Polytechnic School - Department of Electrical, Electronic and Telecommunications Engineering and Naval Architecture (DITEN)
Master's degree course in Internet and Multimedia Engineering

Class LM-27
TEACHING REGULATIONS – Cohort 2023/2024
Established by the Council of the Course of Study on 27 April 2023
Approved by the Department's Council on 19 May 2023
Description of the operations of the Master's degree course

Art. 1. Premise and area of competence

This Regulation, in accordance with the Statute and the Teaching Regulations of the University of Genoa (general part and special part), determines the organizational aspects of the teaching activity of the Master's degree course in **Internet and Multimedia Engineering** t, as well as any other subject of relevance basedon other legislative and regulatory sources.

The Degree Regulation of the Master's degree course in **Internet and Multimedia Engineering** is approved, according to article 25, paragraphs 1 and 4 of the Teaching Regulations of the University of Genoa,general part, by the Council of the Course of Study (CCS) of Internet and Multimedia Engineering, based on a majority vote among its members, and submitted for approval to the Council of the DITEN Department (and to the Councils of the possible associated Departments), after consultation with the Polytechnic School, with the prior favorable opinion of the Teachers-Students Joint Committee of the Polytechnic School, if provided.

The resolutions of the CCS can also be taken in a telematic mode according to the regulations mentioned above and, in particular, to article 14, "meetings with telematic mode", of the current GeneralRegulations of the University (in force since 19/12/2018).

Art. 2. Admission requirements and procedures for verifying individual preparation

Admission to the master's degree course in Internet and Multimedia Engineering is subject to the possessionof specific curriculum requirements and adequate personal preparation.

The curricular requirements for enrolment in the Internet and Multimedia Engineering Master's Degree Course must be acquired before enrolment and consist of knowledge equivalent to the general training objectives of Information Engineering Classes (Class 9 of DM 509/1999 and Class L-8 of DM 270/2004). Concerning curricular requirements, in order to access the Master's Degree in Internet and Multimedia Engineering, it is required:

- to own a degree, master's degree, referred to Ministerial Decree 509/1999 or Ministerial Decree 270/2004, obtained at an Italian University or a five-year degree (before Ministerial Decree 509/1999), obtained at an Italian University or equivalent qualifications;

- to own at least 36 CFU (Italian university training credits) acquired in any university course (bachelor's degree, master's degree, five-year degree, first and second-level university master's degree) in the disciplinary-scientific sectors (SSD) indicated for the basic training activities of Engineering degrees of L-8 class Information Engineering;

- to own at least 45 CFU acquired in any university course (bachelor's degree, master's degree, five-year master's degree, first and second-level university master's degree) in the disciplinary-scientific sectors indicated for the training activities characterizing Engineering degrees of L-8 class Information Engineering, in the disciplinary fields of Automation Engineering, Biomedical Engineering, Electronic Engineering, Computer Engineering, Telecommunications Engineering.

The following degrees awarded by the University of Genoa meet the curricular requirements of the Master's Degree:

- Electronic Engineering and Information Technology
- Telecommunications Engineering
- Computer Engineering
- Biomedical Engineering

For graduates abroad, the curricular requirements will be checked by considering appropriate equivalences between the classes passed, and those ascribable to the SSDs indicated above. The correspondence of a degree obtained in a foreign university is established by analyzing the related transcript of record.

It is admissible to validate credits following the acknowledgment of professional knowledge and skills certified individually in accordance with the regulations in force on the subject, as well as other knowledge and skills acquired in post-secondary level training activities to which the university has contributed.

Adequate knowledge of the English language is required, with reference to the disciplinary lexicon, at the B2 level or higher.

To be admitted to the master's degree course, students in possession of the curriculum requirements must successfully undergo a test to verify their personal preparation, except in the cases provided in the last paragraph. The Examination Committee for this test is composed of at least two members of the Didactic and Admission Committee of the master's degree course, which is, in turn, appointed by the CCS and composed of faculty lecturers belonging to the CCS. The test is carried out in the form of a public interview, a written test, or a video interview through teleconference and is aimed at ascertaining the general preparation of the student with particular reference to the knowledge of fundamental notions and of applicative and professional aspects related to engineering issues. For assessing the student, the Examination Committee also considers the curriculum obtained by the student in the three-year degree course. In the case of a student who obtained a degree in a foreign university, the Committee also takes into consideration the quality of that university. The test result shall only include the words "passed" or "not passed".

The composition of the Examination Committee, the modalities of the test, the place and dates of the tests, the topics to be examined, and the criteria for the evaluation of the candidates are indicated in the Call for Admission to the Master's degree courses of the Polytechnic School and on the website of the present Master's degree course.

A student certifies his/her English proficiency at the B2 level or higher by means of appropriate certificates in his/her possession or, in the absence thereof, by passing the B2 test organized by the Language Center of the University of Genoa (CLAT UniGe). The English proficiency requirement is also satisfied if the student holds a degree in English, to be certified through an official document or letter issued by the corresponding university and indicating that his/her studies were pursued in English. If the previous conditions are not fulfilled, English proficiency must be evaluated within the aforementioned personal preparation test by the corresponding Examination Committee. In this last case, the ability to use the English language fluently is also among the subjects of this test.

The adequacy of personal preparation is automatically verified for those who have obtained a Bachelor's degree, Italian or foreign – or a qualification judged equivalent according to what has been indicated about

the assessment of curricular requirements, with a final mark of at least 9/10 of the maximum achievable mark of their degree, or who have obtained a final mark corresponding at least to the "A" classification of the ECTS system.

Art. 3. Training activities

The list of classes and other possible training activities in the cohort 2023-2024 is given in the relevant annex (Annex 1), which constitutes an integral part of these regulations. A responsible lecturer is identified for each class. A lecturer responsible for a class is whoever is in charge of teaching according to the law, i.e., he/she whom the relative Department Council has attributed the responsibility when assigning teaching tasks to lecturers.
The language used to provide training activities (lessons, exercises, workshops) shall be Italian or another EU language, where expressly decided by the CCS.
Annex 1 to these regulations specifies the language in which each training activity is carried out.

Art. 4. Enrolment in individual training activities

In accordance with Article 5 of the Regulations of the University of Genoa for students, a requirement to enroll in individual training activities is to have a qualification that allows accessing the university.

Art. 5. Curricula

The master's degree course in Internet and Multimedia Engineering is not structured in curricula.

Art. 6. Total time commitment

For each class, the definition of the hourly fraction dedicated to lessons or equivalent teaching activities is established by the CCS and specified in the special part of these regulations (Annex 1). In any case, the correspondence between classroom hours and CFUs is assumed to take values in the range of $8 \div 10$ hours of lessons or assisted teaching activities per CFU.
For each class, the definition of the expected total time commitment reserved for personal study or other training activities of an individual type is specified in the special part of these regulations (Annex 1).
The director of DITEN and the head of the CCS shall be responsible for verifying compliance with the above requirements.

Art. 7. Study plans and prerequisites

Students can enroll full-time or part-time; there are different rights and duties for these two types of students.. Each student chooses the type of registration simultaneously with the presentation of his/her study plan. Each full-time student carries out his/her training activity considering the study plan established by the master's degree course, which is organized into two distinct years and published in the Current Year Degree Programme Table ("Manifesto degli studi") of the master's degree course. The study plan formulated by each student must contain an indication of the training activities, along with the related credits that he/she intends to achieve and that are provided by the official study plan for the corresponding teaching period, up to a maximum of 65 credits per year, except in the case of a transfer from another university. This last situation will be evaluated individually.
Each part-time student must submit an individual study plan specifying the number of credits he/she intends to include, according to the regulations on the university fees of the University of Genoa.
The enrolment of full-time and part-time students is regulated by the Regulations of the University of Genoa for students, considering the operational provisions approved by the Central government bodies and indicated in the Student's Guide (which is published annually on the University website).
The student's educational path can be bound by a system of prerequisites indicated for each class in the special part of these Regulations (Annex 1).
Each student is allowed to include extracurricular classes in his/her study plan up to a maximum of 12 credits. These classes are not considered for the attainment of master's degree title but could be considered should the student pursue a further degree course.
The modality and deadline for the submission of the study plan are established annually by the Polytechnic School and reported in the Current Year Degree Programme Table, which is published on the master's

degree website.

A study plan with a shorter duration than the nominal one needs approval from the CCS.

Art. 8. Attendance to and modalities of the teaching activities

The classes may take the form of: (a) lectures, including distance learning by telematic means; (b) practical exercises; (c) laboratory exercises; and (d) thematic seminars.

The complexity and the demanding nature of the classes taught in the various courses of study offered by the Polytechnic School make attendance to the training activities strongly recommended for an adequate understanding of the topics and, therefore, a good success in the exams.

The class schedule is divided into semesters. As a rule, the semester is divided into at least 12 weeks of lessons plus at least four weeks overall for verification tests and examinations.

The examination period ends with the beginning of the lessons of the following semester. In the middle of the semester, the normal teaching activity (lessons, exercises, laboratories) can be interrupted to conduct graduation exams, examinations, seminars, tutoring activities, and didactic recovery activities.

