Subject Description Form

Subject Code	EIE569
Subject Title	Sensor Networks
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	The students are expected to have some basic knowledge about circuits and IP networks.
Objectives	1. To introduce the fundamental issues, concepts, and design criteria in sensor networks. 2. To understand the key concepts towards the integration of sensor networks and Internet of Things (IoT). 3. To understand hardware, communication stack, and middleware technologies utilized in sensor networks for IoT. 4. To investigate the applications of sensor networks for IoT in smart cities.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: **(1) Professional/academic knowledge and skills** a. Understand sensing/actuation methods, communication stack, middleware technologies and applications of current and emerging sensor networks for IoT. **(2) Attributes for all-roundedness** b. Communicate effectively. c. Think critically and creatively. d. Assimilate new technological development in related fields.
Subject Synopsis/ Indicative Syllabus	1. Sensing and actuation 1.1. Sensors and actuators 1.2. Sensing data acquisition 1.3. Actuator controls 1.4. Sensors/actuators interfaces, standards, and protocols 2. Communication networks 2.1. Optical fiber and wireless communication fundamentals 2.2. Energy and communication models 2.3. Topologies 2.4. Routing 2.5. Scheduling 2.6. Transceivers interfaces, standards, and protocols 3. Middleware technologies 3.1. Detection and coverage 3.2. Localization and tracking 3.3. Data compression and fusion 3.4. Compressive sensing 4. Applications 4.1. Smart grid systems

	4.2. Sensing as a service (SaaS) 4.3. Mobile sensor networks (MSNs) 4.4. Vehicular ad hoc networks (VANETs)

Teaching/Learning Methodology

This course aims to provide students with a theoretical understanding of sensor networks, in particular about their design criteria and limitations when applying in IoT applications. The course is taking a bottom-up approach, which begins with sensing, processing, and communication hardware, followed by data aggregation/dissemination topologies and performance-aware middleware, and finally concluded with real-life IoT applications. It will explain the unique characteristics of sensor networks from conventional optical fiber networks and Ad-Hoc mobile networks, and further elaborate the new challenges introduced by IoT systems. Throughout the course, students will be presented with various algorithms/protocols/standards in sensor networks/IoT, together with the rationales behind their designs. Upon completion, students will be able to design, implement, and evaluate their own hardware, algorithms, middleware, and applications for sensor networks in IoT.

Teaching/Learning Methodology	Intended Subject Learning Outcomes			
	a	b	c	d
Lecture	✓			
Tutorial	✓		✓	
Presentation / Case study	✓	✓	✓	✓

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Midterm test	10%	✓	✓	✓	✓
2. Assignments	10%	✓	✓	✓	✓
3. Case study	10%	✓	✓	✓	✓
2. Final examination	70%	✓	✓	✓	✓
Total	100%				

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

Assignments let students review the taught materials, do further reading for deeper learning and apply the learnt materials to solve problems in sensor networks for IoT.

Case study requires the student to do further reading, search for information, keep abreast of current development, give a presentation and write a report.

Student Study Effort Expected

Class contact:	
▪ Lecture/Tutorial	33 Hrs.
▪ Case study – presentations and discussions	6 Hrs.
Other student study effort:	
▪ Self-reading, doing homework/assignment	72 Hrs.

	Total student study effort	111 Hrs.
Reading List and References	1. Pethuru Raj and Anupama C. Raman, *The Internet of Things: Enabling Technologies, Platforms, and Use Cases*, CRC Press, 2017 2. Fawzi Behmann and Wu Kwok, *Collaborative Internet of Things (C-IoT): For Future Smart Connected Life and Business*, John Wiley and Sons, 2015 3. G.P. Agrawal, *Fiber-optic communication systems*, Wiley, 2010 4. Shizhuo Yin, Paul B. Ruffin, Francis T.S. Yu, *Fiber Optic Sensors*, CRC Press, 2008 5. W. Dargie and C. Poellabauer, *Fundamentals of Wireless Sensor Networks: Theory and Practice*, John Wiley and Sons, 2010 6. I.F. Akyildiz, M.C. Vuran, *Wireless Sensor Networks*, John Wiley and Sons, 2010 7. Holger Karl, Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, John Wiley and Sons, 2005 8. D.P. Agrawal and Q. Zeng, *Introduction to Wireless and Mobile Systems*, Cengage Learning, 2016	