UNIVERSITY of NICOSIA

# Course Syllabus

| Course Code | Course Title | ECTS Credits |
|---|---|---|
| COMP-513DL | Cyber-Physical Systems and the Internet of Things | 10 |
| **Prerequisites** | **Department** | **Semester** |
| None | Computer Science | Fall |
| **Type of Course** | **Field** | **Language of Instruction** |
| Required | Computer Science | English |
| **Level of Course** | **Lecturer(s)** | **Year of Study** |
| 2nd Cycle | Prof. Constandinos X. Mavromoustakis | 1st |
| **Mode of Delivery** | **Work Placement** | **Co-requisites** |
| Distance Learning | N/A | None |

**Course Objectives:**

The main objectives of the course are to:

- demonstrate and analyze the basic computer networking technologies and the required infrastructure which comprises the key steps involved in the communication process
- introduce Caching Techniques for Web content and availability methodologies for Navigating Content Networks and demonstrate the Internet Content-oriented Protocol
- introduce and provide students with deep knowledge for the up-to-date Internet and Web technologies and their access implementations (including Sensor Networks, Internet of Things (IoT), Mobile and Cloud Computing paradigm etc.)
- introduce the concepts regarding the system Architecture of the Cyber-Physical Systems (CPS), the Edge connectivity and protocols on the resource manipulation for Cognitive systems and how these systems handle efficiently the network resources
- provide students with deep knowledge for the up-to-date techniques for Streaming Media and critically assess the technical challenges in Peer to Peer Networks with case studies (Torrents and file sharing platforms) and Agent-based Systems
- make students aware of Interactive Content Delivery in Wireless and Mobile Systems as well as the Cross Layer Design (CLD) for Wireless Networks using active elements and the differences existing over different platforms
- provide students with deep knowledge for the Semantic Web and assess the Big Data manipulations through different protocols as well as introduce state-of-the art research in the area

**Learning Outcomes:**

After completion of the course students are expected to be able to:

1. provide a good realization and clear identification of the physical and logical control of today's modern networking architectures as well as the connectivity characteristics for end-to-end reliable data transmission
2. provide students with deep knowledge for System Architecture of the Cyber-Physical Systems (CPS), Edge connectivity (Internet of Things/ Internet of Everything) and protocols (N-tier applications, Usability Principles, Cloud Computing paradigm and related Technologies)
3. provide students with deep knowledge of the existing technologies for cognitive Internet of Things (IoT) systems, Agent-based systems and Cross layering issues and Traffic based schemes and how these concepts affect the efficiency of the network resources
4. introduce state-of-the art research in the area of modern Internet Technologies regarding the Caching Techniques for Streaming Media
5. introduce state-of-the art research in the area of Wireless Sensor Network, U-WSNs and Cloud-based systems and provide students with deep knowledge for existing technical challenges in Peer-to-Peer Content Networks and the file sharing platforms
6. research in state-of-the-art areas in data and network communication systems and web technologies

**Course Content:**

1. Introduction to Cyber-Physical Systems: Standards, Topologies, Network Hardware, Network Standardization, Transmission Principles
2. Networked Systems and Internet structure: Introduction to the Internet and Cyber-Physical application interface, basic concepts of the Internet Services and Protocols, higher level protocols
3. System Architecture of the Cyber-Physical Systems (CPS), Edge connectivity and protocols - Collaborative outsourcing in CPS, Sockets and Client/Server structures and wireless and wired P2P existing architectures
4. Hybrid and purely Mobile Peer-to-Peer Communication and principles, supported protocols and communication pros and cons
5. Wireless systems and CPS configuration and supported foundations and architectures

6. Cognitive CPS: efficiency, and resource manipulation
7. Wireless Sensor Network (WSN), life cycle, energy efficiency, lifetime of WSNs, energy conservation
8. Internet of Things (IoT) in the smart spaces Era
9. Enabling Multimedia applications in Cyber-Physical Systems
10. Resource Sharing schemes and protocols
11. Cloud Computing paradigm and the state-of-the-art methodologies
12. CPS and Edge Computing as a novel paradigm-Case studies

**Learning Activities and Teaching Methods:**

Lectures, lab presentations, lab tutorials, practical exercises, assignments and research essays

**Assessment Methods:**

Mid-term and Final Examinations

Projects (1 Programming Individual and 1 Simulation or Emulation Individual)

Assignments (2), Quizzes (2)

**Required Textbooks / Readings:**

| Title | Author(s) | Publisher | Year | ISBN |
|---|---|---|---|---|
| Content Networking: Architecture, Protocols, and Practice | M. Hofmann and L. Beaumont | The Morgan Kaufmann (Series in Networking) | 2013 | ISBN 10: 1-55860-834-6 |
| Cyber-Physical Systems: Foundations, Principles and Applications (Intelligent Data-Centric Systems: Sensor | H. Song, D. B Rawat, S. Jeschke and C. Brecher | Academic Press | 2016 | ISBN-10: 0128038012 ISBN-13: 978-0128038017 |

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|---|---|---|---|---|
| Collected Intelligence) | | | | |
| Beyond the Internet of Things: The Internet of Everything | J. Mongay Batalla et al. | Springer International Publishing AG | 2016 | ISBN-10: 3319507567 ISBN-13: 978-3319507569 |

**Recommended Textbooks / Readings:**

| Title | Author(s) | Publisher | Year | ISBN |
|---|---|---|---|---|
| Internet of Things and Smart Environments | S. Shahrestani | Springer International Publishing AG | 2017 | ISBN-10: 3319601636<br>ISBN-13: 978-3319601632 |
| Ambient Assisted Living and Enhanced Living Environments:<br>Principles, Technologies and Control | C. Dobre et al. | Elsevier, Publisher | 2017 | eBook ISBN: 9780128052822<br>Paperback ISBN: 9780128051955 |
| Internet of Things (IoT) in 5G Mobile Technologies (Modeling and Optimization in Science and Technologies) 1st ed. 2016 | C. X. Mavromoustakis, G. Mastorakis and J. Mongay Batalla | Springer International Publishing AG | 2016 | ISBN-10: 3319309110<br>ISBN-13: 978-3319309118 |