Universidad de Alcalá

TEACHING GUIDE

Networks Architecture II

Degree in
Telecommunication Technologies Engineering (GITT)
Telecommunication Systems Engineering (GIST)
Telematics Engineering (GIT)
Electronic Communications Engineering (GIEC)

Universidad de Alcalá

Academic Year 2023/2024

2nd Year - 2nd Semester (GITT+GIST+GIT+GIEC)

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TEACHING GUIDE

Course Name:	**Networks Architecture II**
Code:	**350015 (GITT+GIST+GIT+GIEC)**
Degree in:	**Telecommunication Technologies Engineering (GITT)** **Telecommunication Systems Engineering (GIST)** **Telematics Engineering (GIT)** **Electronic Communications Engineering (GIEC)**
Department and area:	**Automática** **Telematics Engineering**
Type:	**Compulsory (GITT+GIST+GIT+GIEC)**
ECTS Credits:	**6.0**
Year and semester:	**2nd Year - 2nd Semester (GITT+GIST+GIT+GIEC)**
Teachers:	Dr. Miguel Ángel López Carmona (miguelangel.lopez@ uah.es)
Tutoring schedule:	Check the course webpage
Language:	English

1. COURSE SUMMARY

This course, together with “Network Architectures I” and “Communication Networks”, comprises the mandatory subject of “Telematics Fundamentals”. The subject contents encompass an introduction to telematics, the main elements of communication networks and the necessary knowledge to understand how they work, to analyse their performance, to design data networks and to make decisions about their deployment.

The learning process follows a top-down model, starting with the applications the students are already familiar with, discussing the needs these applications must work properly in a distributed environment. In this way, w ego down the different layers of the protocol stack until we reach the link and physical layers.

In particular, this course continues the study started in “Network Architectures I” (basic concepts and the application and transport layers), and finishes the top-down review of the classical protocol stack covering the network and link layers. Later, the course addresses the study of other technologies, not tied to a particular protocol layer, such as wireless and mobile networks, network security and network management.

In summary, the main content blocks we cover in this course are:

- Network interconnection. Addressing. Routing algorithms and protocols.
- Data link. Error control.
- Medium Access techniques. Local area networks. Switched networks. VLAN.
- Wireless networks. Mobile networks.
- Network security.
- Network management.

The course contents include activities of network monitoring, using traffic and protocol analyzers, and network emulators.

It is recommended to have passed the course “Network Architectures I” before taking this course.

2. SKILLS

Basic, Generic and Cross Curricular Skills.

This course contributes to acquire the following generic skills, which are defined in the Section 3 of the Annex to the Orden CIN/352/2009:

en_TR2 - Knowledge of basic subjects and technologies that enables to learn new methods and technologies, as well as to provide versatility that allows adaptation to new situations.

en_TR3 - Aptitude to solve problems with initiative, decision making, creativity, and to communicate and to transmit knowledge, skills and workmanship, comprising the ethical and professional responsibility of the activity of the Technical Engineer of Telecommunication.

en_TR5 - Easy to handle specifications, regulations and mandatory standards.

en_TR8 - Capacity of working in a multidisciplinary and multilingual team and of communicating, both in spoken and written language, knowledge, procedures, results and ideas related to telecommunications and electronics.

Professional Skills

This course contributes to acquire the following professional skills, which are defined in the Section 5 of the Annex to the Orden CIN/352/2009:

en_CT1 - Skills for autonomous learning of new concepts and techniques suitable for the conception, development or commissioning of telecommunication systems and services.

en_CT2 - Ability to use telecommunications and computing aplications (ofimatics, data bases, advanced calculus, project management, visualization, etc) in order to support the exploration and development of nets, services and aplications of telecomunications and electronic.

en_CT3 - Ability to use computer tools to search bibliographic resources or information relating to telecommunications and electronics.

en_CT6 - Ability to conceive, deploy, organize and manage networks, systems, services and telecommunication infrastructures in residential (home, city and digital communities), business or institutional contexts, taking responsibility for their implementation and continuous improvement, as well as to know their economic and social impact.

en_CT12 - Knowledge and use of the concepts of network architecture, protocols, and communication interfaces.

en_CT13 - Capability to discern concepts of access network versus transport network, circuit and packet switching networks, wired and mobile networks, distributed systems and distributed network applications, voice services, data services, audio, video, interactive and multimedia services.

en_CT14 - Knowledge of the methods of network interconnection and routing, as well as the fundamentals of planning, dimensioning of networks according to traffic parameters.