The class schedule for the entire academic year is published, before the start of the classes of each academic year, on the website of the University of Genoa and can be reached from the website of the course of study. The class schedule guarantees the possibility of attending each year of the course as planned in the Current Year Degree Programme Table of the master's degree course. Students must then formulate their study plan, also taking into account the timetable of the classes. For practical reasons, the compatibility among the timetables of all the formally possible elective classes is not guaranteed.

Art. 9. Examinations and other performance verifications

Examinations can be carried out in written, oral, or both written and oral forms, according to the modalities indicated in the sheet of each class, which is published on the website of the University of Genoa and can be reached from the website of the master's degree course.

Upon request, specific learning verification arrangements may be provided that take into account the needs of disabled students or students with specific learning disorders (D.S.A.), in accordance with article 20, paragraph 4 of the Teaching Regulations of the University of Genoa.

In the case of classes structured into modules with several lecturers, all such lecturers collectively participate in the overall evaluation of the student's performance, which cannot, in any case, be split into separate evaluations on the individual modules.

The examination schedule is established by the deadline defined by the Ministry for the following academic year, is published on the website of the University of Genoa, and can be reached from the website of the master's degree course.

Examinations are held during periods of interruption of the classes. Examinations may be planned during the period of the classes only for students who, in the current academic year, have not included training activities in their study plan.

Before taking the final examination, each student must pass the exams of all his/her classes by the deadline defined by the Student Office of the Polytechnic School and indicate in the "memo" that is published on the website of the University of Genoa and can be reached from the website of the master's degree course The result of each examination, with the mark obtained, is recorded in accordance with article 20 of the Teaching Regulations of the University of Genoa.

The Examination Committees of all the classes are appointed by the director of DITEN or, on his behalf, by the head of the master's degree course. For each class, the Examination Committee is composed of at least three members. For each exam session, at least two members participate. The lecturer responsible for a class is a member of the related Examination Committee in the capacity of president of this committee. "Cultori della materia" nominated by the CCS based on scientific, didactic, or professional criteria are allowed to be members of the Examination Committee. These criteria are held valid in the case of retired faculty lecturers. When the Examination Committee is nominated, a deputy president is also nominated. Each exam session is chaired by either the president or a deputy.

Art. 10. Acknowledgment of credits

The CCS decides upon the approval of applications for change from another degree course of the University of Genoa or applications for transfer from other universities in accordance with the rules provided for in

the Teaching Regulations of the University of Genoa, article 18. It also decides upon the approval, in the form of training credits and for a maximum number of 12 CFU, of professional knowledge and skills certified in accordance with the current legislation.

The evaluation of applications for change will take into account the didactic specificities and the up-to-dateness of the educational content of the individual exams taken by the applicant, reserving the right to establish any forms of verification and supplementary exams on a case-by-case basis.

Art. 11. Mobility, studies abroad, international exchanges

The CCS strongly encourages internationalization activities, particularly students' participation in mobility and international exchange programs. For this purpose, it shall ensure, in accordance with the rules in force, the approval of the training credits obtained within these programs and shall appropriately organize the training activities in order to make these activities efficient and effective.

The CCS acknowledges, for each enrolled student who has regularly completed a period of study abroad, the exams passed during such period and the relevant credits with which the student proposes to replace some of the exams of his/her own study plan.

For the purpose of the acknowledgment of these examinations, each student, when submitting the plan of the training activities he/she intends to attend at a university abroad, must submit suitable documentation proving the equivalence between the content of the classes abroad and the content of the classes that are taught in the Master's degree course and he/she intends to replace. Equivalence shall be evaluated by the CCS.

The conversion of the marks will take place according to the criteria approved by the CCS considering the European ECTS system whenever possible:

- If the hosting foreign university provides the necessary input information, then the CCS will apply the ECTS guidelines by applying the Grading Tables;
- Otherwise, the CCS will address the conversion by using the Mark Conversion table.

Prior to his/her mobility, the student can ask the lecturer responsible for the agreement with the hosting university (e.g., Erasmus+ agreement) for indications about the information available from this university and/or about the Mark Conversion table.

Any period of study abroad, which has lasted a minimum of one semester and has involved the approval of training credits, will be evaluated for the purpose of the final examination. In the case of a period of study abroad aimed at preparing for the final examination, the number of credits that are acknowledged as obtained abroad is related to the duration of the period.

Art. 12. Procedures for the final examination

The final examination consists of discussing a written dissertation aimed at ascertaining the candidate's technical-scientific and professional preparation.

For the purpose of obtaining a Master's degree, the final examination consists of the writing of a thesis dissertation, elaborated by the student in an original way under the guidance of one or more supervisors, on a subject relevant to a discipline for which he/she has passed the exam. Among the supervisors, there must be at least one lecturer from the Polytechnic School or the master's degree course.

The thesis dissertation can be written in English; the authorization of the CCSis required to use another EU language. In these cases, the thesis manuscript must be accompanied by the title and an extensive summary in Italian.

The thesis dissertation must reveal the student's ability to deal with research and/or application issues. The thesis dissertation must consist of a project and/or the development of an application that proposes innovative solutions with respect to the state of the art and demonstrates the student's analytical and design skills. The thesis must also reveal:

- adequate preparation in the disciplines characterizing the Master's degree course;
- adequate engineering preparation;
- correct use of sources and bibliography;
- systematic and argumentative skills;
- clarity in the exposition;
- design and experimental skills;

- critical skills.

The Final Examination Committee comprises at least five members, including the Committee president, and is appointed by the Director of the DITEN Department.

The procedure for the final examination consists of the oral presentation of the thesis by the student to the Final Examination Committee, followed by a discussion of any questions raised by the members of the Committee.

The commitment required of the student to prepare the final examination must be aligned with the number of credits assigned to the final examination itself.

If the final examination is passed, the Committee evaluates this examination by incrementing the average of the marks obtained in the examinations of the training activities that require a final mark and weighted on the number of credits associated with the individual training activities of an amount ranging from 0 to 6 – six being the maximum established by the Polytechnic School in agreement with the Departments.

Any period of study abroad, lasting a minimum of one semester, which has involved the approval of training credits, may result in an increase of up to one point on the final mark of the master's degree in the 110-scale.

Art. 13. Guidance services and tutoring

The Polytechnic School, in agreement with DITEN, organizes and manages a tutoring service for supporting students, aiming to prevent dropout and delays in studies and to promote fruitful active participation in university life in all its forms.

Art. 14. Verification of the obsolescence of the credits

CFUs acquired within the framework of the Master's degree course can be subject to obsolescence verification after six years. If the CCS decides upon the obsolescence of even a single part of the relevant educational content, it establishes the supplementary tests that must be taken by the student, defining the topics, the verification modalities, and the composition of the Examination Committee.

Once the required tests have been passed, the CCS validates the credits acquired with a resolution. If the related training activity provides a mark, this mark may update the one previously obtained by the student upon a proposal from the Examination Committee that carried out the verification.

Art. 15. Current Year Degree Programme Table

DITEN, after consulting the Polytechnic School, approves annually the Current Year Degree Programme Table of the Master's degree course, which is published on the University website and can be reached from the website of Master's degree course. In the Current Year Degree Programme Table, the main provisions of the teaching system and the teaching regulations of the Master's degree course, to which additional information may be added, are indicated.

The Current Year Degree Programme Table of the Master's degree course contains the list of the classes activated for the corresponding academic year. The sheets of the individual classes are published on the website of the University of Genoa and can be reached from the website of the Master's degree course.

Annex 1 to the Degree Regulation of the Master's degree course in Internet and Multimedia Engineering
List of training activities and related learning outcomes

Year	Code	Teaching course	CFU	SSD	Type	Area	Language	Prerequisites	Learning outcomes	Hours of assisted teaching activity	Hours of personal study
1	66202	MATHEMATICAL METHODS AND OPERATIONS RESEARCH	10		RELATED OR SUPPLEMENTARY ACTIVITY	Related or Supplementary Learning Activity				0	0
1	66204	OPERATIONS RESEARCH	5	MAT/09	RELATED OR SUPPLEMENTARY ACTIVITY	Related or Supplementary Learning Activity	English		The students will learn a set of models and methods of Operations Research (linear mathematical programming models; integer programming methods; graphs and network flow models).	50	75
1	106819	MATHEMATICAL METHODS	5	MAT/09	RELATED OR SUPPLEMENTARY ACTIVITY	Related or Supplementary Learning Activity	English		The course aims at providing knowledge on the use of mathematical methods to describe real-world phenomena, such as heat diffusion and wave propagation, as well as to take optimal decisions. More specifically, the students will be able to classify and manage the main analytical solution methods for linear partial differential equations. In addition, the students will learn how to manage multistage optimization problems by means of dynamic programming, and how to find the solution to nonlinear programming problems.	50	75
1	90138	MOBILE COMMUNICATIONS	10	ING-INF/03	CORE LEARNING ACTIVITY	Telecommunications Engineering				0	0
1	90139	PHYSICAL LAYER MODELS AND TECHNIQUES FOR SOFTWARE RADIO	5	ING-INF/03	CORE LEARNING ACTIVITY	Telecommunications Engineering	English		Mathematical models for radio transmission: (20) Radio Channel models; Free space model; Probabilistic rain model; Multipath time-variant general statistical model (Time variant pulse response, First order channel models (Fading (Rayleigh, Rice, Nagakami)); Second order models. Radio transmission system models: Frequency selectivity and temporal fading; Slow and fast fading; Diversity transmission (frequency, time, space); Wideband transmissions as frequency selective channels; Channel models and rake receivers. Wideband Digital radio transmission: systems and techniques (20):	50	75

