Course guide
240309 - 240IIT21 - Data Process and Communication

Last modified: 05/07/2023

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 723 - CS - Department of Computer Science.

Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Optional subject).

Academic year: 2023 **ECTS Credits:** 4.5 **Languages:** Catalan

LECTURER

Coordinating lecturer: Josep Vilaplana Pastó

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEETI5. (ENG) Dissenyar sistemes de comunicació que enllacen sensors, controladors i actuadors (Competència específica associada a l'especialitat en Tecnologies de la Informació per a la Industria).
CEETI2. (ENG) Modelar sistemes de comunicació i gestió de dades entre processos mitjançant protocols de comunicació i de forma segura. (Competència específica associada a l'especialitat en Tecnologies de la Informació per a la Industria).

TEACHING METHODOLOGY

The subject will be taught in theory sessions alternating the theoretical and practical part. The practical part will consist of solving exercises and doing practical work. The learning of this subject will depend a lot on the personal work of the students.

LEARNING OBJECTIVES OF THE SUBJECT

Introduce students to the basics to follow the new trends in industry digitalization, and facilitate further study in other subjects. Gain basic knowledge of computer structure, organization, and networking. Basic knowledge of communication protocols. Introduce the student to the development of concurrent applications, exchange of messages and protocols, within the field of the Internet of Things (IoT) and web servers. Gain basic knowledge of data security, management and learning techniques.

STUDY LOAD

Type	Hours	Percentage
Hours large group	40,5	36.00
Self study	72,0	64.00

Total learning time: 112.5 h

CONTENTS

Structure and operation of computers and multiprocessor systems.

Description:
The operation of the Von Neuman type computer is explained by describing the interaction and operation of the processor components (arithmetic-logic unit, registers, etc.), memory, bus, and input / output. The advantages and disadvantages of the different interconnection systems between many processors and memories are then studied.

Specific objectives:
The student will be able to describe the structure and operation of the main components of a computer.

The student will be able to understand the performance of a computer according to the interconnection between its components.

The student will be able to evaluate network configurations between processors and memories.

Full-or-part-time: 4h
Theory classes: 2h
Self study : 2h

Operating systems

Description:
The operation of an operating system is explained with special emphasis on processor scheduling and virtual memory management. Among the various types of operating systems, real-time operating systems are explained with more detail.

Specific objectives:
Know the main functions of an operating system and the reason for its need.

Understand the role that the operating system plays in the efficient management of the processor, memory, and peripherals.

Know how to program with libraries of the operating system.

Full-or-part-time: 10h
Theory classes: 2h
Practical classes: 2h
Self study : 6h

Computer networks

Description:
Introduction to current computer networks. OSI level model. TCP / IP protocol. CAN protocol. IOT protocols. Network Applications. Security.
Cryptography. Protections. Threats. Certification. Blockchain technology

Specific objectives:
Know the basics of the internet, the packet network, standards.

Know the format of an IP datagram. IP addressing. Datagram routing.

Know the TCP protocol. Communication of applications by sockets.

Have basic notions of network security and protection.

Know other specific protocols and their advantages and disadvantages. CAN for automotive, LPWAN, zigbee, NFC, bluetooth (MQTT, XMPP, ...) for IoT.

Full-or-part-time: 30h
Theory classes: 6h
Practical classes: 6h
Self study : 18h

Concurrent Programming

Description:
Concurrent programming is introduced and possible conflicts (mutual exclusion, indefinite blocking, starvation, etc.) that may be found are studied. Two ways of approaching concurrent programming are studied: Programming by means of execution threads, programming by means of separate processes.

Specific objectives:
Be able to develop concurrent programs that share memory.

Understand interference and blockages in a concurrent system.

Know how to apply techniques that avoid interference and blockages in concurrent programs.

Be able to develop concurrent programs that pass messages

Full-or-part-time: 24h
Theory classes: 3h
Practical classes: 6h
Self study : 15h

Distributed systems.

Description:
The principles on which distributed systems are based are described. Models are introduced to build distributed applications that facilitate the correctness, reliability, and scalability of the application. Some real examples will be studied.

Specific objectives:
Understand that it means a distributed system and what are the problems to be faced for its design and implementation (concurrence, lack of a single control, heterogeneity, fault tolerance, scalability, ...).

Know possible applications of a distributed system.

Apply a distributed system paradigm (client-server, processor farm, etc.) in the context of IIOT.

Full-or-part-time: 23h
Theory classes: 2h
Practical classes: 6h
Self study : 15h

Machine learning

Description:
Neural networks are introduced and their application in the field of machine learning

Specific objectives:
Introduce the fundamentals of machine learning.

Know the various techniques for solving machine learning problems.

Full-or-part-time: 20h
Theory classes: 2h
Practical classes: 6h
Self study : 12h

GRADING SYSTEM

Throughout the course there will be three assignements L1, L2 and L3. The final grade of the subject will be calculated as
NF = max (0.6 * NL + 0.4 * NEF, NEF)

and

NAC = 0.2 * L1 + 0.3 * L2 + 0.5 * L3
NEF = final exam grade.

BIBLIOGRAPHY

Complementary:
- Stallings, W. Organización y arquitectura de computadores [on line]. 7a. ed. Madrid [etc.]: Prentice Hall, cop. 2006 [Consultation: 11/10/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=1266. ISBN 8489660824.
- Stallings, William. Operating systems : internals and design principles [on line]. 9th ed. Harlow: Pearson Education Ltd., 2017 [Consultation: 30/03/2023]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?docID=5186478. ISBN 9781292214306.
- Tanenbaum, Andrew S; Steen, Maarten van. Distributed systems : principles and paradigms. 2nd ed. Upper Saddle River, N.J.: Pearson : Prentice Hall, cop. 2007. ISBN 0136135536.
- Silberschatz, Abraham; Galvin, Peter B; Gagne, Greg. Operating system concepts: global edition. Global edition (tenth edition). Hoboken: John Wiley & Sons, [2019]. ISBN 9781119454083.
- Chollet, François. Deep learning with Python [on line]. 2nd ed. Shelter Island, New York: Manning Publications Co, 2021 [Consultation: 16/11/2022]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=6798497. ISBN 9781638350095.

RESOURCES

Hyperlink:
- https://www.python.org/doc/. https://www.python.org/doc/