

Academic Year: (2023 / 2024)

Review date: 28-04-2023

Department assigned to the subject: Computer Science and Engineering Department, Telematic Engineering Department

Coordinating teacher: VALERA PINTOR, FRANCISCO

Type: Compulsory ECTS Credits : 6.0

Year : 1 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Secure computer network systems

OBJECTIVES

The objectives of the subject are as follows:

- To understand the fundamental concepts of the Quantum Internet and how it differs from the classical Internet.
- To understand the relationship between the Quantum Internet and the fundamentals of quantum mechanics.
- To know the basic components of quantum networks, including end systems, communication lines, switches, and routers (repeaters).
- To understand the architecture of protocols in quantum networks and their implementation.
- To learn the fundamentals and applications of quantum cryptography, particularly key distribution.
- To know the basic concepts of post-quantum cryptography and its practical applications.
- To explore current and future applications of the Quantum Internet in different areas.

DESCRIPTION OF CONTENTS: PROGRAMME

- Quantum foundations of the Quantum Internet
- Quantum networks: end systems, communication lines, switches and routers (repeaters)
- Protocol architecture in quantum networks
- Quantum Internet
- Fundamentals and applications of quantum cryptography: key distribution
- Post-quantum cryptography
- Applications of the quantum Internet

LEARNING ACTIVITIES AND METHODOLOGY

Learning activities:

- Theoretical classes
- Practical laboratory classes
- Tutorials
- Individual student work
- Mid-term and final exams

Methodology:

- Critical reading of texts recommended by the professor of the subject: articles, reports, manuals and/or academic articles, either for later discussion in class, or to expand and consolidate the knowledge of the subject.
- Resolution of case studies, problems, etc. raised by the teacher individually or in groups
- Presentation and discussion in class, under the moderation of the teacher of topics related to the content of the subject, as well as case studies
- Preparation of papers and reports individually or in groups.

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ASSESSMENT SYSTEM

% end-of-term-examination:	60
% of continuous assessment (assignments, laboratory, practicals...):	40
- Individual or group work done during the course, 40%	
- Final exam, 60%	

BASIC BIBLIOGRAPHY

- Beullens, Ward ; D'Anvers, Jan-Pieter ; Hülsing, Andreas ; Lange, Tanja ; Panny, Lorenz ; Saint Guilhem, Cyprien de ; Smart, Nigel P Post-quantum cryptography: current state and quantum mitigation, Publications Office , 2021
- Federico Grasselli author Quantum cryptography : from key distribution to conference key agreement, Springer, 2021
- Kollmitzer, Christian ; Schauer, Stefan ; Rass, Stefan ; Rainer, Benjamin Quantum Random Number Generation: Theory and Practice, Springer International Publishing , 2021
- Rodney Van Meter Quantum Networking, John Wiley & Sons Ltd., 2014

ADDITIONAL BIBLIOGRAPHY

- Bernstein, Daniel J ; Hülsing, Andreas ; Lange, Tanja ; Rekleitis, Evangelos Post-quantum cryptography: integration study, Publications Office , 2022
- Roger A. Grimes Cryptography apocalypse : preparing for the day when quantum computing breaks today's crypto, Wiley , 2020

BASIC ELECTRONIC RESOURCES

- Chonggang Wang, Akbar Rahman, Ruidong Li, Melchior Aelmans, Kaushik Chakraborty . Application Scenarios for the Quantum Internet: <https://datatracker.ietf.org/doc/draft-irtf-qirg-quantum-internet-use-cases/>
- Wojciech Kozlowski, Stephanie Wehner, Rodney Van Meter, Bruno Rijsman, Angela Sara Cacciapuoti, Marcello Caleffi, Shota Nagayama . Architectural Principles for a Quantum Internet: <https://datatracker.ietf.org/doc/rfc9340/>