									Multiple Access techniques overview; Wideband modulations: Spread Spectrum: General concepts, Direct Sequence Spread Spectrum and CDMA, Orthogonal Frequency Division Modulation (OFDM). Software and Cognitive Radio (10) : Software radio architectures;. from software to cognitive radio		
1	90140	PERVASIVE COMMUNICATION AND CONTEXT AWARENESS	5	ING-INF/03	CORE LEARNING ACTIVITY	Telecommu nications Engineering	English		The Internet society is based on technological solution for continuative and pervasive connection of persons and objects (IoT). In the course, different radio technologies are investigated and compared able to guarantee such global connection, including terrestrial and satellite solutions. Radio coverage strategies will be examined by comparing different cell planning methodologies. Terrestrial mobile telephone standards like GSM/GPRS, WCDMA and LTE will be examined and compared with satellite technologies like Globalstar and Iridium. The smartphone platform will be considered as a multi-standard platform able to connect persons and things beyond the telephone network, including Wifi, Bluetooth, RFID, BLE, NFC. The added value represented by position estimation of terminal, persons and things will be considered with reference to applications for logistics, transportation and health. In such view, methodologies based on terrestrial radio fingerprinting and satellite-based global systems (GPS/Galileo/Egnos) will be introduced.	50	75
1	90147	INTERNET TECHNOLOGIES: ARCHITECTURES AND PROTOCOLS	10	ING-INF/03	CORE LEARNING ACTIVITY	Telecommu nications Engineering	English		• Review of the Internet Architecture and Protocols; o IPv4 review (management of IP addresses); IP routing algorithms and protocols review; Multicast; IPv6; UDP/TCP; Flow and congestion control in packet networks; Application layer; • Network and Computer Security; o Basic concepts; Algorithms; Standard protocols; Vulnerability of networks; Summary of the local (Italian) regulations; Computer security; • Wireless Network architecture and Protocols; o Wi-Fi (IEEE 802.11); Bluetooth (IEEE 802.15.1); • Quality of Service (QoS) in IP Networks; o Introduction to QoS in IP networks; Differentiated Services and Integrated Services IETF Architectures; ReSerVation Protocol	100	150

									(RSVP); Multi Protocol Label Switching (MPLS); • Multimedia services over the Internet; o Voice and Video over IP; Real Time Protocol (RTP) and Session Description Protocol (SDP)		
1	90315	ANTENNAS AND ELECTROMAGNETIC PROPAGATION	10	ING-INF/02	CORE LEARNING ACTIVITY	Telecommunications Engineering				0	0
1	90316	ANTENNAS	5	ING-INF/02	CORE LEARNING ACTIVITY	Telecommunications Engineering	English		The course provides knowledge and skills concerning antennas, with reference to both their working principles and their use in different applicative fields. The following main topics will be addressed. Fundamentals of electromagnetic radiation and antenna parameters. Linear antennas, aperture antennas, reflector antennas, printed antennas. Antenna Arrays. MIMO systems for multimedia communications. Smart and reconfigurable antennas. Wide band antennas for high–speed internet links. Antenna systems for industrial, civil and biomedical applications	50	75
1	90317	ELECTROMAGNETIC PROPAGATION	5	ING-INF/02	CORE LEARNING ACTIVITY	Telecommunications Engineering	English		"The course provides knowledge and skills concerning antennas and guided electromagnetic propagation, with reference to both their working principles and their use in different applicative fields. The following main topics will be addressed. Fundamentals of electromagnetic radiation and antenna parameters. Linear antennas, aperture antennas, reflector antennas, printed antennas. Antenna Arrays. MIMO systems for multimedia communications. Smart and reconfigurable antennas. Wide band antennas for high–speed internet links. Antenna systems for industrial, civil and biomedical applications. Fundamentals of guided propagation. Longitudinal-transverse decompositions of Maxwell's equations, TEM, TE, TM modes, rectangular waveguides, higher TE and TM modes, operating bandwidth, power transfer an attenuation, group velocity in waveguides, reflection model of waveguide propagation, dielectric slab guides. Oblique incidence and Snel's laws, Zenneck surface wave, surface plasmons. Plasmonic waveguides, plasmonic and oscillatory modes, MDM and DMD configurations. RFID technology, active and passive RFID tags, plasmonic RFID.	50	75

1	103909	EU LAW AND NEW TECHNOLOGIES	5	IUS/13	ELECTIVE LEARNING ACTIVITY	Student's Elective Learning Activity	English		Provide technical students with the legal framework of Eu intervention in the sector they are approaching from a technical point of view. The interdisciplinary approach will empower graduates with new and useful skills for the job market and it will give students a greater awareness on the conseuqences deriving from the use and functioning (malfunctioning) of the technology.	50	75
1	104631	FUNDAMENTALS OF TELECOMMUNICATIONS	5	ING-INF/03	ELECTIVE LEARNING ACTIVITY	Student's Elective Learning Activity	English		The class aims at giving the students a review of the basic knowledge about signal theory, random phenomena, analog modulations, digital signal processing, and telecommunication networks. The specific objective is to enhance the initial preparation of the students on basic topics of fundamental relevance for the master course, increasing their opportunity to effectively exploit the advanced content of the other courses.	50	75
1	104760	DIGITAL COMMUNICATIONS I	5	ING-INF/03	CORE LEARNING ACTIVITY	Telecommunications Engineering	English		"The course is aimed at providing the bases of digital communications: the baseband and bandpass transmissions will be presented, discussed, and compared. The goal is to give the students an adequate knowledge needed to understand the key elements for designing and developing modern telecommunication systems.	50	75
1	104852	MACHINE LEARNING FOR PATTERN RECOGNITION	5	ING-INF/03	CORE LEARNING ACTIVITY	Telecommunications Engineering	English		In this course several Machine learning methods applied to pattern recognition are presented and their application to images from real domains are discussed: • Decision Theory • Supervised Probability Density Estimation • Feature Reduction • Linear and Nonlinear Classifiers (MDM, k-nn, SVMs,Random forest) • Neural Networks and Deep Learning • Accuracy of Supervised Classifiers • Unsupervised Classifiers (Clustering) • Fuzzy Classifiers	50	75
2	60279	COGNITIVE TELECOMMUNICATION SYSTEMS	5	ING-INF/03	CORE LEARNING ACTIVITY	Telecommunications Engineering	English		The course aims at providing theory and techniques for architectural and functional design of interactive self-awsre cognitive dynamic systems. Knowledge will be provided related to methods coming from data fusion, mutilevel bayesian state estimation, machine learning and their application to autonomous agents using different sensors.The student will acquire the capability to understand and design systems	50	75

								integrating such techniques within a cognitive agent framework. Labs including programming in matlab over assigned data sets will allow students to acquire design capabilities related to the concepts exposed during lessons.		
2	66175	MASTER THESIS	18		FINAL EXAMINATION	For the Final examination	English		The Master thesis consists of a report on a specific topic investigated under the tutoring of one or more professors. It should provide evidence of the student's ability to carry out independent investigations and to present the results in a clear and systematic form.	0	450
2	90144	QUALITY OF SERVICE AND PERFORMANCE EVALUATION	10	ING-INF/03	CORE LEARNING ACTIVITY	Telecommu nications Engineering				0	0
2	90145	QUALITY OF SERVICE OVER HETEROGENEOUS NETWORKS	5	ING-INF/03	CORE LEARNING ACTIVITY	Telecommu nications Engineering	English		• Definition of QoS, SLA (Service Level Agreement) and SLS (Service Level Specification). • Definition of heterogeneity. • QoS-oriented technologies: ATM, MPLS, IPv4, IPv6, user flow and traffic class identification • Integrated Services, Differentiated Services and DSCP Assignation, advantages and drawbacks, • Network control issues versus time: Traffic Identification, Traffic Shaping, introduction to Scheduling, CAC (Feasibility Region, Equivalent Bandwidth, Bandwidth Reservation), QoS Routing. • QoS over Heterogeneous Networks: concepts and problems, Horizontal and Vertical QoS Mapping, QoS Architectures, QoS Gateway, Relay Node and Relay Layer. • Software Defined Networking (SDN): introduction and aim, architecture, OpenFlow and Flow Table, conclusions and research activities • Delay Tolerant Networking (DTN): introduction and aim, architecture, Bundle Layer, CLA, conclusions and research activities	50	75
2	90146	NETWORK PERFORMANCE EVALUATION	5	ING-INF/03	CORE LEARNING ACTIVITY	Telecommu nications Engineering	English		Methods of network performance evaluation: analytical models, simulation, experimental measurements• Packet-level and flow-level models• Elementary queueing theory: elements of a queue, statistics of input and service, general results on infinite- and finite-buffer queues,	50	75

