful completion of this module the student will be able to:</p> <p>L1. Demonstrate critical understanding of the wireless communications and mobile network structure, concepts, technologies, and protocols.</p> <p>L2. Demonstrate analytical and systematic skills in analyzing and evaluating the requirements of smartphone applications and applying these criteria efficiently in practice.</p> <p>L3. Demonstrate critical understanding of the process of smartphone application development, the key development techniques and programming concepts.</p> <p>L4. Demonstrate a critical awareness of smartphone application industry and markets, state-of-the-art development tools and emerging mobile technologies.</p> <p>L5. Demonstrate extensive knowledge and practical development skills through the development of mobile applications which meet industry standards.</p>

Employability Skills and Personal Development Planning (PDP) Skills	
<b>SCQF Headings</b>	During completion of this module, there will be an opportunity to achieve core skills in:
Knowledge and	SCQF Level 11.

Understanding (K and U)	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 Level 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 Level 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 Level 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 Level 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.

<b>Pre-requisites:</b>	Before undertaking this module the student should have undertaken the following:	
	<b>Module Code:</b>	<b>Module Title:</b>
	<b>Other:</b>	
<b>Co-requisites</b>	<b>Module Code:</b>	<b>Module Title:</b>

\* Indicates that module descriptor is not published.

<b>Learning and Teaching</b>
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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.

<b>Learning Activities</b> During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below:	<b>Student Learning Hours</b> (Normally totalling 200 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
	200 Hours Total

**\*\*Indicative Resources: (eg. Core text, journals, internet access)**

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

Core text and resource:

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 Requirements

In line with the Academic Engagement and Attendance Procedure, Students are defined as academically engaged if they are regularly engaged with timetabled teaching sessions, course-related learning resources including those in the Library and on Moodle, and complete assessments and submit these on time. Please refer to the Academic Engagement and Attendance Procedure at the following link: [Academic engagement and attendance procedure](#)

### Supplemental Information

<b>Programme Board</b>	Computing
<b>Assessment Results (Pass/Fail)</b>	No
<b>Subject Panel</b>	Business & Applied Computing
<b>Moderator</b>	Zeeshan Pervez
<b>External Examiner</b>	C Luo
<b>Accreditation Details</b>	
<b>Version Number</b>	1.12

### Assessment: (also refer to Assessment Outcomes Grids below)

The assessment consists of two components:

A. 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%.

B. 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%.

(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 Handbook.)

### Assessment Outcome Grids (Footnote A.)

#### Component 1

Assessment Type (Footnote B.)	Learning Outcome (1)	Learning Outcome (2)	Learning Outcome (3)	Learning Outcome (4)	Learning Outcome (5)	Weighting (%) of Assessment Element	Timetabled Contact Hours
Dissertation/ Project report/ Thesis	✓	✓	✓	✓	✓	70	0

#### Component 2

Assessment Type (Footnote B.)	Learning Outcome (1)	Learning Outcome (2)	Learning Outcome (3)	Learning Outcome (4)	Learning Outcome (5)	Weighting (%) of Assessment Element	Timetabled Contact Hours
Workbook/ Laboratory notebook/ Diary/ Training log/ Learning log	✓	✓	✓	✓	✓	30	0
<b>Combined Total For All Components</b>						100%	0 hours

#### Footnotes

A. Referred to within Assessment Section above

B. Identified in the Learning Outcome Section above

#### Note(s):

1. More than one assessment method can be used to assess individual learning outcomes.
2. Schools are responsible for determining student contact hours. Please refer to University Policy on contact hours (extract contained within section 10 of the Module Descriptor guidance note).  
This will normally be variable across Schools, dependent on Programmes &/or Professional requirements.

### Equality and Diversity

This module should be suitable for all students that can use a computer. In relation to students with special needs, when a student discloses a disability, the individual module tutor, in consultation with the special needs coordinator will agree any appropriate adjustments to be made. Students should note that the language of instruction is English and that they will need to have a reasonable grasp of the language in order to understand the teaching materials and write the submitting assessed work. Diversity in cultures, backgrounds, abilities, learning and cognitive styles and individual differences are valued and appreciated. The assessments have taken this into account.

[UWS Equality and Diversity Policy](#)

(N.B. Every effort will be made by the University to accommodate any equality and diversity issues brought to the attention of the School)