## MHRD Scheme on Global Initiative on Academic Network(GIAN)

COURSE TITLE: **Wireless Sensor Networks and Underlying Characteristics**

Overview:

Wireless Sensor Network (WSN) is a wireless network formed by spatially distributed devices equipped with sensors to monitor physical or environmental conditions such as light, heat, pressure etc.,. WSN provides a virtual layer where physical world information can be captured by any computational system. So, WSN becomes a key technology for realizing vision of Internet of Things (IoT). A WSN employs a Base Station (BS) or a sink collecting information from a large number of sensor nodes (SNs) for monitoring activities without any human intervention. Various characteristics of WSNs are covered as SNs have small local memory, processing of raw data and inclusion of wireless transceiver has made them versatile and useful in monitoring of an unattended area. Various underlying issues and associated parameters are studied in detail. As all WSN units get power from the battery, it is critical to conserve energy as much as possible. There are many civilian applications where access to the event area is possible and SNs can be placed at predefined locations. First topologies that are appropriate for these applications are defined and associated performance issues are characterized. There are many underlying issues that need careful considerations and this course provides an insight of various parameters that affect the performance and have long-lasting impact. Security considerations are also covered in this course to illustrate the balance between algorithmic complexity, power consumption and security requirements. Final comments about future research work are added to help audience think about potential open research areas.

Objectives:

The primary objectives of the course are as follows:

i) Understanding Wireless technology and recent advances in Sensor Networks,
ii) Providing exposure to engineers and researchers from both industry and universities,
iii) Building confidence and capability amongst the participants in the applications of wireless technologies and techniques,
iv) Providing exposure to practical problems and their solutions, through case studies,
v) Building adequate background by introducing recent but useful results in a simple and effective manner.

**Prerequisite:** Knowledge of basic wireless networking is necessary for benefiting from the course.

**Course details:**

**Total theory/tutorial/lab Sessions: 36**

## Duration: 14-23 December, 2016

**COURSE DETAILS:**

**Day 1: 14 December 2016 Wednesday**

**Registration: 9:00 A.M. to 10:00 A.M.**

**Inaguration: 10:00 A.M. to 11:00 A.M.**

Lecture 1: 11:00 A.M. to 12:45 P.M.

Introduction to Wireless Systems

Lecture 2: 2:00 P.M. to 3:30 P.M.

Architecture of WSN, Defense Applications of WSN

Lecture 3: 3:45 P.M. to 5:15 P.M.

Civilian Applications of Sensor Networks, Issues in WSN

**Day 2: 15 December 2016 Thursday**

Lecture 4: 9:30 A.M. to 11:00 A.M.

Sensors, Different kinds of Sensing Devices

Lecture 5: 11:15 A.M. to 12:45 P.M.

Sensing Range Modeling and its limitations

Lecture 6: 2:00 P.M. to 3:30 P.M.

Clock Synchronization

Tutorial 1: 3:45 P.M. to 5:15 P.M.

Sensing Range Modeling

**Day 3: 16 December 2016 Friday**

Lecture 7: 9:30 A.M. to 11:00 A.M.

Topology discovery, Residual Energy and Energy Harvesting

Lecture 8: 11:15 A.M. to 12:45 P.M.

Camera as a sensor

Lecture 9: 2:00 P.M. to 3:30 P.M.

Sensor Localization

Tutorial 2: 3:45 P.M. to 5:15 P.M.

Wireless Mesh Networks

**Day 4: 17 December 2016 Saturday**

Lecture 10: 9:30 A.M. to 11:00 A.M.

Broadcasting, Data Aggregation, and Opportunistic Forwarding

Lecture 11: 11:15 A.M. to 12:45 P.M.

Coverage and connectivity in Random Topology

Lecture 12: 2:00 P.M. to 3:30 P.M.

Random Processes

Lecture 13: 3:45 P.M. to 5:15 P.M.

Random Processes applied to wireless networks

**Day 5: 18 December 2016 Sunday**

Lecture 14: 9:30 A.M. to 11:00 A.M.
Clustering of sensors in Random Topology

Lecture 15: 11:15 A.M. to 12:45 P.M.
Random Topology Sensor MAC

Lecture 16: 2:00 P.M. to 3:30 P.M.
Security in wired systems

Lecture 17: 3:45 P.M. to 5:15 P.M.
Merkele tree for Security

**Day 6: 19 December 2016 Monday**

Lecture 18: 9:30 A.M. to 11:00 A.M.
Mathematical Modeling

Lecture 19: 11:15 A.M. to 12:45 P.M.
Application of soft computing to Coverage problem