								Little's Theorem, Kendall's notation • Markovian queues: Poisson arrivals, exponential distribution, stationary distribution of general birth-death systems; M/M/1, M/M/1/K, M/M/m/m, M/M/m• Discrete- and continuous-time Markov Chains• M/G/1 and Pollaczek-Kinchin formula; Pareto distribution; M/G/1 with vacations; priority queueing• Networks of queues: Jackson networks, independence hypothesis, Kleinrock's delay formula		
2	104761	DIGITAL COMMUNICATIONS II	5	ING-INF/03	CORE LEARNING ACTIVITY	Telecommu nications Engineering	English		The course will provide the bases of digital techniques for transmitting analog signals and for protecting data in digital communications (i.e. channel codes). Specifically, after a review of fundamentals of information theory, linear block codes and convolutional codes will be covered, as well as basics of Pulse Code Modulation. The aim is to furnish an adequate knowledge to understand the main components to be used to improve the reliability of modern digital telecommunication systems.	50	75
2	104770	SECURITY, 5G AND IOT	10		MIXED TYPE	Telecommu nications Engineering				0	0
2	104773	5G, CLOUD AND IOT	5	ING-INF/03	CORE LEARNING ACTIVITY	Telecommu nications Engineering	English		The course aims at introducing the 5G radio mobile networks and IoT technologies from the point of view of the functional architecture, the definition of protocols and standard procedures, and the AmI related functions.	50	75
2	108931	CYBER SECURITY	5	ING-INF/03	RELATED OR SUPPLEMENTA RY ACTIVITY	Related or Supplement ary Learning Activity			The class aims at giving the students the basic knowledge about the main aspects and technologies involved in the network and telecommunication security, including short summaries about privacy issues, blockchain technologies, and the audit and risk assessment procedures. Although the most substantial part of the course is focused on the network and telecommunication security, most of the introductory concepts and techniques included in this course are relevant also for the computer security contest, which is, in any case, briefly introduced and discussed too.	50	75

2	104778	INTERNET PROGRAMMING AND AUTONOMOUS SYSTEMS	5	ING-INF/03	ELECTIVE LEARNING ACTIVITY	Student's Elective Learning Activity				0	0
2	104779	INTERNET PROGRAMMING	2,5	ING-INF/03	ELECTIVE LEARNING ACTIVITY	Student's Elective Learning Activity	English		"The course is aimed at providing the bases of inter-process communication (IPC) under an Unix operating system: the main system calls for controlling the processes and the socket application programming interfaces (APIs) will be covered. The goal is to give the students an adequate knowledge needededto write client-server applications which are at the base of almost all Internet appliances."	25	37,5
2	104780	MULTIMEDIA SIGNAL PROCESSING FOR AUTONOMOUS SYSTEMS	2,5	ING-INF/03	ELECTIVE LEARNING ACTIVITY	Student's Elective Learning Activity	English		The course is aimed at providing machine learning basic and advanced techniques for data driven signal processing models to be used within autonomous systems design. In particular, perception and control modules in autonomous systems rely more and more on signal processing approaches whose parametrization can be learned from observing multimedia heterogeneous signals produced by the artificial system while performing specific tasks. The course analyses data acquisition and processing tradeoffs between edge and cloud resources on the basis of real-time, computational and energy consumption requirements. Specific attention will be devoted to high dimensional data processing on the edge (with real practical examples in Python), showing how deep learning approaches can be adapted and optimized for working with limited computational capabilities.	25	37,5
2	104847	IMAGE PROCESSING AND REMOTE SENSING	10		CORE LEARNING ACTIVITY	Telecommunications Engineering				0	0
2	104782	DIGITAL IMAGE PROCESSING	5	ING-INF/03	CORE LEARNING ACTIVITY	Telecommunications Engineering	English		"In this course the basic techniques of digital signal and image processing are presented and their application to signals and images from real domains are discussed: • Digital Image Representation and Color Spaces • Image Filtering (linear and non-linear)• Edge Detection• Image Segmentation• Texture Analysis • Mathematical Morphology• Moments and Hough Transform• Adaptive Processing, Multiscale, Data Fusion	50	75

2	104827	REMOTE SENSING AND SATELLITE IMAGES	5	ING-INF/02	CORE LEARNING ACTIVITY	Telecommunications Engineering	English		"Remote Sensing — Based on the concepts ruling the generation and propagation of electromagnetic wave fields, the objective is to provide the students with basic knowledge about the fundamentals and basic definitions of remote sensing; passive remote sensing in the optical, microwaves, and infrared frequency bands; active remote sensing and radar imaging; instrumentation for remote sensing.Satellite Images — The objective is to provide the students with basic knowledge about past, current, and forthcoming space missions for Earth observation; computational methods for the display, the modeling, and the filtering of satellite imagery; change detection techniques for multitemporal data; and regression techniques for bio/geophysical parameter retrieval from remote sensing. In this framework, machine learning techniques rooted in the areas of ensemble learning, neural networks, and kernel machines will be discussed as well.	50	75
2	104851	SOFT SKILLS	2		OTHER ACTIVITY	Learning and Orientation Traineeships	English		The activity is meant to be developed as a preparatory work for the realization of the master thesis. Its target is providing the students with a methodological and scientific approach, to enable a research and development vision toward the final Master of Science project.	20	30

Scuola Politecnica
Dipartimento di Ingegneria Navale, Elettrica, Elettronica e delle Telecomunicazioni (DITEN)
Corso di Laurea Magistrale in Internet and Multimedia Engineering
Classe LM-27
REGOLAMENTO DIDATTICO – coorte 2023/24

Deliberato dal Consiglio di Corso di Studio del 27/04/2023
Approvato dal Consiglio di Dipartimento del 19/05/2023

Descrizione del funzionamento del Corso di Laurea Magistrale

Art. 1   Premessa e ambito di competenza

Il presente Regolamento, in conformità allo Statuto ed al Regolamento didattico di Ateneo (parte generale e parte speciale), disciplina gli aspetti organizzativi dell'attività didattica del Corso di Laurea Magistrale in Internet and Multimedia Engineering, nonché ogni diversa materia ad esso devoluta da altre fonti legislative e regolamentari.

Il Regolamento didattico del Corso di Laurea Magistrale in Internet and Multimedia Engineering è deliberato, ai sensi dell'articolo 25, commi 1 e 4 del Regolamento didattico di Ateneo, parte generale, dal Consiglio dei Corsi di Studio (CCS) di Ingegneria delle Telecomunicazioni a maggioranza dei componenti e sottoposto all'approvazione del Consiglio del Dipartimento DITEN (e dei Consigli degli eventuali Dipartimenti associati), sentita la Scuola Politecnica previo parere favorevole della Commissione Pariteticadi Scuola.

Le delibere del CCS possono essere assunte anche in modalità telematica ai sensi dei sovraordinati regolamenti e, in particolare, dell'articolo 14 "Riunioni con modalità telematiche" del vigente Regolamento Generale di Ateneo (in vigore dal 19/12/2018).

Art. 2   Requisiti di ammissione e modalità di verifica della preparazione individuale

L'ammissione alla Laurea Magistrale in Ingegneria in Internet and Multimedia Engineering è subordinata al possesso di specifici requisiti curricolari e di adeguatezza della preparazione personale.

I requisiti curriculari necessari per l'iscrizione al Corso di Laurea Magistrale in Internet and Multimedia Engineering devono essere acquisti prima dell'immatricolazione e consistono in conoscenze equivalenti a quelle previste dagli obiettivi formativi generali delle Lauree della Classe Ingegneria dell'informazione (Classe 9 del DM 509/1999 e Classe L-8 del DM 270/2004).

In riferimento ai requisiti curriculari, per l'accesso alla Laurea Magistrale in Internet and Multimedia Engineering, occorre:

• essere in possesso di Laurea, Laurea Specialistica o Laurea Magistrale, di cui al DM 509/1999 o DM 270/2004,

oppure una Laurea quinquennale (ante DM 509/1999), o titoli esteri equivalenti;

• essere in possesso di almeno 36 CFU, o conoscenze equivalenti, acquisiti in un qualunque corso universitario (Laurea, Laurea Specialistica, Laurea Magistrale, Master Universitari di primo e secondo livello) nei settori scientifico-disciplinari indicati per le attività formative di base previste dalle Lauree della Classe L-8 Ingegneria dell'Informazione;

• essere in possesso di almeno 45 CFU, o conoscenze equivalenti, acquisiti in un qualunque corso universitario (Laurea, Laurea Specialistica, Laurea Magistrale, Master Universitari di primo e secondo livello) nei settori scientifico disciplinari indicati per le attività formative caratterizzanti delle Lauree della Classe L-8 Ingegneria dell'Informazione, negli ambiti disciplinari Ingegneria dell'Automazione, Ingegneria Biomedica, Ingegneria Elettronica, Ingegneria Informatica, Ingegneria delle Telecomunicazioni.

