Smart Sensors and Internet of Things

Overview

Environmental parameters are necessary in several domains, such as home automation, industrial automation, medical aids, mobile healthcare, elderly assistance, intelligent energy management and smart grids, automotive, traffic management, and many others. At present, it is a clear trend to integrate new components and expand the features of the older ones in order to make the whole assembly smarter. Smart sensors are sensors with integrated electronics that can perform one or more of the logic functions, two-way communication, make decisions. Physically, it consists of transduction element, signal conditioning electronics and controller/processor that support some intelligence in a single package. While Internet of Things (IoT) is all about physical items talking to each other, machine-to-machine communications and person-to-computer communications. Key technologies that will drive the future IoT will be related to smart sensor technologies including wireless sensor network (WSN), Nanotechnology and miniaturization of sensing devices. This course is aimed at developing the technical skills for the researchers and engineers working/planning to work in the area of environmental monitoring.

In this course, the important sensors, associated interface electronics, signal conditioning, technology of smart sensor and IOT for the measurement and monitoring of vital environmental parameters will be discussed. This is a research level cum higher undergraduate level course and it is interdisciplinary in nature. Course participants will learn these topics through **expert lectures and hands-on tutorials**. **Also case studies and assignments will be shared to stimulate research motivation of participants.**

Objectives of the course include (a) Importance of environmental parameters measurement and monitoring (b) Exposing participants to the comprehensive fundamentals of Smart Sensors and Internet of Things (IOT) (c) to develop necessary technical skill to select suitable smart sensors, components of IOTs with associated knowledge of interface electronics and signal conditioning (d) to train the participants on the best methods to transmit, acquire and interpret the measured parameters with the help of smart sensors and IOT for smart homes/smart city application (e) Appreciation of the cutting-edge research questions in Smart Sensors and IOT.

Modules/Brief Syllabus	**A:** **Duration:** March 21 – 31, 2016 **B:** **Venue** **Department of Electrical Engineering, Jamia Millia Islamia (A Central University), New Delhi – 25, India** *Number of participants for the course will be limited to fifty.*
You may consider attending If…	- you are an executive, engineer and researcher from industry and government organizations, including R&D laboratories interested work in smart sensors and IOT - you are an electronics engineer or research scientist interested in designing and development of sensors and electronics systems for smart homes, smart city, smart health assessment.
Fees	The participation fees for taking the course is as follows: **Participants from abroad : US $500** **Industry/ Research Organizations: INR 6000** **Academic Institutions:** - **Faculty members:** Rs. 3000/- - **Students:** Rs. 1500/- The above fee include all instructional materials, tutorials and assignments, laboratory equipment usage charges, 24 hour free internet facility. The participants will be provided accommodation on payment basis, subject to the availability.

The Faculty

Dr. Subhas Chandra Mukhopadhyay has received **PhD (Eng.)** degree from Jadavpur University, India and **Doctor of Engineering degree** from Kanazawa University, Japan. Currently he is working as a **Professor of Sensing Technology** with the School of Engineering and Advanced Technology, Massey University, Palmerston North, New Zealand. He has over 25 years of teaching and research experiences. His fields of interest include Sensors and Sensing Technology, Instrumentation, Wireless sensor networks, Electromagnetics, control, electrical machines and numerical field calculation etc. He has authored/co-authored three books and over **300** papers in different international journals, conferences and book chapters. He has edited **twelve** conference proceedings. He has also edited **eleven** special issues of international journals as lead guest editor and **nineteen** books out of which **seventeen** are with Springer-Verlag. He has delivered **216** seminars as keynote, invited, tutorial and special lectures in **24** countries. He was a Distinguished Lecturer of IEEE Sensors council from 2010 to 2013. He is a Fellow of IEEE (USA), a **Fellow** of IET (UK) and a **Fellow** of IETE (India). He is a **Topical Editor** of IEEE Sensors journal, an **Associate Editor** of IEEE Transactions on Instrumentation and Measurements and a **Technical Editor** of IEEE Transactions on Mechatronics. He is the co-Editor-in-chief of the International Journal on Smart Sensing and Intelligent Systems (www.s2is.org). He was the Technical Programme Chair of various international conferences. He chairs the IEEE IMS Technical Committee 18 on Environmental Measurements.

