University of Engineering and Technology
School of Computer Science
Syllabus of Course – Academic Period 2017-I

1. **Code and Name:** CS231. Networking and Communication
2. **Credits:** 3
3. **Hours of theory and Lab:** 1 HT; 4 HP;
4. **Professor(s)**
   Meetings after coordination with the professor
5. **Bibliography**

[KR13] J.F. Kurose and K.W. Ross. *Computer Networking: A Top-down Approach*. Always learning. Pearson, 2013. ISBN: 9780132856201.

6. **Information about the course**

   (a) **Brief description about the course** The ever-growing development of communication and information technologies means that there is a marked tendency to establish more computer networks that allow better information management..

   In this second course, participants will be introduced to the problems of communication between computers, through the study and implementation of communication protocols such as TCP / IP and the implementation of software on these protocols

   (b) **Prerrequisites:** CS2S1. Sistemas Operativos. (6^{to} Sem)

   (c) **Type of Course:** Mandatory

7. **Competences**

   - That the student implements and / or modifies a data communication protocols.
   - That the student master the data transmission techniques used by the existing network protocols.

8. **Contribution to Outcomes**

   b) An ability to design and conduct experiments, as well as to analyze and interpret data. (**Familiarity**)

   c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. (**Usage**)

   e) Understand correctly the professional, ethical, legal, security and social implications of the profession. (**Familiarity**)

   g) The broad education necessary to understand the impact of computing solutions in a global, economic, environmental, and societal context. (**Assessment**)

   i) An ability to use the techniques, skills, and modern computing tools necessary for computing practice. (**Usage**)

   j) Apply the mathematical basis, principles of algorithms and the theory of Computer Science in the modeling and design of computational systems in such a way as to demonstrate understanding of the equilibrium points involved in the chosen option. (**Usage**)

9. **Competences (IEEE)**

   C1. An intellectual understanding and the ability to apply mathematical foundations and computer science theory.⇒ **Outcome j,e**

C6. Ability to design and implement larger structural units that utilize algorithms and data structures and the interfaces through which these units communicate.⇒ **Outcome c,b**

C7. Being able to apply the software engineering principles and technologies to ensure that software implementations are robust, reliable, and appropriate for their intended audience.⇒ **Outcome c**

CS2. Identify and analyze criteria and specifications appropriate to specific problems, and plan strategies for their solution.⇒ **Outcome g,b**

CS5. Specify, design, and implement computer-based systems.⇒ **Outcome c**

CS8. Apply the principles of human-computer interaction to the evaluation and construction of a wide range of materials including user interfaces, web pages, multimedia systems and mobile systems..⇒ **Outcome b**

CS12. Operate computing equipment and software systems effectively.⇒ **Outcome i**

10. List of topics

1. Introduction
2. Networked Applications
3. Reliable Data Delivery
4. Routing and Forwarding
5. Local Area Networks
6. Resource Allocation
7. Mobility
8. Social Networking

11. Methodology and Evaluation
Methodology:

Theory Sessions:
The development of the theoretical sessions is focused on the student, through his active participation, solving problems related to the course with the individual contributions and discussing real cases of the industry. The students will develop throughout the course a project of application of the tools received in a company.

Lab Sessions:
Practical sessions are held in the laboratory. Laboratory practices are performed in teams to strengthen their communication. At the beginning of each laboratory the development of the practice is explained and at the end the main conclusions of the activity in group form are highlighted.

Oral Presentations :
Individual and team participation is encouraged to present their ideas, motivating them with additional points in the different stages of the course evaluation.

Reading:
Throughout the course different readings are provided, which are evaluated. The average of the notes in the readings is considered as the mark of a qualified practice. The use of the UTEC Online virtual campus allows each student to access the course information, and interact outside the classroom with the teacher and with the other students.
Evaluation System:

.