Le seguenti Lauree erogate dall'Ateneo di Genova soddisfano i requisiti curricolari richiesti dalla laurea magistrale:

- • Ingegneria Elettronica e Tecnologie dell'Informazione
- • Ingegneria delle Telecomunicazioni
- • Ingegneria Informatica
- • Ingegneria Biomedica

Nel caso di possesso di lauree differenti da quelle indicate nel presente Regolamento didattico e sopra menzionate, il CCS verificherà la presenza dei requisiti curricolari o delle conoscenze equivalenti, sulla base degli esami sostenuti dallo studente nel Corso di Laurea di provenienza, nonché la presenza di eventuali esami extracurricolari, le attività di stage e le esperienze lavorative maturate.

Ai fini dell'ammissione al Corso di Laurea Magistrale gli studenti, in possesso dei requisiti curricolari, dovranno sostenere con esito positivo una prova per la verifica della preparazione personale, salvo i casi disposti dall'ultimo comma.

La prova di verifica sarà svolta sotto forma di colloquio pubblico o di test scritto, e sarà finalizzata ad accertare la preparazione generale dello studente con particolare riferimento alle materie ingegneristiche di base specifiche dell'ingegneria delle telecomunicazioni e con particolare riferimento a:

- – scienze matematiche/fisiche;
- – architetture dei calcolatori, strutture dati e algoritmi;
- – elettronica analogica e digitale;
- – trattamento e trasmissione di segnali;
- – reti e sistemi di telecomunicazioni;

Per i laureati all'estero, la verifica dei requisiti curricolari è effettuata considerando opportune equivalenze tra gli insegnamenti seguiti con profitto e quelli ascrivibili ai SSD sopra indicati. L'equivalenza dei titoli di studio stranieri è determinata attraverso l'analisi dei relativi transcript of record.

La procedura di presentazione della candidatura da parte degli studenti stranieri ai fini della verifica dell'ammissibilità alla Laurea Magistrale deve preferibilmente avvenire tramite il portale DreamApply secondo le scadenze che vengono stabilite per ogni anno accademico.

È prevista la convalida di CFU a seguito del riconoscimento di conoscenze e abilità professionali certificate individualmente ai sensi della normativa vigente in materia, nonché di altre conoscenze e abilità maturate in attività formative di livello post-secondario alla cui progettazione e realizzazione l'università abbia concorso.

È richiesto inoltre il possesso di un'adeguata conoscenza della lingua inglese, con riferimento anche ai lessici disciplinari, di livello pari a B2 o superiore.

Ai fini dell'ammissione al corso di laurea magistrale, gli studenti in possesso dei requisiti curricolari devono sostenere con esito positivo una prova per la verifica della preparazione personale, salvo i casi disposti dall'ultimo comma. La Commissione d'esame di tale prova è composta da almeno due componenti la Commissione Didattica e

Ammissione alla Laurea Magistrale del CdS, la quale è, a sua volta, nominata dal CCS e composta da docenti afferenti al CCS. La prova è svolta sotto forma di colloquio pubblico, test scritto o video-intervista per via telematica ed è finalizzata ad accertare la preparazione generale dello studente con particolare riferimento alla conoscenza di nozioni fondamentali e di aspetti applicativi e professionali relativi alle tematiche proprie dell'ingegneria. Ai fini della valutazione dello studente, la Commissione d'esame tiene conto anche del curriculum ottenuto nel percorso di laurea di primo livello. Nel caso di studenti con titoli di studio estero, la Commissione prende in considerazione anche la qualità dell'università che ha erogato il titolo di studio di primo livello. L'esito della prova prevede la sola dicitura "superato" o "non superato".

Nel bando per l'ammissione ai corsi di laurea magistrale della Scuola Politecnica e sul sito web del CdS sono indicati: la composizione della Commissione d'esame, le modalità della prova, il luogo e la data, gli argomenti oggetto d'esame, i criteri di valutazione dei candidati.

La conoscenza della lingua inglese pari al livello B2 o superiore è verificata tramite certificazione in possesso dello studente, o, in assenza di essa, tramite superamento del test B2 erogato dal Centro Linguistico di Ateneo (CLAT UniGe). Il requisito della conoscenza linguistica è altresì soddisfatto se lo studente è in possesso di un titolo di laurea in lingua inglese, da certificarsi tramite documento ufficiale o lettera dell'università che abbia erogato tale titolo, da cui si evinca che gli studi si sono svolti in lingua inglese. Se nessuna delle precedenti condizioni è soddisfatta, la conoscenza linguistica deve essere verificata durante la prova di verifica della preparazione personale da parte dalla relativa Commissione d'esame. In quest'ultimo caso, costituisce quindi oggetto della verifica della preparazione personale anchela capacità di utilizzare fluentemente la lingua inglese.

L'adeguatezza della preparazione personale è automaticamente verificata per coloro che hanno conseguito la Laurea triennale, italiana od estera, o titolo giudicato equivalente in sede di accertamento dei requisiti curriculari, con una votazione finale di almeno 9/10 del voto massimo previsto dalla propria Laurea o che hanno conseguito una votazione finale corrispondente almeno alla classifica "A" del sistemaECTS.

Art. 3   Attività formative

L'elenco degli insegnamenti e delle altre attività formative attivabili nella coorte 2023/2024, è riportato nell'apposito allegato (ALL.1) che costituisce parte integrante del presente Regolamento.

Per ogni insegnamento è individuato un docente responsabile.

È docente responsabile di un insegnamento chi ne sia titolare a norma di legge, ovvero colui al quale il Consiglio del Dipartimento di afferenza abbia attribuito la responsabilità stessa in sede di affidamento deicompiti didattici ai docenti.

La lingua usata per erogare le attività formative (lezioni, esercitazioni, laboratori) è l'Italiano o un'altra lingua della UE ove espressamente deliberato dal CCS.

Nell'allegato (ALL.1) al presente Regolamento è specificata la lingua in cui viene erogata ogni attività formativa.

Art. 4 Iscrizione a singole attività formative

In conformità con l'articolo 5 del Regolamento di Ateneo per gli studenti, per iscriversi a singole attività formative occorre possedere un titolo di studio che permetta l'accesso all'Università.

Art. 5 Curricula

Il Corso di Laurea Magistrale in Internet and Multimedia Engineering non è articolato in curricula.

Art. 6 Impegno orario complessivo

La definizione della frazione oraria dedicata a lezioni o attività didattiche equivalenti è stabilita, per ogni insegnamento, dal CCS e specificata nella parte speciale del Regolamento. In ogni caso si assumono i seguenti intervalli di variabilità della corrispondenza ore aula/CFU: 8 ÷ 10 ore di lezione o di attività didattica assistita.

La definizione dell'impegno orario complessivo presunto, riservato allo studio personale o ad altre attivitàformative di tipo individuale, è stabilito, per ogni insegnamento, nell'allegato (ALL.1) del presente regolamento.

Il Direttore del Dipartimento DITEN e il Coordinatore del CCS sono incaricati di verificare il rispetto delle predette prescrizioni.

Art. 7 Piani di studio e propedeuticità

Gli studenti possono iscriversi a tempo pieno o a tempo parziale; per le due tipologie di studente sono previsti differenti diritti e doveri.
Lo studente sceglie la tipologia di iscrizione contestualmente alla presentazione del piano di studio.

Lo studente a tempo pieno svolge la propria attività formativa tenendo conto del piano di studio predispostodal Corso di Laurea Magistrale, distinto per anni di corso e pubblicato nel Manifesto degli studi del Corso di Laurea Magistrale. Il piano di studio formulato dallo studente deve contenere l'indicazione delle attività formative, con i relativi crediti che intende conseguire, previsti dal piano di studio ufficiale per tale periododidattico, fino ad un massimo di 65 dei crediti previsti in ogni anno, salvo in casi di trasferimento da altri Atenei che verranno valutati singolarmente.

Lo studente a tempo parziale è tenuto a presentare un piano di studio individuale specificando il numerodi crediti che intende inserire secondo quanto disposto dal regolamento per la contribuzione studentescadi Ateneo.

L'iscrizione degli studenti a tempo pieno e a tempo parziale è disciplinata dal Regolamento di Ateneo per gli studenti tenuto conto delle disposizioni operative deliberate dagli Organi centrali di governo ed indicatenella Guida dello studente (pubblicata sul sito web dell'Università).
Il percorso formativo dello studente può essere vincolato attraverso un sistema di propedeuticità, indicateper ciascun insegnamento nella parte speciale del presente Regolamento (ALL. 1).

Lo studente può aggiungere insegnamenti "fuori piano/extracurriculari" fino ad un massimo di 12 CFU. Tali insegnamenti non sono presi in considerazione ai fini del conseguimento della laurea, ma possono esserevalutati per il conseguimento di un ulteriore titolo di studio

Il piano di studio articolato su una durata più breve rispetto a quella normale, è approvato dal Consiglio del Corso di Studio.
La modalità e il termine per la presentazione del piano di studio sono stabiliti annualmente dalla Scuola Politecnica e riportate sul Sito web del CdS alla pagina "Studenti".

Art. 8 Frequenza e modalità di svolgimento delle attività didattiche

Gli insegnamenti possono assumere la forma di: (a) lezioni, anche a distanza mediante mezzi telematici;
(b) esercitazioni pratiche; (c) esercitazioni in laboratorio, (d) seminari tematici.
Il profilo articolato e la natura impegnativa delle lezioni tenute nell'ambito dei vari Corsi di Studio offerti dalla Scuola Politecnica rendono la frequenza alle attività formative fortemente consigliata per una adeguata

comprensione degli argomenti e quindi per una buona riuscita negli esami. Il calendario delle lezioni è articolato in semestri. Di norma, il semestre è suddiviso in almeno 12 settimane di lezione più almeno 4 settimane complessive per prove di verifica ed esami di profitto.