Learning Outcomes

Students successfully passing this course will be able to:

RA1: Identify and explain the protocols and data formats used at the network layer in the Internet and at the link layer in wired and wireless local area networks, along with the mechanisms used to interconnect networks.
RA2: Organize, leverage and manage IP network addressing.
RA3: Describe and apply the routing algorithms and techniques used in IP networks.
RA4: Identify and describe the different medium access control techniques, and explain the fundamentals of switched local area networks and VLANs.
RA5: Identify problems and propose basic solutions regarding network security and network management.

3. CONTENTS

Contents Blocks	Total number of hours
Network layer: virtual circuits networks and datagram networks, IP and ICMP protocols. Routing protocols: OSPF y BGP. Addressing, DHCP protocol and NAT.	20 hours (5 weeks)
Link laker: link control; ARP; medium access control techniques; Ethernet; switches; VLAN; PPP protocol; wireless networks (WiFi and Bluetooh) and mobile networks.	16 hours (4 weeks)
Cryptrography and network security. Network management.	12 hours (3 weeks)
Global review and integration exercises.	4 hours (1 weeks)

4. TEACHING - LEARNING METHODOLOGIES. FORMATIVE ACTIVITIES.

4.1. Credits Distribution

Number of on-site hours:	Large group sessions: 28 hours (2 hours x 14 weeks) Reduced group sessions and labs: 28 hours (2 hours x 14 weeks) Final Evaluation: 2 hours Total: 58 hours
Number of hours of student work:	Class preparation, exercise preparation, autonomous learning, lab and quiz preparation, readings, final exam preparation: Total: 92 hours
Total hours	150

4.2. Methodological strategies, teaching materials and resources

Theory sessions (large groups)	• Concept presentations and/or reviews. • Presentations, interactive activities, and other activities.
Clases Prácticas (en grupos reducidos)	• Practical concept presentation and/or review • Problem solving. Case studies. • Practical lab sessions to strengthen previously presented concepts as well as to familiarize the student with IT and hardware tools that are useful to support the study of the subject and future professional performance (protocols analysers, network simulators). • Presentations, interactive activities, and other activities.
Individual, group and online office hours	• Solving student questions • Support to autonomous learning
Autonomous student work	• Reading assignments. • Activities: exercises, information look up, self-assessment work.

5. ASSESSMENT: procedures, evaluation and grading criteria

Preferably, students will be offered a continuous assessment model that has characteristics of formative assessment in a way that serves as feedback in the teaching-learning process.

5.1. PROCEDURES

The evaluation must be inspired by the criteria of continuous evaluation (Regulations for the Regulation of Teaching Learning Processes, NRPEA, art 3). However, in compliance with the regulations of the University of Alcalá, an alternative process of final evaluation is made available to the student in accordance with the Regulations for the Evaluation of Apprenticeships (approved by the Governing Council on March 24, 2011 and modified in the Board of Directors). Government of May 5, 2016) as indicated in Article 10, students will have a period of fifteen days from the start of the course to request in writing to the Director of the Polytechnic School their intention to take the non-continuous evaluation model adducing the reasons that they deem convenient. The evaluation of the learning process of all students who do not apply for it or are denied it will be done, by default, according to the continuous assessment model. The student has two calls to pass the subject, one ordinary and one extraordinary.

Ordinary Call

In the ordinary call, students will undertake a continuous assessment process. This process includes lab assignments, activities in class, self-assessment quizzes, and two intermediate exams.

In exceptional circumstances, adequately documented, a student might be assessed by a **Single Final Exam**.

