

ADVANCED TOPIC: CONNECTED INDUSTRIES, SMART CITIES & E-GOVERNMENTS

**Bachelor in Data and Business Analytics BDBA SEP-2023
CISCEG-DBA.4.M.A**

Area Computer Science and AI

Number of sessions: 15

Academic year: 23-24

Degree course: FOURTH

Number of credits: 3.0

Semester: 2^o

Category: COMPULSORY

Language: English

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EDUARDO RODRÍGUEZ LORENZO

Eduardo Rodriguez Lorenzo is Senior Manager at NETSCOUT and Adjunct Professor at IE School of Science and Technology. He is a technologist specializing in Telecommunication Networks, Cybersecurity, Software Architecture, Data Engineering and Analytics.

He studied at UPM (Universidad Politécnica de Madrid), King's College London and London University.

At NETSCOUT, he leads a global team of Data and Network Engineers with a strong focus on Network Service Assurance, Cybersecurity, Data Engineering and Analytics.

He has gained broad international experience delivering high-value Consulting Services (Customer Experience & Customer Journeys, Business Intelligence, Service Assurance, Data Monetization, Process Engineering...) and Data-driven Solutions (Cloud & Backend Architecture, Data Feeds, Database, Dashboard, Interaction & Visualisation Design) to global Enterprises and Communication Service Providers. He has played an active role in the launch, measurement and optimisation of Mobile Networks for various top international Telcos.

He is a member of the Spanish Charter of Telecommunications Engineers (COIT) where he is an active member of the Telecommunications Policy and Regulation Group and the Digital Transformation Group.

His main interests include Disruptive Technologies, Data Engineering Architectures, Networks, Distributed Systems and Graph technology.

He joined IE University in 2020.

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Office Hours

Office hours will be on request. Please contact at:

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SUBJECT DESCRIPTION

This course provides an overview of connected industries, smart & connected cities and e-government along with emerging perspectives and trends. Specifically, students will study how technology is transforming industries, cities and governments in the digital era, from the perspective of innovation and processes impacted due to deployment of technology. Topics covered include:

- Internet of Things
- 5G Networks and Telecommunications technology
- Cyber Physical Systems
- Cybersecurity
- Industry 4.0 and Smart Factories
- Edge Computing and Analytics
- Trends in Smart City and Mobility solutions
- Emerging Digital Regulations

LEARNING OBJECTIVES

By taking this course, students will gain a basic understanding of these topics:

Internet of Things

- Understanding of terminology, components and standards
- Basic design and implementation of IoT solutions using Edge and Cloud technology
- Understand the importance of IPv6 as the foundation of the Internet of Things

Mobile Networks and 5G

- Basic knowledge of Telecommunications technologies and Mobile Networks
- Understand the key features of 5G technology
- Mobile edge computing
- Applications and technologies that comprise 5G verticals
- Overview of mobility management, session management and Quality of Service frameworks
- Ultra-low latency and high reliability use cases and enablers, challenges and requirements
- An outline of the requirements and challenges imposed by massive numbers of devices connected to cellular networks

Cyber Physical Systems, Control & Security

- Understand the basic building blocks of Smart Objects and Cyberphysical Systems
- The importance of feedback loops and their role in the design of intelligent systems
- Notions of Cybersecurity for Industry 4.0
- The impact of automation in the future of work

Smart Cities & Mobility Solutions

- Understand the concept of Smart City
- Understand the potential uses of IoT in smart cities globally.
- Know the relevance of smart IT infrastructure for smart cities
- Gain insight about the necessity of smart, inclusive cities
- Know the key performance indicators for smart, sustainable cities
- Interpret the City Resilience Framework
- Understand how data can enable smart cities
- Understand the necessity of governance in smart cities
- Gain an insight on cyber threats in smart cities
- Understand the role of citizens in smart city governance
- Understand the FiWARE platform and Ecosystem

E-Government and Emergent Regulations

- Understand the layers of e-Government
- Understand the impact of regulations on IoT applications
- Understand the regulatory requirements of the EU for Digital Business
- Understand Europe's Digital Single Market
- Interpret the strategic alignment of user-privacy needs for connected applications

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	29.33 %	22.0 hours
Discussions	13.33 %	10.0 hours
Exercises in class, Asynchronous sessions, Field Work	24.0 %	18.0 hours
Group work	17.33 %	13.0 hours
Individual studying	16.0 %	12.0 hours
TOTAL	100.0 %	75.0 hours

PROGRAM

SESSION 1 (LIVE IN-PERSON)

Introduction to Connected Industries, Smart Cities & E-Governments

Internet of Things: Fundamentals

- What is IoT
- IoT market stats
- IoT Architectures
- Sensors
- IoT Networks: SANETs, WSN
- IoT Standards: BLE, LoWPA, ZigBee, 802.15.4 and other access technologies...
- IoT Data Management Stack: Edge/Fog/Cloud
- Industrial Internet of Things (IIOT) and Internet of Services
- LPWANs and Emerging Wireless Infrastructure

SESSION 2 (LIVE IN-PERSON)

Programming the Internet of Things

- IPv6: A foundation for the Internet of Things
- Use of MQTT, CoAP, and other protocols to connect IoT devices and services
- Use of cloud services to support IoT ecosystems

SESSION 3 (LIVE IN-PERSON)

Cyber Physical Systems, Control & Security

- Cyberphysical Systems
- Feedback Loops and Control Theory
- Human-in-the-Loop
- From Sensors to Smart Objects
- Robotic Automation and Collaborative Robots
- Cybersecurity applied to Connected Industries

SESSION 4 (LIVE IN-PERSON)