12. Content

Unit 1: Introduction (5)	
Competences Expected: C1,CS8	
Learning Outcomes	**Topics**
• Articulate the organization of the Internet [Familiarity] • List and define the appropriate network terminology [Familiarity] • Describe the layered structure of a typical networked architecture [Familiarity] • Identify the different types of complexity in a network (edges, core, etc) [Familiarity]	• Organization of the Internet (Internet Service Providers, Content Providers, etc.) • Switching techniques (e.g., circuit, packet) • Physical pieces of a network, including hosts, routers, switches, ISPs, wireless, LAN, access point, and firewalls • Layering principles (encapsulation, multiplexing) • Roles of the different layers (application, transport, network, datalink, physical)
Readings : [KR13]	

Unit 2: Networked Applications (5)	
Competences Expected: CS2,CS5	
Learning Outcomes	**Topics**
• List the differences and the relations between names and addresses in a network [Familiarity] • Define the principles behind naming schemes and resource location [Familiarity] • Implement a simple client-server socket-based application [Usage]	• Naming and address schemes (DNS, IP addresses, Uniform Resource Identifiers, etc.) • Distributed applications (client/server, peer-to-peer, cloud, etc.) • HTTP as an application layer protocol • Multiplexing with TCP and UDP • Socket APIs
Readings : [KR13]	

Unit 3: Reliable Data Delivery (10)	
Competences Expected: C6,CS2,CS5	
Learning Outcomes	**Topics**
• Describe the operation of reliable delivery protocols [Familiarity] • List the factors that affect the performance of reliable delivery protocols [Familiarity] • Design and implement a simple reliable protocol [Usage]	• Error control (retransmission techniques, timers) • Flow control (acknowledgements, sliding window) • Performance issues (pipelining) • TCP
Readings : [KR13]	

Unit 4: Routing and Forwarding (12)	
Competences Expected: CS2,CS5	
Learning Outcomes	**Topics**
• Describe the organization of the network layer [Familiarity] • Describe how packets are forwarded in an IP network [Familiarity] • List the scalability benefits of hierarchical addressing [Familiarity]	• Routing versus forwarding • Static routing • Internet Protocol (IP) • Scalability issues (hierarchical addressing)
Readings : [KR13]	

Unit 5: Local Area Networks (10)	
Competences Expected: C1,C7	
Learning Outcomes	**Topics**
• Describe how frames are forwarded in an Ethernet network [Familiarity] • Describe the interrelations between IP and Ethernet [Familiarity] • Describe the interrelations between IP and Ethernet [Familiarity] • Describe the steps used in one common approach to the multiple access problem [Familiarity]	• Multiple Access Problem • Common approaches to multiple access (exponential-backoff, time division multiplexing, etc) • Local Area Networks • Ethernet • Switching
Readings : [KR13]	

Unit 6: Resource Allocation (12)	
Competences Expected: C6,CS5,CS12	
Learning Outcomes	**Topics**
• Describe how resources can be allocated in a network [Familiarity] • Describe the congestion problem in a large network [Familiarity] • Compare and contrast fixed and dynamic allocation techniques [Familiarity] • Compare and contrast current approaches to congestion [Familiarity]	• Need for resource allocation • Fixed allocation (TDM, FDM, WDM) versus dynamic allocation • End-to-end versus network assisted approaches • Fairness • Principles of congestion control • Approaches to Congestion (e.g., Content Distribution Networks)
Readings : [KR13]	

Unit 7: Mobility (5)	
Competences Expected: C1,C7	
Learning Outcomes	**Topics**
• Describe the organization of a wireless network [Familiarity] • Describe how wireless networks support mobile users [Familiarity]	• Principles of cellular networks • 802.11 networks • Issues in supporting mobile nodes (home agents)
Readings : [KR13]	

Unit 8: Social Networking (5)	
Competences Expected: C1,CS2,CS8	
Learning Outcomes	**Topics**
• Discuss the key principles (such as membership, trust) of social networking [Familiarity] • Describe how existing social networks operate [Familiarity] • Construct a social network graph from network data [Usage] • Analyze a social network to determine who the key people are [Usage] • Evaluate a given interpretation of a social network question with associated data [Familiarity]	• Social networks overview • Example social network platforms • Structure of social network graphs • Social network analysis
Readings : [KR13]	