Lecture 20: 2:00 P.M. to 3:30 P.M.
Indoor localization/navigation techniques

Lecture 21: 3:45 P.M. to 5:15 P.M.
Data Aggregation in Regular Topology

**Day 7: 20 December 2016 Tuesday**

Lecture 22: 9:30 A.M. to 11:00 A.M.
Routing and Performance of Regular WSNs

Lecture 23: 11:15 A.M. to 12:45 P.M.
Personal / Body Area Networks

Lecture 24: 2:00 P.M. to 3:30 P.M.
Random Key assignment to sensors

Lecture 25: 3:45 P.M. to 5:15 P.M.
Health-Care Applications

**Day 8: 21 December 2016 Wednesday**

Lecture 26: 9:30 A.M. to 11:00 A.M.
Authentication and Encryption

Lecture 27: 11:15 A.M. to 12:45 P.M.
Secure Communication in WSNs

Lecture 28: 2:00 P.M. to 3:30 P.M.
Interaction with Actuators

Lecture 29: 3:45 P.M. to 5:15 P.M.
Introduction to ns-2 and ns-3

**Day 9: 22 December 2016 Thursday**

Lecture 30: 9:30 A.M. to 11:00 A.M.
Deployed Large-scale WSNs and Associated Design Steps

Lecture 31: 11:15 A.M. to 12:45 P.M.
Physical layer aware routing in WSN

Lab : 2:00 P.M. to 5:15 P.M.
ns-2 Simulation experiments &
ns-3 Simulation experiments

**Day 10: 23 December 2016 Friday**
Lab : 9:30 A.M. to 12:45 P.M.
Lab Experiments
Lecture 32: 2:00 P.M. to 3:30 P.M.
Recent advances and IoT
**Valedictory Function 4:00 P.M. to 5:00 P.M.**

## Teaching Faculty:

**Dharma P. Agrawal** is the Ohio Board of Regents Distinguished Professor and the founding director for the Centre for Distributed and Mobile Computing in the Department of Electrical Engineering and Computing Systems. He has been a faculty member at the ECE Dept., Carnegie Mellon University (on sabbatical leave), N.C. State University, Raleigh and the Wayne State University. His current research interests include applications of sensor networks in monitoring Parkinson's disease patients and neurosis, applications of sensor networks in monitoring fitness of athletes' personnel wellness, applications of sensor networks in monitoring fire-fighters physical condition in action, efficient secured communication in Sensor networks, secured group communication in Vehicular Networks, use of Femto cells in LTE technology and interference issues, heterogeneous wireless networks, and resource allocation and security in mesh networks for 4G technology. His recent contribution in the form of a co-authored introductory text book on *Introduction to Wireless and Mobile Computing* has been widely accepted throughout the world and fourth edition is in press. The book has been has been reprinted both in China and India and translated in to Korean and Chinese languages. His co-authored book on *Ad hoc and Sensor Networks, 2nd edition,* has been published in spring of 2011. A co-edited book entitled, *Encyclopedia on Ad Hoc and Ubiquitous Computing*, has been published by the World Scientific and co-authored books entitled *Wireless Sensor Networks: Deployment Alternatives and Analytical Modeling,* and *Innovative Approaches to Spectrum Selection, Sensing, On-Demand Medium Access in Heterogeneous Multihop Networks*, and *Sharing in Cognitive Radio Networks* have being published by Lambert Academic. He is a founding Editorial Board Member, I*nternational Journal on Distributed Sensor Networks*, *International Journal of Ad Hoc and Ubiquitous Computing (IJAHUC), International Journal of Ad Hoc & Sensor Wireless Networks* and *the Journal of Information Assurance and Security (JIAS)*. He has served as an editor of the IEEE *Computer magazine*, and the *IEEE Transactions on Computers, the Journal of Parallel and Distributed Systems and* the *International Journal of High Speed Computing*. He has been the Program Chair and General Chair for numerous international conferences and meetings. He has received numerous certificates from the IEEE Computer Society. He was awarded a *Third Millennium Medal*, by the IEEE for his outstanding contributions. He has delivered keynote speech at 34 different international conferences. He has

published over 655 papers, given 52 different tutorials and extensive training courses in various conferences in USA, and numerous institutions in Taiwan, Korea, Jordan, UAE, Malaysia, and India in the areas of Ad hoc and Sensor Networks and Mesh Networks, including security issues. He has graduated 70 **PhDs and 58 MS students**. He has been named as an **ISI Highly Cited Researcher**, is a Fellow of the **IEEE,** the **ACM**, the **AAAS** and the **World Innovation Foundation,** and a recent recipient of **2008 IEEE CS Harry Goode Award**. Recently, in June 2011, he was selected as the **best Mentor for Doctoral Students** at the University of Cincinnati. Recently, he has been inducted as a **charter fellow of the National Academy of Inventers.** He has also been elected a **Fellow of the IACSIT (**International Association of Computer Science and Information Technology), 2013.

**Who can attend:**

1. Faculty, researchers and students at all levels (Ph.D. scholors/ M.Tech./ B.Tech.) who want to learn state-of-the-art in Wireless Sensor Networks
2. Executives, engineers and researchers involved in process control, automation, defense applications, unattended 24x7 monitoring, human health conditions

**Registration Fee:**

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|---|---|
| Participants from abroad | : US $500 |
| Industry/research organizations | : Rs. 15000/- |
| Academic institutions | : Rs. 10,000/- |
| Students | : Rs.2000/- |
| SC/ST students | **:** Rs.1000/- |

***There will be a concession of 50% of the fee for the faculty working in the constituent and affiliated colleges of JNTUH.***

**Limited accommodation is available in the University guest house and nearby student hostels run by private parties outside the University campus.**

**Course Coordinator: Dr. Kavitha Athota**

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