Il periodo destinato agli esami di profitto termina con l'inizio delle lezioni del semestre successivo.

A metà semestre, la normale attività didattica (lezioni, esercitazioni, laboratori) può essere interrotta per lo svolgimento di esami di laurea, prove riservate a studenti non frequentanti, seminari, attività di tutorato e attività didattica di recupero.

L'orario delle lezioni per l'intero anno accademico è pubblicato sito web di Ateneo e accessibile da quello del CdS prima dell'inizio delle lezioni dell'anno accademico. L'orario delle lezioni garantisce la possibilità di frequenza per anni di corso previsti dal vigente Manifesto degli Studi del Corso di Laurea Magistrale. Per ragioni pratiche non è garantita la compatibilità dell'orario per tutte le scelte formalmente possibili degli insegnamenti opzionali. Gli studenti devono quindi formulare il proprio piano di studio tenendo conto dell'orario delle lezioni.

Art. 9   Esami e altre verifiche del profitto

Gli esami di profitto possono essere svolti in forma scritta, orale, o scritta e orale, secondo le modalità indicate nelle schede di ciascun insegnamento pubblicato sul sito pubblicate sul sito web di Ateneo e accessibili da quello del CdS.

A richiesta, possono essere previste specifiche modalità di verifica dell'apprendimento che tengano conto delle esigenze di studenti disabili e di studenti con disturbi specifici dell'apprendimento (D.S.A.), in conformità all'art. 20 comma 4 del Regolamento didattico di Ateneo.

Nel caso di insegnamenti strutturati in moduli con più docenti, questi partecipano collegialmente alla valutazione complessiva del profitto dello studente che non può, comunque, essere frazionata in valutazioni separate sui singoli moduli.

Il calendario degli esami di profitto è stabilito entro la scadenza ministeriale per l'anno accademico successivo e viene pubblicato sul sito web di Ateneo e accessibile dal sito web del CdS. Il calendario delle eventuali prove di verifica in itinere è stabilito dal CCS e comunicato agli studenti all'inizio di ogni ciclo didattico.

Gli esami si svolgono nei periodi di interruzione delle lezioni. Possono essere previsti appelli durante il periodo delle lezioni soltanto per gli studenti che, nell'anno accademico in corso, non abbiano inserito attività formative nel proprio piano di studio.

Tutte le verifiche di profitto relative alle attività formative devono essere superate dallo studente entro la scadenza prevista dalla segreteria studenti della Scuola Politecnica in vista della prova finale, come indicato nel "promemoria" pubblicato sul sito web di Ateneo e accessibile da quello del CdS.

L'esito dell'esame, con la votazione conseguita, è verbalizzato secondo quanto previsto all'art. 20 del Regolamento didattico di Ateneo.

Le commissioni di esame di profitto sono nominate dal Direttore del DITEN o, su sua delega, dal Coordinatore del CdS e sono composte da almeno tre componenti. Ad ogni sessione di esame sono presenti almeno due membri. Il docente responsabile dell'insegnamento è membro con funzione di presidente. Possono essere componenti la commissione cultori della materia individuati dal CCS sulla base di criteri che assicurino il possesso di requisiti scientifici, didattici o professionali; tali requisiti si possono presumere posseduti da parte di docenti universitari a riposo. Per ogni commissione, all'atto di nomina, va individuato almeno un presidente supplente. In ogni sessione di esame le commissioni sono presiedute dal presidente o da un supplente.

Art. 10 Riconoscimento di crediti

Il Consiglio dei Corsi di Studio delibera sull'approvazione delle domande di passaggio o trasferimento da un altro Corso di Studi dell'Ateneo o di altre Università secondo le norme previste dal Regolamento didattico di Ateneo,

art. 18. Delibera altresì il riconoscimento, quale credito formativo, per un numero massimo di 12 CFU, di conoscenze e abilità professionali certificate ai sensi della normativa vigente.

Nella valutazione delle domande di passaggio si terrà conto delle specificità didattiche e dell'attualità dei contenuti formativi dei singoli esami sostenuti, riservandosi di stabilire di volta in volta eventuali forme di verifica ed esami integrativi.

Nel quadro della normativa nazionale e regionale su alternanza formazione/lavoro, è possibile per il Corsodi Studio prevedere, per studenti selezionati, percorsi di apprendimento che tengano conto anche di esperienze lavorative svolte presso aziende convenzionate.

Art. 11   Mobilità, studi compiuti all'estero, scambi internazionali

Il CCS incoraggia fortemente le attività di internazionalizzazione, in particolare la partecipazione degli studenti ai programmi di mobilità e di scambi internazionali. A tal fine garantisce, secondo le modalità previste dalle norme vigenti, il riconoscimento dei crediti formativi conseguiti all'interno di tali programmi, e organizza le attività didattiche opportunamente in modo da rendere agevoli ed efficaci tali attività.

Il CCS riconosce agli studenti iscritti, che abbiano regolarmente svolto e completato un periodo di studi all'estero, gli esami sostenuti fuori sede e il conseguimento dei relativi crediti che lo studente intenda sostituire ad esami del proprio piano di studio.

Ai fini del riconoscimento di tali esami, lo studente all'atto della compilazione del piano delle attività formative che intende seguire nell'Ateneo estero, dovrà produrre idonea documentazione comprovante l'equivalenza dei contenuti tra l'insegnamento impartito all'estero e l'insegnamento che intende sostituire, impartito nel Corso di Laurea Magistrale in Internet and Multimedia Engineering. L'equivalenza è valutatadal CCS.

La conversione dei voti avviene secondo criteri approvati dal CCS, quando possibile congruenti con il sistema europeo European Credit Transfer and Accumulation System (ECTS):

•   se l'università straniera mette a disposizione i dati necessari, il consiglio adotterà la guida europea ECTS utilizzando le Grading Tables;

•   altrimenti, il consiglio convertirà i voti seguendo la tabella di Conversione dei Voti.

Le indicazioni relative alla disponibilità dei dati necessari messi a disposizione dall'università ospitante e/o alla tabella di conversione dei voti possono essere richiesti dallo studente, prima della partenza per la propria mobilità, al docente referente della borsa Erasmus.Un periodo di studio all'estero che abbia comportato riconoscimento di crediti formativi viene valutato ai fini della prova finale. Per periodi di studio dedicati alla preparazione della prova finale, il numero di CFU riconosciuti come acquisiti all'estero è messo in relazione alla durata del periodo svolto all'estero.

Art. 12   Modalità della prova finale

La prova finale consiste nella discussione di un elaborato scritto, tendente ad accertare la preparazione tecnico-scientifica e professionale del candidato.

Ai fini del conseguimento della Laurea Magistrale, l'elaborato finale consiste nella redazione di una tesi, elaborata dallo studente in modo originale sotto la guida di uno o più relatori, su un argomento definito attinente ad una disciplina di cui abbia superato l'esame.

Tra i relatori deve essere presente almeno un docente della Scuola o del CdS.

La tesi può essere redatta anche in lingua inglese; in caso di utilizzo di altra lingua della UE è necessaria l'autorizzazione del CCS. In questi casi la tesi deve essere corredata dal titolo e da un ampio sommario in italiano.

La tesi dovrà rivelare le capacità dello studente nell'affrontare tematiche di ricerca e/o di tipo applicativo.

La tesi dovrà essere costituita da un progetto e/o dallo sviluppo di un'applicazione che proponga soluzioniinnovative rispetto allo stato dell'arte e dimostri le capacità di analisi e di progetto dello studente.

La tesi dovrà altresì rivelare:

- ✓ adeguata preparazione nelle discipline caratterizzanti la Laurea Magistrale;
- ✓ adeguata preparazione ingegneristica;
- ✓ corretto uso delle fonti e della bibliografia;
- ✓ capacità sistematiche e argomentative;
- ✓ chiarezza nell'esposizione;
- ✓ capacità progettuale e sperimentale;
- ✓ capacità critica.

La Commissione per la prova finale è composta da almeno cinque componenti compreso il Presidente ed è nominata dal Direttore del Dipartimento DITEN.

Le modalità di svolgimento della prova finale consistono nella presentazione orale della tesi da parte dello studente alla Commissione per la prova finale, seguita da una discussione sulle questioni eventualmente poste dai membri della Commissione.

L'impegno richiesto allo studente per la preparazione della prova finale deve essere commisurato al numero di crediti assegnati alla prova stessa.

La valutazione della prova finale da parte della commissione avviene, in caso di superamento della stessa, attribuendo un incremento, variabile da 0 a 6, massimo stabilito dalla Scuola Politecnica di concerto con i Dipartimenti, alla media ponderata dei voti riportati nelle prove di verifica relative ad attività formative che prevedono una votazione finale, assumendo come peso il numero di crediti associati alla singola attività formativa.

