COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering				
DEPARTMENT	Electrical and Computer Engineering				
LEVEL OF STUDY	Undergraduate				
COURSE UNIT CODE	9.020	SEMESTER 9 th			
COURSE TITLE	Broadband and next generation networks				
(COURSEWORK BREAKDOWN		TEACHING WEEKLY HOU	RS	ECTS Credits
	Theory (Lectures)		3		3
Tutorial/Project			1		0.5
Laboratory			1		0.5
TOTAL		5		4	
COURSE UNIT TYPE	Scientific area course / specialization / skill development				
PREREQUISITES					
LANGUAGE OF	Greek				
INSTRUCTION/EXAMS					
COURSE DELIVERED TO ERASMUS	Yes				
STUDENTS					
WEB PAGE (URL)	https://eclass.hmu.gr/courses/ECE123/				

(2) LEARNING OUTCOMES

Learning Outcomes

The course is a compulsory elective course (CEC) of the third Direction (Telecommunications and Information Technology) aiming to introduce students the principles of broadband communications and next generation networks, by offering them the necessary knowledge and skills to: a) design the implementation of infrastructures, b) to analyze their overall performance as well as that of individual components, c) to supervise , monitor and optimize their performance, and d) to study techniques for the development of novel services, and e) to elaborate on system architectures that will allow the convergence with emerging technologies. In this context, the student will become familiar with the various types of broadband networks, will acquire knowledge on the principles of wired/cable and wireless broadband infrastructures, will get in-depth understanding of the design consideration of modules and system architecture, and will gain skills for managing user requirements and how these are accommodated by contemporary broadband networks. Finally, the student will gain knowledge on interoperability aspects and will be familiarised with the interconnection of existing and next generation networks for providing novel, secure and reliable services with guaranteed QoS.

Upon successful completion of the course the student will be able to:

- 1. Understand the operation and organization of broadband networks and the use of applications for transferring information and services through them.
- Knows, recognise and be aware of the tools used for the implementation and management of broadband networks, the interconnection of heterogeneous modules both to each other and to the Internet, as well as the operation of the most widespread broadband networking protocols and standards.
- 3. Apply tools for the analysis and the evaluation of the performance of broadband networks, as well as mechanisms and methods for optimal operation, toward robust and secure transfer of information and services.
- 4. Analyse and calculate the principle characteristics of information transfer over broadband networks, based on specific QoS properties.
- 5. Propose solutions for the implementation and maintenance of broadband networks, and techniques for enhancing the performance, based on widespread international standards.

General Skills

- Search, analysis and synthesis of data and information, using the necessary technologies
- Adaptation to new situations
- Decision making
- Autonomous work
- Teamwork
- Work in an international environment
- Work in an interdisciplinary environment
- Promoting liberal, creative and inductive/deductive thinking

(3) SYLLABUS

Theoretical Lectures

Network services and technologies, circuit/packet switching, broadband network architectures, ATM packet switching architectures, resource management and carrier-grade service categories, telecommunication traffic standardization and performance estimation, signalling and service

control systems, optical networks for integrated services access, Digital Subscriber Line (DSL), wireless access, local area broadband networks, synchronous and synchronous transmission, routing and congestion protocols, quality of service (QoS), Multi-Protocol Label Transfer, network broadcast, queuing theory, next generation networks and resource/functions virtualization.