Extraordinary Call

The Extraordinary Call will have a **similar exam** format to the one used for the Final Exam assessment in the Ordinary Call.

5.2. EVALUATION

EVALUATION CRITERIA

The assessment criteria evaluate the degree of acquisition of the competences described in Section 2 of this Syllabus. The following criteria are described:

CE1: The student has acquired the technical knowledge regarding the network layer and link layer standards used in the Internet and in wired/wireless local area networks, respectively, regarding data format, protocols, and network interconnection.

CE2: The student can leverage, organize, and manage IP addressing spaces for an arbitrary network topology.

CE3: The student can compute shortest paths given a network topology using Distance Vector and Dijkstra algorithms, and to configure routing tables accordingly using a minimum number of entries.

CE4: The student can identify and describe the main medium access control techniques, and to solve basic medium access control exercises.

CE5: The student shows knowledge of the fundamentals of wireless LANs, switched LANS and VLANs.

CE6: The student shows knowledge about the fundamentals of cryptography and network security

techniques used to achieve confidentiality, authentication, and integrity in communication networks.

CE7: The student can explain the general problems and solutions related to network management.

CE8: The student shows skill to operate network simulation tools and protocol analysers.

CE9: The student is able to work collaboratively to solve problems related to computer networks.

CE10: The student is able to communicate effectively their knowledge, procedures, results and ideas in the context of the subject, both in writing and orally.

GRADING TOOLS

The following grading instruments will be applied to each of the assessment criteria:

1. **Lab Assessment Assignments (PL):** lab assignments with protocol analysers and network emulators.
2. **Self- Assessment Quizzes (E):** online quizzes and in-class activities and quizzes.
3. **Intermediate Assessment Exams (PEI):** involving practical exercises and demonstration of knowledge about theoretical concepts.
4. **Final Assessment Exam (PEF):** involving practical exercises and demonstration of knowledge about theoretical concepts. It will be similar in structure to the PEIs, but covering the whole contents of the course, while each PEI covers different contents.

GRADING CRITERIA

Here we quantify the grading criteria for the course.

Ordinary Call, Continuous Assessment

In the ordinary call with continuous assessment, we have the following relationship between assessment instruments and criteria.

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
TR2-3, TR5, TR8, CT1-3, CT6, CT12, CT14	RA1-5	CE1-3, CE5-6, CE8-10	PL, E	20%
TR2, CT1, CT12-14	RA1-5	CE1-10	E	15%
TR2-3, TR5, CT1, CT6, CT12-14	RA1-3	CE1-3, CE10	PEI1	30%
	RA4-5	CE4-7, CE10	PEI2	35%

All quizzes, exams and assignments are additive (there are no eliminatory tests). Students which, while undertaking the continuous assessment procedure, do not take any of the PEI and PEF, will have a “Not presented” grade in the ordinary call.

Ordinary Call, students without continuous assessment

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
TRx, CTx	RA1-5	CE1-10	PEF	100%

Extraordinary call

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
TRx, CTx	RA1-5	CE1-10	PEF	100%

All the students will take the PEF exam that covers the theoretical and practical contents of the subject. In the case of students subject to continuous assessment in the ordinary call, they will have the option of maintaining their laboratory grade with a weight of 20% on the total score.

6. BIBLIOGRAPHY

6.1. Basic Bibliography

- "Computer Networking: A Top-Down Approach" (7th Edition), J. Kurose & K.W. Ross. Pearson Education, 2017.

6.2. Additional Bibliography

- Data and Computer Communications (9th Edition), W. Stallings. Prentice Hall, 2010.
- Computer Networks (5th Edition), A.S. Tanenbaum. Prentice-Hall, 2010.
- Computer Networking and the Internet (5th Edition), F. Halsall, Addison Wesley, 2005.

Disclosure Note

During the evaluation tests, the guidelines set out in the Regulations establishing the Rules of Coexistence of the University of Alcalá must be followed, as well as the possible implications of the irregularities committed during said tests, including the consequences for committing academic fraud according to the Regulation of Disciplinary Regime of the Students of the University of Alcalá.