IoT Lab

- IoT Platforms case study
- Understanding Feedback Loops

SESSION 5 (LIVE IN-PERSON)

Telecommunication Networks & Business Models

- Overview of Telecommunication Technologies
- Architecture, Protocols and Operations of different access Networks
- Mobile Networks Economics: spectrum auctions & competition

SESSION 6 (LIVE IN-PERSON)

5G Networks

- Standards Review: From 1G to 4G
- Key 5G technology features: massive MIMO and beamforming technologies, spectrum

- considerations, Network Slicing
- Software Defined Networking (SDN) for 5G
- Overview of mobility management, session management and Quality of Service frameworks
- Mobile edge computing
- Ultra-low latency and high reliability use cases and enablers, challenges and requirements
- An outline of the requirements and challenges imposed by massive numbers of devices connected to cellular networks
- 5G Rollouts around the world
- The economic importance of 5G

SESSION 7 (LIVE IN-PERSON)

Beyond 5G

- Current issues, trends and 6G research
- Emerging Use Cases: Augmented Reality, Digital Twins, ...
- Group discussion on these topics

SESSION 8 (LIVE IN-PERSON)

Smart City & Mobility Solutions

- Growing Urbanization: The Imperative for Smart Cities
- Smart City Design Goals
- Smart City as Mediator: Moving from Sensors to Services
- The Smart City Stack

SESSION 9 (LIVE IN-PERSON)

Smart City & Mobility Solutions

- Smart Management for Smarter Cities
- Design Thinking applied to Smart City design
- Smart City Planning and Management
- Fundamentals of Smart Infrastructure & Mobility
- Smart City GovernanceSmart City Analytics

SESSION 10 (LIVE IN-PERSON)

Smart City & Mobility Solutions

- Use Cases and Success Stories
- Smart City and Mobility Trends
- Urban design trends
- Sustainable cities and the role of technology

SESSION 11 (LIVE IN-PERSON)

Connected Industries and Industry 4.0

- Digitalisation and the Networked Economy

- The evolution of factories. Industry 4.0 Factory
- Smart Manufacturing, Devices and Products
- Trends in Smart Business Transformation
- Reference Architecture and Standards
- Future of Work and Skills for Workers in the Industry 4.0 Era
- Introduction to FiWARE technology: Smart Data Models, Context-aware solutions and Open-APIs

Students will be exposed to Industry 4.0 examples on different verticals and areas of application. Then, students will be required to engage in a discussion to reflect on key insights and learnings from selected case studies and how they would apply their newly acquired knowledge in the real world.

SESSION 12 (LIVE IN-PERSON)

E-Government, European Digital Single Market and Emerging Regulations

- Layers of e-Government
- E-Government and its implications for Citizens and Society
- Open Data Initiatives
- Case Studies: E-Government Good Practices

SESSION 13 (LIVE IN-PERSON)

E-Government, European Digital Single Market and Emerging Regulations

- Emerging Digital Regulation and the global role of the European Union
- Digital Single Market
- Digital & Data Sovereignty
- Privacy and Data Ethics considerations

SESSION 14 (LIVE IN-PERSON)

The politics of Connected Industries

- Trends and emerging topics
- Chip wars and the semiconductors industry
- Internet Governance
- Geopolitics, Technology and Global prosperity

SESSION 15 (LIVE IN-PERSON)

Team Presentations

EVALUATION CRITERIA

Course evaluation is through individual assignments, labs, class participation (in-class quizzes...) and a group assignment. There is no Final Exam.

Throughout the semester, readings will be shared by the Professor on the discussion board, about relevant topics (for example, advances in communication networks, smart city trends, digital regulation, urban design ...). Students are expected to read and contribute to the forum with the own views and resources, plus, readings will be an important part of in-class quizzes.

criteria	percentage	Learning Objectives	Comments
Quizzes, Assignments and Labs	45 %		
Group Presentation	35 %		
Discussion forum and other interactive activities	20 %		

RE-SIT / RE-TAKE POLICY

The overall passing course grade is 5.0 (50%). If a student scores lower than this minimum, he will have to go to June retake.

BIBLIOGRAPHY

Recommended

- Shyam Varan Nath, Ann Dunkin, Mahesh Chowdhary, Nital Patel. *Industrial Digital Transformation*. Packt Publishing. ISBN 9781800207677 (Digital)
- Andy King. (2021). *Programming the Internet of Things*. O'Reilly Media, Inc.. ISBN 9781492081418 (Digital)
- Rath Vannithamby, Anthony Soong. *5G Verticals*. Wiley. ISBN 9781119514817 (Digital)
- Carol L. Stimmel. *Building Smart Cities: Analytics, ICT, and Design Thinking*. Routledge. ISBN 9781498702768 (Digital)
- Abhik Chaudhuri. *Internet of Things, for Things, and by Things*. Routledge. ISBN 9781138710443 (Digital)
- Devaki Chandramouli, Rainer Liebhart, Juho Pirskanen. (2019). *5G for the Connected World*. Wiley. ISBN 9781119247081 (Digital)
- David Nunes, Jorge Sá Silva, Fernando Boavida. *A Practical Introduction to Human-in-the-Loop Cyber-Physical Systems*. Wiley-IEEE Press. ISBN 9781119377788 (Digital)
- Vesnic-Alujevic L, Scapolo F. (2019). *The Future of Government 2030 : Policy Implications and Recommendations*. Luxembourg: Publications Office of the European Un. ISBN 9789276112075 (Digital)

BEHAVIOR RULES

Please, check the University's Code of Conduct [here](#). The Program Director may provide further indications.

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