SENSOR NETWORKS AND THE INTERNET OF THINGS

GENERAL

SCHOOL	ENGINEERING		
DEPARTMENT	INFORMATICS AND COMPUTER ENGINEERING		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE		**SEMESTER**	2ο
COURSE TITLE	SENSOR NETWORKS AND THE INTERNET OF THINGS		

INDEPENDENT TEACHING ACTIVITIES *(In case credits are allocated to distinct parts of the course, e.g., Lectures, Laboratory Exercises, etc. If credits are allocated uniformly to the entire course, state the weekly teaching hours and total credits.)*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	8

COURSE CONTENT

The course includes the following teaching units:

- **The Concept of Ubiquitous Computing:** Its role in modern computing systems and applications.
- **Architectural Applications of Ubiquitous Computing:** Wireless Sensor Networks, IoT applications, etc. Heterogeneous computing systems as components of a mobile and ubiquitous computing architecture.
- **Introduction to IoT:** Definition, key features, IoT architectures, IoT applications. Differences between IoT and Web of Things (WoT), and Internet of Everything (IoE). IoT challenges, such as standardization, scalability, device size, power consumption, security and privacy, addressing, quality of service, mobility, etc.
- **IoT Hardware/Devices:** Smart devices, Sensors and Actuators, RFIDs, GPS, Cyber Physical Systems, BeagleBone Black, Arduino, Raspberry Pi platforms, etc. Processing units in embedded systems (Microcontrollers, Microprocessors, DSPs, PLDs, FPGAs, SoC).
- **Wireless Sensor Networks (WSNs) and Sensor-Actuator Networks (WSANs):** Node structure and technology, Architecture, and topologies. Physical layer standards and protocols. Communication, distribution, and organization issues. Routing protocols, etc.
- **Algorithmic Issues in WSNs/WSANs:** Clustering algorithms. Energy-efficient data collection and processing algorithms. Connectivity, localization, coverage, and topology control issues and algorithms. Energy consumption and node recharging issues.
- **Operating Systems and Middleware for WSNs/WSANs:** Design and implementation of applications, Programming tools and issues, Simulators, and emulators.
- **IoT Protocols and Application Development Environments:** Communication protocols and IoT device interconnectivity. Networking communication architectures and protocols. Addressing and information discovery. Application description and development languages across platforms. Programming device issues, interoperability, and implementation integration at the application level, with indicative examples.
- **IoT Architecture and Resource Management:** Distributed system architectures and future internet architectures. Device interconnection based on publish/subscribe models. Use of cloud computing and fog computing for IoT services. Edge computing techniques.
- **IoT Security:** Network and other attacks in WSNs and IoT. Data transmission security and reliability in wireless sensor networks. Secure device communication over the internet. Network security mechanisms in IoT.
- **IoT Applications:** E-health, Smart homes, Smart cities, Precision agriculture, Transportation/Logistics, Other industrial applications, Mobile edge applications. Case studies of IoT implementations.
- **Optimization Techniques for WSNs and IoT Applications:** Heuristic and metaheuristic optimization methods for clustering problems (e.g., genetic algorithms, ant colony/particle swarm

optimization). Problems of shortest path finding and multi-criteria satisfaction applied to data aggregation protocols, etc.

- **Special Cases of Interest:** Vehicular Ad Hoc Networks (VANETs/IoV) and Unmanned Aerial Vehicle Networks (UAVs/FANETs). Key features, routing protocols, and applications.
- **Other Topics – Future Directions:** Intelligence and situational awareness, device self-awareness, Internet of Everything ecosystem, Social Internet of Things, Regulatory, legal, and ethical issues.