



FACULTY OF APPLIED SCIENCES
MASTER OF SCIENCE IN BIG DATA AND INTERNET OF THINGS
LEARNING MODULE OUTLINE

Academic Year	2023/2024	Semester	2
Module Code	COMP6134		
Learning Module	Communication Technology for Internet of Things		
Pre-requisite(s)	Nil		
Medium of Instruction	English		
Credits	3	Contact Hours	45 hrs
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MODULE DESCRIPTION

This learning module provides a comprehensive study of the major communication technologies and emerging standards that enable applications on Internet of Things (IoT). It covers a wide range of technologies which IoT is expected to bridge in the formation of an autonomous communication network that supports smart applications and intelligent decision making. Topics include: cellular technologies (2G/3G/4G/5G) and M2M communications, covering their transmission characteristics, physical layer technologies, medium access protocols, and routing protocols; WiFi; Bluetooth; Radio Frequency Identification (RFID); Near Field Communication (NFC); Wireless Sensor Networks; Wireless Personal Area Networks including IEEE 802.15.4 and ZigBee, and the Low Power networks such as SigFox and LoRa.

MODULE INTENDED LEARNING OUTCOMES (ILOS)

On completion of this learning module, students will be able to:

M1.	Utilize knowledge in advanced communication technologies; (AHEP4-M1)
M2.	Assess and contrast major communication technologies and emerging standards that enable Internet of thing applications; (AHEP4-M4)
M3.	Review and critique research literature in communication technologies for IoT; (AHEP4-M4)
M4.	Devise advanced solutions to meet specific communication requirements appropriate for an IoT application. (AHEP4-M1, AHEP4-M5)



These ILOs aims to enable students to attain the following Programme Intended Learning Outcomes (PILOs):

PILOs	M1	M2	M3	M4
P1. Master the principles of system engineering and relevant enabling technologies for building of IoT solutions	✓			
P2. Critically evaluate scientific methodologies and mathematical models for Big Data and its applications		✓	✓	
P3. Master the advanced software and programming tools and techniques for IoT solutions and Big Data				
P4. Explain the processes involved in IoT solutions and Big Data analytics in a typical business setting		✓		
P5. Explain different application domains and analyze their requirements for IoT and Big Data				✓
P6. Apply knowledge in advanced communication and multimedia technologies for the design and implementation of IoT solutions				✓
P7. Apply knowledge in applied statistics, machine learning, leading-edge technologies and programming techniques for Big Data				
P8. Design and carry out an advanced project following an ethical and professional methodology				
P9. To demonstrate advanced knowledge and R&D techniques in Big Data and IoT	✓			
P10. To investigate and develop new, emerging ICT technology for Big Data and IoT				✓
P11. To develop a global vision on the critical development and new application of Big Data and IoT		✓		
P12. To communicate technically and effectively in both speaking and writing				
P13. To have a positive attitude towards society and the environment.		✓		
P14. To adhere to high moral standards and commit to excellence in life-long learning.				



MODULE SCHEDULE, COVERAGE AND STUDY LOAD

Week	Content Coverage	Contact Hours
1-4	1. Fundamental of wireless communications	10.5 hours
	1.1 Antenna and radio wave propagation	
	1.2 Fading in the IoT environment	
	1.3 Channel capacity	
	1.4 Signal encoding techniques	
	1.5 Coding and error control	
	1.6 Multiple access techniques	
4-5	1.7 Wireless sensor networks	3 hours
	2. Transmission strategies in IoT	
	2.1 Cooperative communications	
5-7	2.2 Distributed-based and cluster-based communications	7.5 hours
	3. Cellular network and 5G	
	3.1 2G/3G/4G	
	3.2 5G architecture	
	3.3 5G network slicing	
8-10	3.4 5G PHY and MAC	7.5 hours
	4. WiFi and IoT	
	4.1 IEEE 802.11	
11	4.2 IEEE 802.11 ah	3 hours
	5. Bluetooth and NFC	
12-14	5.1 Bluetooth	7.5 hours
	5.2 NFC	
	6. Low-power network	
	6.1 6LoWan	
14-15	6.2 LoRa	6 hours
	6.3 SigFox	
	7. Wireless personal area network	



	7.1 IEEE 802.15.4	
	7.2 ZigBee	
	7.3 Z-Wave	

TEACHING AND LEARNING ACTIVITIES

In this learning module, students will work towards attaining the ILOs through the following teaching and learning activities:

Teaching and Learning Activities	M1	M2	M3	M4
T1. Lectures	✓	✓	✓	✓
T2. Tutorials	✓			✓

ATTENDANCE

Attendance requirements are governed by the Academic Regulations Governing Master's Degree Programmes of the Macao Polytechnic University. Students who do not meet the attendance requirements for the learning module shall be awarded an 'F' grade.

ASSESSMENT

In this learning module, students are required to complete the following assessment activities:

Assessment Activities	Weighting (%)	AHEP4 LOs	ILOs to be Assessed
A1. Projects	40%	AHEP4-M3, AHEP4-M4	P2, P5, P6, P9, P10, P11, P13
A2. Test	20%	AHEP4-M1, AHEP4-M2	P1, P2, P4, P6, P9
A3. Examination	40%	AHEP4-M1 AHEP4-M2 AHEP4-M4	P1, P2, P4, P6, P9

The assessment will be conducted following the University's Assessment Strategy (see www.mpu.edu.mo/teaching_learning/en/assessment_strategy.php). Passing this learning module indicates that students will have attained the ILOs of this learning module and thus acquired its credits.

Students with an overall score of less than 35 in the coursework will fail the module even if the overall score for the module is 50 or above.

Students with a score of less than 35 in the final examination will fail the module even if the overall score for the module is 50 or above.

REQUIRED READINGS

There is no official required readings for this module. Module notes are distributed in the class.



REFERENCES

1. Daniel Chew (2018), *The Wireless Internet of Things: A Guide to the Lower Layers*, Wiley.
2. Osseiran, et al, (2016). *5G Mobile and Wireless Communications Technology*, Cambridge University Press
3. Cirani, et al, (2018). *Internet of Things: Architectures, Protocols, and Standards*, Wiley.
4. Zaidi, et al, (2018). *5G Physical Layer: Principles, Models and Technology Components*, Academic Press
5. Stallings, W. (2005). *Wireless Communications and Networks (2nd ed.)*. Prentice Hall
6. Forouzan, B. A. (2013). *Data Communications and Networking (5th ed.)*. McGraw-Hill
7. Heath Jr. Robert. (2017). *Introduction to Wireless Digital Communication: A Signal Processing Perspective (1st ed.)*. Pearson

STUDENT FEEDBACK

At the end of every semester, students are invited to provide feedback on the learning module and the teaching arrangement through questionnaires. Your feedback is valuable for instructors to enhance the module and its delivery for future students. The instructor and programme coordinators will consider all feedback and respond with actions formally in the annual programme review.

ACADEMIC INTEGRITY

The Macao Polytechnic University requires students to have full commitment to academic integrity when engaging in research and academic activities. Violations of academic integrity, which include but are not limited to plagiarism, collusion, fabrication or falsification, repeated use of assignments and cheating in examinations, are considered as serious academic offenses and may lead to disciplinary actions. Students should read the relevant regulations and guidelines in the Student Handbook which is distributed upon the admission into the University, a copy of which can also be found at www.mpu.edu.mo/student_handbook/.