- Circuit switching, packet switching, Frame Relay, optical switching, synchronous Digital Hierarchy (SDH / SONET).
- Broadband Integrated Services Network Architectures (B-ISDN), Digital Subscriber Line (xDSL).
- Asynchronous Transfer Mattress (ATM), ATM Adjustment Mattress (AAL).
- Telecommunication traffic characterization and standards.
- Resource management, connection control, usage parameters and control algorithms, traffic shaping.
- Carrier-grade services, performance and management techniques, comparison of input-output queuing schemes.
- Wireless broadband networks (UMTS, WiMax, LTE), access networks, passive optical broadband networks (RON), local and metropolitan High Speed Networks.
- Convergence of Internet technologies (All-IP), Multipurpose tag switching (MPLS), separation of control and packet forwarding., labelling routers (LSR, LER).
- Compatibility with ATM technology, tunneling and multipath delivery, Interconnection and interoperability of networks, quality of service (QoS), MPLS and differentiated services, MPLS and integrated services.
- Software defined networks, virtual switches & controllers, Openflow stack/protocol, network virtualization, network abstractions / overlays, network function virtualization (NFV).
- Management of Virtual Network Functions, storage and retrieval of Virtual Network Functions (VNFs), creation and update of VNFs profile, composition of VNFs for the implementation of network services, supervision, monitoring and functions' optimisation for the provision of services with guaranteed quality over virtualised broadband connections.
- Orchestration of virtual network functions, mapping of VNF's requirements to network resource and vice versa, the ETSI MANO standard and its individual components.

Laboratory

Projects utilising open-source software tools and hardware modules for the implementation and performance evaluation of broadband network characteristics.

- Software Defined Networks (OpenStack).
- Network Functions Virtualisation (NFV) and management of virtualised network functions (Open Source MANO, OPEN-O project, Gigaspaces Cloudify TOSCA-based).

(4) TEACHING METHODS - ASSESSMENT

MODE OF DELIVERY	In-Class Face-to-Face		
USE OF INFORMATION AND	 Use of ICTs in lecturing 		
COMMUNICATION TECHNOLOGY	 Use of ICTs in laboratory-based training 		
	• Use of ICTs for the communication with students via the		
	e-class platformSpecialised software tools for experimentation		
	 Specialised hardware and cloud infrastructure that can 		

	support experimentation with xDSL, MPLS, SDN και NFV				
	technologies				
	 Support of the educational process via the e-class 				
	platform				
TEACHING ORGANISATION	Method description /				
	Activity Semester Workload				
	Lectures	39			
	Tutorials	13			
	Laboratory work	13			
	Project-based assignments	10			
	Journal/paper reading & 5				
	theoretical study				
	Non-guided personal study	40			
	Total Contact Hours	120			
ASSESSMENT METHODS	Language of Assessment				
	Greek				
	Description				
	Written exams, laboratory evaluation and project evaluation				
	Student accessment methods				
	• Writton examination with chart answer succeions				
	Concluding)				
	(concluding)				
	 written exams with multiple choice questions (Concluding) 				
	Written assignment (Formative)				
	• White assignment (Formative)				
	Public presentation (Formative)				
	 Laboratory/project work (Formative) 				
	For the successful completion of the course the students				
	must obtain a grade of ≥5.0 in both the final written				
	examination and the laboratory work, as well as in the				
	elaboration and public presentation of the project				
	• Final written examination in the entire course consists of:				
	(65%)	in the entire course content			
	(65%),				
	Elaboration of theoretical project (10%)				
	• Public presentation of the project (5%),				
	 Elaboration of laboratory-based projects/work (20%). 				
	The assessment criteria are announced to students at the				
	beginning of the semester and are published on the course				
	webpage in the e-Class platform.				

(5) RECOMMENDED BIBLIOGRAPHY

- Recommended Bibliography:

• Shami, Abdallah, Maier, Martin, Assi, Chadi, "Broadband Access Networks: Technologies and Deployments", Springer, 2009, ISBN: 978-0-387-92131-0.

- Jingming Li Salina, Pascal Salina, "Next Generation Networks: Perspectives and Potentials", John Wiley and Sons 1st Edition, , ISBN: 978-0470516492
- Arvind R. Raghavan, Thomas Starr, Stefano Galli, "Broadband Access", Steve Gorshe, Wiley Online Library, ISBN:9780470741801.
- Relevant Scientific Journals:
- IEEE Communications Magazine
- IEEE Wireless Communications
- IEEE Communications Surveys & Tutorials
- IEEE Transactions on Communications
- IEEE Transactions on Wireless Communications
- IEEE Access