

## Subject Description Form

<b>Subject Code</b>	EIE568
<b>Subject Title</b>	IoT – Tools and Applications
<b>Credit Value</b>	3
<b>Level</b>	5
<b>Pre-requisite/ Co-requisite/ Exclusion</b>	The students are expected to have some basic knowledge on computer hardware and software.
<b>Objectives</b>	<ol style="list-style-type: none"> <li>1. To provide an overview on IoT tools and applications including sensing devices, actuation, processing and communications.</li> <li>2. To introduce hands-on IoT concepts including sensing, actuation, and communication through lab exercises with IoT development kits.</li> </ol>
<b>Intended Learning Outcomes</b>	<p>Upon completion of the subject, students will be able to:</p> <p><b>(1) Professional/academic knowledge and skills</b></p> <ol style="list-style-type: none"> <li>a. Understand key IoT concepts on sensing devices, actuation, processing and communications</li> <li>b. Hands-on skills on prototyping IoT products and applications</li> </ol> <p><b>2) Attributes for all-roundedness</b></p> <ol style="list-style-type: none"> <li>c. Communicate effectively.</li> <li>d. Think critically and creatively.</li> <li>e. Assimilate new technological development in related field.</li> </ol>
<b>Subject Synopsis/ Indicative Syllabus</b>	<ol style="list-style-type: none"> <li>1. <u>Introduction to Internet of Things (IoT)</u> <ul style="list-style-type: none"> <li>- Historical background of IoT</li> <li>- The IoT system stack: Sensors, edge computing, networking, cloud computing</li> <li>- How IoT could enable innovative products and services</li> </ul> </li> <li>2. <u>Electronics for IoT</u> <ul style="list-style-type: none"> <li>- Overview of electronic signals (sampling and Nyquist theorem)</li> <li>- General Purpose Input/Output (GPIO) and Pulse Width Modulation (PWM)</li> <li>- ADC and DAC concepts</li> <li>- Microcontrollers and computers for IoT (e.g., Arduino, Raspberry Pi, etc.)</li> </ul> </li> <li>3. <u>Sensors for IoT</u> <ul style="list-style-type: none"> <li>- An overview of sensors used in IoT</li> <li>- Sampling frequency and bandwidth requirements for different sensors</li> <li>- Interface common sensors and actuators to IoT development kits</li> </ul> </li> <li>4. <u>Software and Data Analytics for IoT</u> <ul style="list-style-type: none"> <li>- Libraries of development kits and examples (e.g., Arduino)</li> <li>- Selection of development programming languages for different IoT services</li> <li>- Web server and web services (e.g., ThingsBoard, MQTT/HTTP)</li> <li>- Data analytics with machine learning techniques (e.g., Python, Anaconda)</li> </ul> </li> <li>5. <u>Low Power Wide Area Networks (LPWAN)</u> <ul style="list-style-type: none"> <li>- Transmission of latency-sensitive real-time data and reliable signaling data</li> <li>- Protocols for exchanging information among different IoT devices</li> <li>- IoT communication protocols: Sigfox, LoRa, NB-IoT, etc.</li> </ul> </li> <li>6. <u>Internet of Things Capstone</u> <ul style="list-style-type: none"> <li>- To conclude the subject with a hands-on project on IoT applications</li> </ul> </li> </ol>

<b>Teaching/Learning Methodology</b>	<p>The theories and applications of IoT will be described and explained in lectures. Tutorial and lab sessions will be conducted to deliver hands-on skills on prototyping IoT products and applications based on IoT development kits. Finally, the subject will be concluded with a hands-on project on IoT applications. Students are requested to present their developed applications and summarize their findings through a presentation and a written report.</p>						
<b>Assessment Methods in Alignment with Intended Learning Outcomes</b>	Teaching/Learning Methodology		Intended Subject Learning Outcomes				
		a	b	c	d	e	
	Lecture	✓					
	Tutorial and Lab	✓	✓		✓		
	Mini project	✓	✓	✓	✓	✓	
	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%						
<b>Student Study Effort Expected</b>	<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p>						
	<p>Assignments and test/quizzes let students review the taught materials, do further reading for deeper learning and apply the learnt materials to solving problems.</p>						
	<p>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.</p>						
	<p>Class contact:</p>						
	<ul style="list-style-type: none"> <li>▪ Lecture/Tutorial</li> </ul>					24 Hrs.	
	<ul style="list-style-type: none"> <li>▪ Laboratory sessions</li> </ul>					15 Hrs.	
<p>Other student study effort:</p>							
<ul style="list-style-type: none"> <li>▪ Lecture: further reading, doing homework /assignment</li> </ul>					72 Hrs.		
<p>Total student study effort</p>					111 Hrs.		
<b>Reading List and References</b>	<p>1. R. Buyya, A. V. Dastjerdi, <i>Internet of Things: Principles and Paradigms</i>, Cambridge, MA, 2016.  <u>Others:</u>  2. IEEE Transactions and other journals.</p>						