Tarikul Islam received the Ph.D degree from Jadavpur University, Kolkata, India, in 2007. He is a Professor in the Electrical Engineering Department, Jamia Millia Islamia (Central University), New Delhi with over **17** years of experience in Academic and Research. His research interests are in the areas of thin film/thick film sensors for environmental parameters measurement, processing and functionalization of electronic materials for fabrication of sensors, sensors array for electronic nose. He is keenly interested in developing capacitive sensors of different types such as parallel late, interdigital, cylindrical cross-capacitor, and surface acoustic wave (SAW) sensors. He is also interested in conductive, cross-conductive, impedance, fractional order impedance sensors for the structural/transformer health monitoring, and the quality assessment of liquid drinks. He works extensively on interface electronic circuits for the sensors and signal conditioning using analog/digital/softcomputing techniques. He is an **associate editor of IEEE Sensors journal**. He has published more than **110** papers in peer reviewed journals and conferences. He has received research grant of nearly **160,000 (US $)** from different research funding agencies. He is a life member of ISTE, IETE, and ICTP. He is a program committee member of several international/national conferences, reviewer of various papers from IEEE Transactions, Elsevier, Springer, and Institution of Engineering & Technology (IET). Further details about T. Islam can be seen at **http://jmi.ac.in//electrical/sensorandinstrument.**

Course Co-ordinator

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For registration:

http://www.gian.iitkgp.ac.in/GREGN

GIAN SCHEDULE

Smart Sensors and Internet of Things (IOTs)

INAUGURAL CEREMONY: March 21, 2016 9:00AM - 10:00 AM

MODULE I : Sensors and Smart Sensors

Lecture No	Date	Time	Topics to be covered
1	March 21	10:30-11:45 AM	Environmental Parameters Measurement and Monitoring: Why measurement and monitoring are important, effects of adverse parameters for the living being
2	March 21	11:50 – 1.05 PM	Sensors: Working Principles: Different types; Selection of Sensors for Practical Applications;
3	March 22	9:00 - 10:15 AM	Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas etc
4	March 22	10:20 - 11:35 AM	Important Characteristics of Sensors: Determination of the Characteristics
5	March 22	11:40 - 12:55 PM	Fractional order element: Constant Phase Impedance for sensing applications such as humidity, water quality, milk quality
6	March 26	9:00 - 10:15 AM	Impedance Spectroscopy: Equivalent circuit of Sensors and Modelling of Sensors
7	March 26	10:20 - 11:35 AM	Importance and Adoption of Smart Sensors
8	March 26	11:40 - 12:55 PM	Architecture of Smart Sensors: Important components, their features
9	March 27	9:00 - 10:15 AM	Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel
10	March 27	10:20 - 11:35 AM	Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor
11	March 27	11:40 - 12:55 PM	Usefulness of Silicon Technology in Smart Sensor And Future scope of research in smart sensor

Module II : Internet of Things (IoT)

Lecture No	Date	Time	Topics to be covered
12	March 28	9:00 - 10:15 AM	Wireless sensor network (WSN) and Internet of Things (IoT)
13	March 28	10:20 - 11:35 AM	Vision and Challenges for realizing the Internet of Things
14	March 28	11:40 - 12:55 PM	Internet of Things Application Domains
15	March 29	9:00 - 10:15 AM	Internet of Things Architecture
16	March 29	10:20 - 11:35 AM	Design and development of Security and Privacy Technologies related to IoT
17	March 29	11:40 - 12:55 PM	Design and Implementation of IoT for Environmental Condition Monitoring
18	March 30	9:00 - 10:15 AM	Case study: Development of WSN Based Smart Bed for Health Care Application
19	March 30	10:20 - 11:35 AM	Case study: Study of Smart City and its Design
20	March 30	11:40 - 12:55 PM	Relevance of IoT to Developing World and Research Scope for the Internet of things
21	March 31	10:00 - 11:15 AM	Examination for performance evaluation
22	March 31	2:00 - 4:00 PM	**VALIDECTORY CEREMONY**