Subject Description Form

Subject Code	EIE568
Subject Title	IoT – Tools and Applications
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	The students are expected to have some basic knowledge on computer hardware and software.
Objectives	1. To provide an overview on IoT tools and applications including sensing devices, actuation, processing and communications. 2. To introduce hands-on IoT concepts including sensing, actuation, and communication through lab exercises with IoT development kits.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: **(1) Professional/academic knowledge and skills** a. Understand key IoT concepts on sensing devices, actuation, processing and communications b. Apply skills on prototyping IoT products and applications **2) Attributes for all-roundedness** c. Communicate effectively. d. Think critically and creatively. e. Assimilate new technological development in related field.
Subject Synopsis/ Indicative Syllabus	1. Introduction to Internet of Things (IoT) - Historical background of IoT - The IoT system stack: Sensors, edge computing, networking, cloud computing - How IoT could enable innovative products and services 2. Electronics for IoT - Overview of electronic signals (including sampling and Nyquist theorem) - General Purpose Input/Output (GPIO) and Pulse Width Modulation (PWM) - ADC and DAC concepts - Microcontrollers and computers for IoT (e.g., Arduino, Raspberry Pi, etc.) 3. Sensors for IoT - An overview of sensors commonly used in IoT applications - Sampling frequency and bandwidth requirements for different sensors - Interfacing common sensors and actuators in IoT development kits 4. Software and Data Analytics for IoT - Libraries of development kits and example uses (e.g., for Arduino) - Selection of development programming languages for different IoT services - Web server and web services (e.g., ThingsBoard, MQTT/HTTP) - Data analytics with machine learning techniques (e.g., Python, Anaconda) 5. Low Power Wide Area Networks (LPWAN) - Transmission of latency-sensitive real-time data and reliable signaling data - Protocols for exchanging information among different IoT devices - IoT communication protocols: Sigfox, LoRa, NB-IoT, etc. 6. Internet of Things Capstone - To consolidate and apply knowledge learnt in the subject with an IoT project

Teaching/Learning Methodology

The theories and applications of IoT will be described and explained in lectures. Tutorial and lab sessions will be conducted to cultivate students' hands-on skills on prototyping IoT products and applications based on IoT development kits. Finally, the subject will be consolidated with a hands-on IoT project. Students will also learn to present their developed applications and summarize their findings through a presentation and a written report.

Teaching/Learning Methodology	Intended Subject Learning Outcomes				
	a	b	c	d	e
Lecture	✓				
Tutorial and Lab	✓	✓		✓	
Mini-project	✓	✓	✓	✓	✓

Assessment Methods in Alignment with Intended Learning Outcomes

(should this be "Alignment of Assessment and Intended Subject Learning Outcomes"?)

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
		a	b	c	d	e
1. Assignments	20%	✓		✓	✓	
2. Test/Quizzes	20%	✓		✓	✓	✓
3. Lab	20%		✓		✓	✓
4. Mini-project	40%	✓	✓	✓	✓	✓
Total	100%					

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Assignments and test/quizzes let students review the taught materials, do further reading for deeper learning and apply the learnt materials to solving problems.

Lab exercises and the mini-project require students to do further reading, search for information, keep abreast of current IoT development, develop their own IoT prototypes, give a presentation and write a report.

Student Study Effort Expected

Class contact:	
▪ Lecture/Tutorial	24 Hrs.
▪ Laboratory sessions	15 Hrs.
Other student study effort:	
▪ Lecture: further reading, doing homework /assignment	72 Hrs.
Total student study effort	111 Hrs.

Reading List and References

1. R. Buyya, A. V. Dastjerdi, *Internet of Things: Principles and Paradigms*, Cambridge, MA, 2016.
2. James, A., Seth, A., & Mukhopadhyay, S. (2022). *IoT System Design : Project Based Approach* (1st ed. 2022.. ed., Smart Sensors, Measurement and Instrumentation, 41). Cham: Springer International Publishing : Imprint:

	Springer. (Full text available at: SpringerNature Complete eBooks via PolyU Library) 3. Tamboli, A. (2019). *Build your own IoT platform : Develop a fully flexible and scalable Internet of Things platform in 24 hours*. New York, NY]: Apress. (Full text available at: SpringerNature Complete eBooks via PolyU Library) <u>Others</u>: 4. IEEE Transactions and other journals.

July 2022