L'eventuale periodo di studio all'estero, della durata minima di un semestre, che abbia comportato riconoscimento di crediti formativi, darà luogo all'incremento di un punto alla media ponderata di cui sopra.

Art. 13   Orientamento e tutorato

La Scuola Politecnica, di concerto con il DITEN, organizza e gestisce un servizio di orientamento e di sostegno degli studenti, al fine di promuovere i diversi percorsi formativi di secondo livello e incentivare una proficua partecipazione attiva alla vita universitaria in tutte le sue forme.

Art. 14   Verifica dell'obsolescenza dei crediti

I crediti formativi universitari acquisiti nell'ambito del corso di laurea possono essere sottoposti a verifica di obsolescenza dopo 6 anni. Qualora il CCS riconosca l'obsolescenza anche di una sola parte dei relativi contenuti formativi, lo stesso CCS stabilisce le prove integrative che dovranno essere sostenute dallo studente, definendo gli argomenti delle stesse, le modalità di verifica, la composizione della commissione di esame.

Una volta superate le verifiche previste, il CCS convalida i crediti acquisiti con apposita delibera. Qualora la relativa attività formativa preveda una votazione, la stessa potrà essere variata rispetto a quella precedentemente ottenuta, su proposta della Commissione d'esame che ha proceduto alla verifica.

Art. 15   Manifesto degli Studi

Il Dipartimento DITEN, sentita la Scuola Politecnica, approva e pubblica annualmente il Manifesto degli Studi del Corso di Laurea Magistrale pubblicato sul sito web di Ateneo ove è accessibile dal sito web del CdS. Nel Manifesto sono indicate le principali disposizioni dell'Ordinamento didattico e del Regolamento didattico del Corso di Laurea Magistrale, a cui eventualmente si aggiungono indicazioni integrative.

Il Manifesto degli Studi del Corso di Laurea Magistrale contiene l'elenco degli insegnamenti attivati per l'anno accademico in questione. Le schede dei singoli insegnamenti sono pubblicate sul sito web di Ateneo e accessibili da quello del CdS.

Allegato 1 Parte speciale del Regolamento didattico del Corso di Laurea Magistrale in Internet and Multimedia Engineering della Scuola Politecnica

Elenco delle attività formative attivabili e relativi obiettivi formativi

Anno di corso	Codice Ins.	Nome insegnamento	CFU	SSD	Tipologia	Ambito	Lingua	Propedeuticità	Obiettivi formativi	Ore riservate attività didattica assistita	Ore riservate allo studio personale
1	66202	MATHEMATICAL METHODS AND OPERATIONS RESEARCH	10		AFFINI O INTEGRATIVE	Attività Formative Affini o Integrative				0	0
1	66204	OPERATIONS RESEARCH	5	MAT/09	AFFINI O INTEGRATIVE	Attività Formative Affini o Integrative	Inglese		The students will learn a set of models and methods of Operations Research (linear mathematical programming models; integer programming methods; graphs and network flow models).	50	75
1	106819	MATHEMATICAL METHODS	5	MAT/09	AFFINI O INTEGRATIVE	Attività Formative Affini o Integrative	Inglese		The course aims at providing knowledge on the use of mathematical methods to describe real-world phenomena, such as heat diffusion and wave propagation, as well as to take optimal decisions. More specifically, the students will be able to classify and manage the main analytical solution methods for linear partial differential equations. In addition, the students will learn how to manage multistage optimization problems by means of dynamic programming, and how to find the solution to nonlinear programming problems.	50	75
1	90138	MOBILE COMMUNICATIONS	10	ING-INF/03	CARATTERIZZANTI	Ingegneria delle Telecomunicazioni				0	0
1	90139	PHYSICAL LAYER MODELS AND TECHNIQUES FOR SOFTWARE RADIO	5	ING-INF/03	CARATTERIZZANTI	Ingegneria delle Telecomunicazioni	Inglese		Mathematical models for radio transmission: (20) Radio Channel models; Free space model; Probabilistic rain model; Multipath time-variant general statistical model (Time variant pulse response, First order channel models (Fading (Rayleigh, Rice, Nagakami)); Second order models. Radio transmission system models: Frequency selectivity and temporal fading; Slow and fast fading; Diversity transmission (frequency, time, space); Wideband transmissions as frequency selective channels; Channel models and rake receivers. Wideband Digital radio	50	75

									transmission: systems and techniques (20): Multiple Access techniques overview; Wideband modulations: Spread Spectrum: General concepts, Direct Sequence Spread Spectrum and CDMA, Orthogonal Frequency Division Modulation (OFDM). Software and Cognitive Radio (10) : Software radio architectures;. from software to cognitive radio		
1	90140	PERVASIVE COMMUNICATION AND CONTEXT AWARENESS	5	ING-INF/03	CARATTERIZZANTI	Ingegneria delle Telecomunicazioni	Inglese		The Internet society is based on technological solution for continuative and pervasive connection of persons and objects (IoT). In the course, different radio technologies are investigated and compared able to guarantee such global connection, including terrestrial and satellite solutions. Radio coverage strategies will be examined by comparing different cell planning methodologies. Terrestrial mobile telephone standards like GSM/GPRS, WCDMA and LTE will be examined and compared with satellite technologies like Globalstar and Iridium. The smartphone platform will be considered as a multi-standard platform able to connect persons and things beyond the telephone network, including Wifi, Bluetooth, RFID, BLE, NFC. The added value represented by position estimation of terminal, persons and things will be considered with reference to applications for logistics, transportation and health. In such view, methodologies based on terrestrial radio fingerprinting and satellite-based global systems (GPS/Galileo/Egnos) will be introduced.	50	75
1	90147	INTERNET TECHNOLOGIES: ARCHITECTURES AND PROTOCOLS	10	ING-INF/03	CARATTERIZZANTI	Ingegneria delle Telecomunicazioni	Inglese		• Review of the Internet Architecture and Protocols; o IPv4 review (management of IP addresses); IP routing algorithms and protocols review; Multicast; IPv6; UDP/TCP; Flow and congestion control in packet networks; Application layer; • Network and Computer Security; o Basic concepts; Algorithms; Standard protocols; Vulnerability of networks; Summary of the local (Italian) regulations; Computer security; • Wireless Network architecture and Protocols; o Wi-Fi (IEEE 802.11); Bluetooth (IEEE 802.15.1); • Quality of Service (QoS) in IP Networks; o Introduction to QoS in IP networks;	100	150

								Differentiated Services and Integrated Services IETF Architectures; ReSerVation Protocol (RSVP); Multi Protocol Label Switching (MPLS); • Multimedia services over the Internet; o Voice and Video over IP; Real Time Protocol (RTP) and Session Description Protocol (SDP)		
1	90315	ANTENNAS AND ELECTROMAGNETIC PROPAGATION	10	ING-INF/02	CARATTERIZZANTI	Ingegneria delle Telecomunicazioni			0	0
1	90316	ANTENNAS	5	ING-INF/02	CARATTERIZZANTI	Ingegneria delle Telecomunicazioni	Inglese	The course provides knowledge and skills concerning antennas, with reference to both their working principles and their use in different applicative fields. The following main topics will be addressed. Fundamentals of electromagnetic radiation and antenna parameters. Linear antennas, aperture antennas, reflector antennas, printed antennas. Antenna Arrays. MIMO systems for multimedia communications. Smart and reconfigurable antennas. Wide band antennas for high–speed internet links. Antenna systems for industrial, civil and biomedical applications	50	75
1	90317	ELECTROMAGNETIC PROPAGATION	5	ING-INF/02	CARATTERIZZANTI	Ingegneria delle Telecomunicazioni	Inglese	"The course provides knowledge and skills concerning antennas and guided electromagnetic propagation, with reference to both their working principles and their use in different applicative fields. The following main topics will be addressed. Fundamentals of electromagnetic radiation and antenna parameters. Linear antennas, aperture antennas, reflector antennas, printed antennas. Antenna Arrays. MIMO systems for multimedia communications. Smart and reconfigurable antennas. Wide band antennas for high–speed internet links. Antenna systems for industrial, civil and biomedical applications. Fundamentals of guided propagation. Longitudinal-transverse decompositions of Maxwell's equations, TEM, TE, TM modes, rectangular waveguides, higher TE and TM modes, operating bandwidth, power transfer an attenuation, group velocity in waveguides, reflection model of waveguide propagation, dielectric slab guides. Oblique incidence and	50	75

