Program	59TL – Telematics Engineering B. Eng.

Course number and name	
Number	595000230
Name	Advanced Networks and Services
Semester	S6 [(February-June)]

Credits and contact hours	
ECTS Credits	6
Contact hours	60

Coordinator's name	Ramos Nespereira, Carlos [carlos.ramosn@upm.es]

Specific course information
Description of course content
The student workload in this course is equivalent to 162 hours, 65% approx. should correspond to self-learning activities.
Thanks to this course the student will get a deeper, global and systemic vision of the most advanced networks, as well as the interworking of their networks and services.
List of topics to be covered
1. MPLS: Advanced applications of MPLS technology.
1.1. Introduction. MPLS applications.
1.2. Layer 3 MPLS Virtual Private Networks.
1.3. Layer 2 MPLS Virtual Private Networks.
2. Structure and services of packet-switched networks.
2.1. Structure of IP networks.
2.2. Services: access to Internet, Intranet and VPN.
2.3. Access types: ADSL, HFC, FTTH, Metro Ethernet (REM).
2.4. Wholesale services: national IP, NEBA.
3. SDN and NFV: Software Defined Networks and Network Function Virtualization
3.1. Introduction: components of modern networks.
3.2. SDN (Software Defined Networking)
3.2.1. SDN controllers.
3.2.2. Definitions, principles and architecture.
3.2.3. Network programming protocols: Southbound Interfaces (SBI) and Northbound Interfaces (NBI).
3.4. SD-WAN (Software Defined Wide Area Network)
3.4.1. SD-WAN architecture: overlay & underlay
3.4.2. Securitization of communications and distributed security.
4. IMS: IP Multimedia Subsystem.
4.1. Introduction to IMS: definition and scopes.
4.2. IMS architecture.

4.3. IMS interfaces and protocols.

4.4. Services in an IMS network.

Lab sessions:

1. MPLS VPN: Layer 3 VPNs over an MPLS network.

6. VLAN: Setting up a Layer 2 switch network with VLANs.

7. SDN: Design and configuration of a SDN network and Openflow traffic analysis

Prerequisites or co-requisites

- Telecommunication Networks and Services
- Computer Networks
- Signaling and Switching

Specific goals for the course

Specific outcomes of instruction

- RA1029 – To apply the knowledge about the supply of MPLS advanced services to the configuration and administration of a network.
- RA566 – To describe the mechanisms and protocols used to supply advanced services with MPLS.
- RA1028 – To describe the IMS architecture and protocols to offer multimedia services with different access technologies (fixed and mobile) over IP networks.
- RA1109 – To configure and manage a network composed by Layer 2 switches and that uses traffic segmentation through VLANs.
- RA1150 – To apply the fundamentals of software-defined networks for controlling and configure the network devices and to analyze exchanged traffic to accomplish these tasks.
- RA1199 – To describe and justify the structure, services, technologies and procedures of a packet switched network in business environments.
- RA1193 – To describe and justify the fundamentals of software-defined networks, including its application to the field of WAN networks (SD-WAN), as well as network function virtualization.

Further reading and supplementary materials

- International Telecommunication Union (Telecommunication Standardization Sector): http://www.itu.int/ITU-T/
- The Internet Engineering Task Force: http://www.ietf.org/
- European Telecommunications Standards Institute (ETSI): http://www.etsi.org/
- Broadband Forum: http://www.broadband-forum.org/
- http://www.tech-invite.com/index.html
- Open Networking Foundation (ONF): https://www.opennetworking.org/
- Network Functions Virtualization (NFV) with a Touch of SDN. Rajendra Chayapathi. CCIE® No. 4991, Syed FarrukhHassan CCIE® No. 21617. PareshSha, Adyson-Wesley.
- Luc De Ghein. MPLS Fundamentals. Cisco Press, 2017: https://learning.oreilly.com/videos/mpls-fundamentals/9780134675398
- https://www.sdxcentral.com/
- Moodle.