								Snel's laws, Zenneck surface wave, surface plasmons. Plasmonic waveguides, plasmonic and oscillatory modes, MDM and DMD configurations. RFID technology, active and passive RFID tags, plasmonic RFID.		
1	103909	EU LAW AND NEW TECHNOLOGIES	5	IUS/13	A SCELTA	A Scelta dello Studente	Inglese		Provide technical students with the legal framework of Eu intervention in the sector they are approaching from a technical point of view. The interdisciplinary approach will empower graduates with new and useful skills for the job market and it will give students a greater awareness on the conseuqences deriving from the use and functioning (malfunctioning) of the technology.	50	75
1	104631	FUNDAMENTALS OF TELECOMMUNICATIONS	5	ING-INF/03	A SCELTA	A Scelta dello Studente	Inglese		The class aims at giving the students a review of the basic knowledge about signal theory, random phenomena, analog modulations, digital signal processing, and telecommunication networks. The specific objective is to enhance the initial preparation of the students on basic topics of fundamental relevance for the master course, increasing their opportunity to effectively exploit the advanced content of the other courses.	50	75
1	104760	DIGITAL COMMUNICATIONS I	5	ING-INF/03	CARATTERIZZANTI	Ingegneria delle Telecomunicazioni	Inglese		"The course is aimed at providing the bases of digital communications: the baseband and bandpass transmissions will be presented, discussed, and compared. The goal is to give the students an adequate knowledge needed to understand the key elements for designing and developing modern telecommunication systems.	50	75
1	104852	MACHINE LEARNING FOR PATTERN RECOGNITION	5	ING-INF/03	CARATTERIZZANTI	Ingegneria delle Telecomunicazioni	Inglese		In this course several Machine learning methods applied to pattern recognition are presented and their application to images from real domains are discussed: • Decision Theory • Supervised Probability Density Estimation • Feature Reduction • Linear and Nonlinear Classifiers (MDM, k-nn, SVMs,Random forest) • Neural Networks and Deep Learning • Accuracy of Supervised Classifiers • Unsupervised Classifiers (Clustering) • Fuzzy Classifiers	50	75
2	60279	COGNITIVE TELECOMMUNICATION SYSTEMS	5	ING-INF/03	CARATTERIZZANTI	Ingegneria delle Telecomuni	Inglese		The course aims at providing theory and techniques for architectural and functional design of interactive self-awsre cognitive dynamic	50	75

					cazioni			systems. Knowledge will be provided related to methods coming from data fusion, mutilevel bayesian state estimation, machine learning and their application to autonomous agents using different sensors.The student will acquire the capability to understand and design systems integrating such techniques within a cognitive agent framework. Labs including programming in matlab over assigned data sets will allow students to acquire design capabilities related to the concepts exposed during lessons.		
2	66175	MASTER THESIS	18		PROVA FINALE	Per la Prova Finale	Inglese		The Master thesis consists of a report on a specific topic investigated under the tutoring of one or more professors. It should provide evidence of the student's ability to carry out independent investigations and to present the results in a clear and systematic form.	0	450
2	90144	QUALITY OF SERVICE AND PERFORMANCE EVALUATION	10	ING-INF/03	CARATTERIZZ ANTI	Ingegneria delle Telecomuni cazioni				0	0
2	90145	QUALITY OF SERVICE OVER HETEROGENEOUS NETWORKS	5	ING-INF/03	CARATTERIZZ ANTI	Ingegneria delle Telecomuni cazioni	Inglese		• Definition of QoS, SLA (Service Level Agreement) and SLS (Service Level Specification). • Definition of heterogeneity. • QoS-oriented technologies: ATM, MPLS, IPv4, IPv6, user flow and traffic class identification • Integrated Services, Differentiated Services and DSCP Assignation, advantages and drawbacks, • Network control issues versus time: Traffic Identification, Traffic Shaping, introduction to Scheduling, CAC (Feasibility Region, Equivalent Bandwidth, Bandwidth Reservation), QoS Routing. • QoS over Heterogeneous Networks: concepts and problems, Horizontal and Vertical QoS Mapping, QoS Architectures, QoS Gateway, Relay Node and Relay Layer. • Software Defined Networking (SDN): introduction and aim, architecture, OpenFlow and Flow Table, conclusions and research activities • Delay Tolerant Networking (DTN):	50	75

									introduction and aim, architecture, Bundle Layer, CLA, conclusions and research activities		
2	90146	NETWORK PERFORMANCE EVALUATION	5	ING-INF/03	CARATTERIZZ ANTI	Ingegneria delle Telecomuni cazioni	Inglese		Methods of network performance evaluation: analytical models, simulation, experimental measurements• Packet-level and flow-level models• Elementary queueing theory: elements of a queue, statistics of input and service, general results on infinite- and finite-buffer queues, Little's Theorem, Kendall's notation • Markovian queues: Poisson arrivals, exponential distribution, stationary distribution of general birth-death systems; M/M/1, M/M/1/K, M/M/m/m, M/M/m• Discrete- and continuous-time Markov Chains• M/G/1 and Pollaczek-Kinchin formula; Pareto distribution; M/G/1 with vacations; priority queueing• Networks of queues: Jackson networks, independence hypothesis, Kleinrock's delay formula	50	75
2	104761	DIGITAL COMMUNICATIONS II	5	ING-INF/03	CARATTERIZZ ANTI	Ingegneria delle Telecomuni cazioni	Inglese		The course will provide the bases of digital techniques for transmitting analog signals and for protecting data in digital communications (i.e. channel codes). Specifically, after a review of fundamentals of information theory, linear block codes and convolutional codes will be covered, as well as basics of Pulse Code Modulation. The aim is to furnish an adequate knowledge to understand the main components to be used to improve the reliability of modern digital telecommunication systems.	50	75
2	104770	SECURITY, 5G AND IOT	10		TIPOLOGIA MISTA	Ingegneria delle Telecomuni cazioni				0	0
2	104773	5G, CLOUD AND IOT	5	ING-INF/03	CARATTERIZZ ANTI	Ingegneria delle Telecomuni cazioni	Inglese		The course aims at introducing the 5G radio mobile networks and IoT technologies from the point of view of the functional architecture, the definition of protocols and standard procedures, and the AmI related functions.	50	75
2	108931	CYBER SECURITY	5	ING-INF/03	AFFINI O INTEGRATIVE	Attività Formative Affini o Integrative	Inglese		The class aims at giving the students the basic knowledge about the main aspects and technologies involved in the network and telecommunication security, including short	50	75

								summaries about privacy issues, blockchain technologies, and the audit and risk assessment procedures. Although the most substantial part of the course is focused on the network and telecommunication security, most of the introductory concepts and techniques included in this course are relevant also for the computer security contest, which is, in any case, briefly introduced and discussed too.		
2	104778	INTERNET PROGRAMMING AND AUTONOMOUS SYSTEMS	5	ING-INF/03	A SCELTA	A Scelta dello Studente			0	0
2	104779	INTERNET PROGRAMMING	2,5	ING-INF/03	A SCELTA	A Scelta dello Studente	Inglese	"The course is aimed at providing the bases of inter-process communication (IPC) under an Unix operating system: the main system calls for controlling the processes and the socket application programming interfaces (APIs) will be covered. The goal is to give the students an adequate knowledge neededto write client-server applications which are at the base of almost all Internet appliances."	25	37,5
2	104780	MULTIMEDIA SIGNAL PROCESSING FOR AUTONOMOUS SYSTEMS	2,5	ING-INF/03	A SCELTA	A Scelta dello Studente	Inglese	The course is aimed at providing machine learning basic and advanced techniques for data driven signal processing models to be used within autonomous systems design. In particular, perception and control modules in autonomous systems rely more and more on signal processing approaches whose parametrization can be learned from observing multimedia heterogeneous signals produced by the artificial system while performing specific tasks. The course analyses data acquisition and processing tradeoffs between edge and cloud resources on the basis of real-time, computational and energy consumption requirements. Specific attention will be devoted to high dimensional data processing on the edge (with real practical examples in Python), showing how deep learning approaches can be adapted and optimized for working with limited computational capabilities.	25	37,5
2	104847	IMAGE PROCESSING AND REMOTE SENSING	10		CARATTERIZZ ANTI	Ingegneria delle Telecomuni cazioni			0	0

2	104782	DIGITAL IMAGE PROCESSING	5	ING-INF/03	CARATTERIZZANTI	Ingegneria delle Telecomunicazioni	Inglese		"In this course the basic techniques of digital signal and image processing are presented and their application to signals and images from real domains are discussed: • Digital Image Representation and Color Spaces • Image Filtering (linear and non-linear)• Edge Detection• Image Segmentation• Texture Analysis • Mathematical Morphology• Moments and Hough Transform• Adaptive Processing, Multiscale, Data Fusion	50	75
2	104827	REMOTE SENSING AND SATELLITE IMAGES	5	ING-INF/02	CARATTERIZZANTI	Ingegneria delle Telecomunicazioni	Inglese		"Remote Sensing — Based on the concepts ruling the generation and propagation of electromagnetic wave fields, the objective is to provide the students with basic knowledge about the fundamentals and basic definitions of remote sensing; passive remote sensing in the optical, microwaves, and infrared frequency bands; active remote sensing and radar imaging; instrumentation for remote sensing.Satellite Images — The objective is to provide the students with basic knowledge about past, current, and forthcoming space missions for Earth observation; computational methods for the display, the modeling, and the filtering of satellite imagery; change detection techniques for multitemporal data; and regression techniques for bio/geophysical parameter retrieval from remote sensing. In this framework, machine learning techniques rooted in the areas of ensemble learning, neural networks, and kernel machines will be discussed as well.	50	75
2	104851	SOFT SKILLS	2		ALTRE ATTIVITA'	Tirocini Formativi e di Orientamento	Inglese		The activity is meant to be developed as a preparatory work for the realization of the master thesis. Its target is providing the students with a methodological and scientific approach, to enable a research and development vision toward the final Master of Science project.	20	30